NHS

Bedside Clinical Guidelines Partnership

Medical Guidelines

2019–20

The guidelines are advisory not mandatory.
Doses assume normal hepatic and renal function,
refer to BNF for alternative doses

If you notice an error or omission, please let us know as soon as possible – bedsideclinicalguidelines@uhnm.nhs.uk

Published by
The Bedside Clinical Guidelines Partnership

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General adult medical guidelines
General adult surgical guidelines
Nursing guidelines
Paediatric guidelines
Neonatal guidelines
Obstetrics guidelines
Emergency medicine guidelines

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PREFACE • 1/2

Unless stated, drug doses assume normal renal and hepatic function

This book has been compiled as an aide-mémoire for all staff concerned with the management of general medical adult inpatients, especially those who present as emergencies.

1. Guidelines on the management of common medical conditions

These have been drafted with reference to published medical literature and amended after extensive consultation. For ease of reference, the layout adopts a standard format, covering Recognition and assessment, Immediate treatment, Subsequent management, Monitoring treatment, and Discharge and follow-up.

Wherever possible, recommendations made are evidence based. Where no clear evidence has been identified from published literature, the advice given represents a consensus of the expert authors and their peers and is based on their practical experience.
No guideline will apply to every patient, even where the diagnosis is clear-cut; there will always be exceptions. These guidelines are not intended as a substitute for logical thought and must be tempered by clinical judgement in the individual patient.

The guidelines are advisory, NOT mandatory

2. Prescribing regimens and nomograms

The administration of certain drugs, especially those given intravenously, requires great care if hazardous errors are to be avoided. This section includes guidance on the Indications, Contraindications, Dosage and Administration (including Preparation and Diluents) for all drugs in this category referred to in the Guidelines. For some, there are Tables or Nomograms to assist dose selection or adjustment.

3. Practical procedures

This section includes advice on how to perform most forms of clinical intervention feasible at the bedside. Drafted with reference to published recommendations, they have also been subject to wide consultation with local experts and put to the test to check their reliability. The layout adopts a standard format, covering Indications, Contraindications, Equipment, Procedure, Specimens, and Aftercare. The recommendations should not be applied rigidly to every patient, and must be tempered by clinical judgement.

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DO NOT attempt to carry out any of these Practical procedures unless you have been trained to do so and have demonstrated your competence

Additions and revisions

The editors acknowledge the infinite time and trouble taken by numerous colleagues in the drafting and amendment of the text. The accuracy of the detailed advice given has been subject to exhaustive checks. However, any errors or omissions that become apparent should be brought to the attention of the Clinical Guidelines Developer/Co-ordinator (Telephone 01782 676697 or bedsideclinicalguidelines@uhnm.nhs.uk), so that these can be amended in the next review, or, if necessary, brought to the urgent attention of users. Constructive comments or suggestions would also be welcome.

Supporting information

Where possible, the guidelines are based on evidence from published literature. It is intended that evidence relating to statements made in the guidelines – and its quality – will be made explicit.

Where supporting evidence has been identified, it is graded 1 to 5 according to standard criteria of validity and methodological quality as detailed in the table below. A summary of the evidence supporting each statement is available, with the original sources referenced, on Trust intranet>Clinicians>Clinical guidance>Clinical guidelines>Medical>Supporting information. The evidence summaries are developed on a rolling programme, which are updated as each guideline is reviewed.

Level	Treatment benefits	Treatment harms	Prognosis	Diagnosis
1	Systematic review of randomized trials or n-of-1 trials	Systematic review of randomized trials, systematic review of nested case-control studies, n of-1 trial with the patient you are raising the question about, or observational study with dramatic effect	Systematic review of inception cohort studies	Systematic review of cross sectional studies with consistently applied reference standard and blinding
2	Randomized trial or observational study with dramatic effect	Individual randomized trial or (exceptionally) observational study with dramatic effect	Inception cohort studies	Individual cross sectional studies with consistently applied reference standard and blinding
3	Non-randomized controlled cohort/follow-up study	Non-randomized controlled cohort/follow-up study provided there are sufficient numbers to rule out a common harm	Cohort study or control arm of randomized trial	Non-consecutive studies, or studies without consistently applied reference standards
4	Case-series, case-control studies, or historically controlled studies	Case-series, case-control, or historically controlled studies	Case-series or case-control studies, or poor quality prognostic cohort study	Case-control studies, or poor or non-independent reference standard
5	Mechanism-based reasoning	Mechanism-based reasoning	n/a	Mechanism-based reasoning

Excerpt from: OCEBM Levels of Evidence Working Group. The Oxford Levels of Evidence 2. Oxford Centre for Evidence-Based Medicine. 2011. http://www.cebm.net/index.aspx?o=5653

Evaluating the evidence base of these guidelines involves continuous review of both new and existing literature. The editors encourage you to challenge the evidence provided in this document. If you know of evidence that contradicts, or additional evidence in support of, the advice given in these guidelines, please forward it to the Clinical Guidelines Developer/Co-ordinator, Room D17, Ground Floor, West Building, University Hospitals of North Midlands NHS Trust, Royal Stoke University Hospital, Newcastle Road, Stoke-on-Trent, ST4 6QG (Telephone 01782 676697 or e-mail: bedsideclinicalguidelines@uhns.nhs.uk)

Evidence-based developments for which funding is being sought

As new treatments prove themselves more effective than existing ones, the onus falls upon those practising evidence-based healthcare to adopt best practice. New treatments are usually more expensive than older ones. Within the finite resources of the Trust and the NHS as a whole, the adoption of these treatments has to be justified in terms of the improvements they will bring to the quality or cost-effectiveness of care. The priorities for funding new areas of treatment and patient care will be determined at Trust level.

Changes for this edition

Additions/changes to text from the last edition are, as always, in blue text. The PDF also retains the changes as blue text for the new edition.

The following guidelines have been added:

- Intravenous levetiracetam (loading dosage in status epilepticus)

The following guidelines contain significant changes:

- Verification of expected death

MEDICAL RECORDS • 1/4

INTRODUCTION

- The patient's clinical record:
  - includes the paper records, computerised records, and other documents, such as the prescription chart (whether electronic/on paper, or both), nursing record(s) (whether electronic/on paper or both), and care plans or pathways of care
  - should be available at all times during inpatient stay and for outpatient appointments
- Illegible, untidy or incomplete medical records put patient safety at risk
- Entries may be scrutinised by patient, or by others with patient's permission
- Note that several computerised record systems currently exist and you may need to refer to some or all of them. Most are now available on iPortal and/or Medway, but access to older documents may require reference to other resources
  - if iPortal system is down a link is available to access notes (select "structured notes" under EPR systems business continuity in the EPR systems sharepoint on Trust intranet)
- Note that paper records are being withdrawn as electronic records become more sophisticated. Electronic records may not include all relevant historical documents, and paper records can usually be obtained if need be, with notice
- Note that electronic prescribing (ePMA) is likely to be introduced, at least in pilot areas, within the next year

Entries must be

- Relevant, accurate, unambiguous, and legible
- Dated, timed, and attributable
  - electronic records should be date and time-stamped automatically and reliably
  - consider use of a stamp with name and GMC number
- Contemporaneous, chronological and frequent

Correction of errors

- Cross through original entry but do not obliterate
- Do not use correction fluid
- Sign and date correction

CONTENTS OF NOTES FOLDER

Always use black ink. Never write offensive or inappropriate comments about patients, relatives, carers or staff in the notes – including acronyms/abbreviations. As far as possible avoid comments that can be interpreted as criticism

Identity of patient

Main record

- Patient's full name – given name(s) first, family/surname in capitals second, **or** family/surname in capitals first, followed by a comma, then given name(s)
- Hospital unit number(s) and/or NHS number
- Full address, postcode and telephone number
- Emergency contact details (and next of kin if different)
- GP name and contact details
- Gender, religion, ethnic origin and first language
- Confirmed allergies and other intolerances (document nature of the intolerance – particularly important for alleged penicillin allergy – see **Antimicrobial** guidelines on Trust intranet)

Notes sheet

- On each notes sheet, record patient's name (format as above), hospital number(s) and/or NHS number and patient's location in hospital

Clerking notes

Date (day, month, year) and time (using 24 hr clock) each entry, sign it, print your name, GMC number and bleep number legibly, if no bleep, your contact telephone number and grade

Initial clerking

- Name of admitting consultant with date and time of initial consultation
  - if there is a change in the consultant with overall responsibility for the patient, record name of new consultant, together with date and time of transfer of care
- Reason for admission/referral
- History and examination and provisional diagnosis
- All treatments/interventions given

Follow-up notes

- Record **whenever** you see or discuss a patient. For example:
  - progress of illness
  - all changes in medication (see especially **Antimicrobial medication** below)
  - results of all investigations
  - written details of oral instructions relating to patient's care
  - all interactions with patient, relatives and/or carers
- If an electronic record is created, a written entry in the contemporaneous written notes (whilst they still exist) should reference the electronic entry
  - as electronic notes become the norm, similarly an entry in the electronic notes should reference any paper records created

Document events as soon as possible, and especially before going off duty. If there is a delay, record time of event and extent of delay. Good practice is to make an entry in records of acute patients at least daily. If a day is missed, document why in next entry

SPECIAL RECORDS

Advance directives and resuscitation status

- Record clearly any advance directives, resuscitation status and DNAR orders. See **Cardiopulmonary resuscitation clinical justification** guideline
  - currently DNAR notices do not appear on iPortal. If and when they do, make sure that these (especially any revocation of DNAR) are up-to-date as well as in paper records, for obvious reasons

Before surgery

- Record consent on correct consent form – see **Consent** guideline
- Pre-operative diagnosis or indication for treatment/surgery/investigations
- Medical care plan, including site and side of procedure
- Note the requirements of WHO checklist; in particular it is imperative that in females of childbearing age who are assumed not to be pregnant, that the justification for this assumption is clearly recorded, and the results of a pregnancy test recorded if there can be any doubt. Writing "N/A" or equivalent is **not** sufficient nor acceptable

Operation notes

- Note that operation record may be typed into the "Theatre" section on iPortal and may be on a pro forma; it may be dictated. In either circumstance good practice would suggest that a hand-written reference to this be inserted at the appropriate point in the notes (where paper records exist)

Summary

- Name of consultant responsible
- Name of operating surgeon, assistant(s) and anaesthetist(s)
- Date and time and duration (or start time and end time)
- Title of operation
- Diagnosis made and procedure performed

Details of operation

- Incision(s) used
- Description of findings
- Details of any tissue removed, altered or added
- Clear description of procedure performed
- Details and serial numbers of implants used (it will usually be appropriate to attach labels from implants, which will have full tracking details)
- Details of tourniquet/cross clamp times and, if relevant, antimicrobials used for surgical prophylaxis
- Details of sutures used and wound closure method
- Document any drains or packs left *in situ*
- Details of blood loss/transfusions

Always inform patients if they have been given a blood transfusion or any other blood products; record the fact that you have told them in the notes (see* Consent for a Blood Transfusion** guideline ***and intranet>Clinicians>Clinical Guidance>Blood and Blood Products)

Complications

- Accurate description of difficulties or untoward events, and how they were managed

Post-operative instructions

- Write immediate post-operative instructions e.g. post-operative monitoring, drain management

Signatures

- Signature of surgeon
- Signature of anaesthetist on anaesthetic record

Anaesthetic record

Pre-operative information	**Patient identity** • Name/hospital unit number and/or NHS number/gender • Date of birth **Pre-op assessment and risk factors** • Date and time of assessment • Assessor, where assessed • Weight (kg) • Basic vital signs (BP, HR) • Height (m) – optional • Medication including contraception • Allergies • Alcohol, tobacco and recreational drug use • Previous GAs/family history • Potential airway problems • Venous access problems	• Prostheses, teeth, crowns • Investigations • Other problems • Cardiorespiratory fitness • ASA physical status +/- comment **Urgency as classified by NCEPOD:** • **'Immediate'** (life, limb or organ-saving) – needing surgery within minutes • **'Urgent'** (acute onset/clinical deterioration of potentially life-threatening condition, threat to limb or organ, fixation of many fractures, relief of pain or distressing symptoms) – needing surgery within hours • **'Expedited'** (early treatment where condition not immediate threat to life, limb or organ) – needing surgery within days (e.g. cancer) • **'Elective'** – timing to suit patient, hospital and staff
Perioperative information	**Checks** • Nil-by-mouth • Consent • Premedication, type and effect **Place and time** • Place • Date, start and end time **Personnel** • All anaesthetists named • Qualified assistant(s) present • Supervising consultant anaesthetist • Operating surgeon(s) **Operation planned/performed** **Apparatus** • Checks performed • Anaesthetic room • Theatre **Vital signs recording/charting** • Monitors used and vital signs (specify)	**Drugs and fluids** • Dose, concentration and volume • Cannulation • Injection site(s), time and route • Warmer used • Blood loss, urine output **Airway** • Route, system used • Ventilation: type and mode • Airway type, size, cuff, shape • Special procedures, humidifier, filter • Throat pack • Difficulty **Regional anaesthesia** • Block performed and time • Entry site • Needle and aid to location used • Catheter • Drug, concentration and dose **Patient position and attachments** • Thromboembolic prophylaxis • Temperature control • Limb positions
Postoperative instructions	• Drugs, fluids and doses • Analgesic techniques • Special airway instructions including oxygen therapy • Monitoring	**Untoward events** • Abnormalities • Critical incidents • Context – cause – effect **Hazard flags** • Warnings for future care

Antimicrobial medication

- It is especially important to record reason for starting and stopping antimicrobial therapy, including a record of any discussion with a member of the microbiology or infectious diseases team. If stop date not recorded on prescription chart, record date to review, both on prescription chart and in patient records. It is unsatisfactory simply to write 'review daily' unless this is actually carried out
- It is a requirement that all empirical antimicrobial prescriptions are reviewed at between 48 and 72 hr (when microbiology results should be available to permit the "Antimicrobial Prescribing Decision"). This is the decision to **stop**, to **switch** from IV to oral, to **change** (usually to a narrower spectrum antimicrobial; occasionally to broader), to **continue**, or to offer OPAT treatment

Discharge summary

- Commence discharge record/summary at time of admission. Good practice dictates that it is completed promptly after patient's discharge and note that under current rules, discharge letters must be completed within 24 hr of discharge

CONSENT • 1/5

INTRODUCTION

Consent is a complex subject. This guideline provides a brief outline of the issues involved in assessing and informing adult patients (aged ≥18 yr), so they can give valid consent. For patients aged <18 yr, see **Trust policy C43** (Trust intranet)

Full Trust policy C43, 'Policy and Procedures for Obtaining Consent' is available on the intranet and must be adhered to at all times. Further information can also be obtained from 'Reference guide to consent for examination or treatment' 2nd edition 2009 https://www.gov.uk/government/publications/reference-guide-to-consent-for-examination-or-treatment-second-edition

CAPACITY

Assessing competence

- Adult patients are assumed to be competent unless it is proved otherwise
- assume competence if patient able to understand, retain and weigh up information needed to make decision and is able to communicate this decision back to you
- unexpected decisions do not prove that a patient is incompetent, but may indicate the need for further information or explanation
- patients may be competent to make some healthcare decisions, even if not competent to make others

The greater the associated risks, the more stringent the consent process should be. This includes making comprehensive notes in the medical records

Does the patient have the capacity to consent?

- To decide whether an individual has capacity to make a decision, apply the test below

Capacity assessment

1 Does the person have an impairment or disturbance in the functioning of his/her mind or brain?
If the answer to this question is 'yes'
2 Has the impairment deprived him/her of the capacity to make **this particular decision?**

- In order to answer the second question you need to ask – can the patient:
- understand information about proposed treatment, its purpose and why it is being proposed?
- retain information for long enough to make an effective decision?
- use or weigh that information as part of the decision-making process?
- understand the benefits, risks and alternatives?
- understand the consequences of his/her refusal?
- communicate his/her decision (whether verbally, using sign language or other means)?

Where there is any doubt or disagreement about whether the patient has capacity, an application to the court MAY be necessary – you must seek advice, in office hours Monday–Friday, from Legal Services Department or, out-of-hours, from the Medical Director or Executive Director on-call, via hospital call centre (0)

CONSENT

When

- Consent is required before an adult is:
- examined
- treated
- cared for
- Consent must be given before commencing a procedure or treatment other than in exceptional circumstances, such as:
- life-saving procedures
- emergencies
- Giving and obtaining consent is usually a process that should start as soon as a patient is offered a procedure, so that s/he has time to assimilate the information. It is not a one-off event and should be revisited should the situation change

Refusal of treatment

- A competent adult has the right to refuse treatment, and it is morally and ethically wrong to persuade him/her otherwise, even if the decision seems apparently irrational. His/her refusal is binding
- A competent pregnant woman may refuse treatment, even if this would be detrimental to the fetus. Advice should be sought from the Legal Services Department where a fetus is placed in danger as a result of a mother's refusal of treatment as it may be appropriate to revert to the Court of Protection
- If the patient refuses, ensure s/he clearly understands the implications of refusal and that it may result in death
- A patient can withdraw consent at any time and has the right to stop treatment at any stage
- if there is any doubt, check that the patient still wishes to proceed

Exception to this rule

- The only exception applies to treatment for a mental disorder in a patient detained under the Mental Health Act. However, this does not preclude the individual from giving or withholding consent to treatment for physical conditions and an assessment of the patient's capacity to consent must be made as above

Consent must be given voluntarily and not under any form of duress or undue influence from healthcare professionals, family or friends

Format of consent

- Consent can be:
- written
- oral
- implied (i.e. patient offering arm for the taking of blood). It would be good practice to document the actions/conversation around implied consent

A signature on a consent form does not in itself prove that consent is valid – the law now requires explanation of all 'material risks'. A risk is material if 'that patient' would attach significance to it

Implied consent

- Assumed when, following explanation of the proposed procedure/treatment, patient indicates willingness to proceed by co-operating, for example:
- extending arm to have blood taken

Expressed consent

- Must be obtained for any procedure carrying a 'material risk' – a risk is material if that patient would attach significance to it
- Usually given in writing by signing consent form, but can be given orally with written documentation supporting the oral discussion
- Consent need not necessarily be spoken, but should be clear and interpretable (e.g. hand squeeze) and should be given free from duress

Expressed consent must be recorded in patient's clinical records; a consent form alone is no longer enough

SEEKING VALID CONSENT IN A COMPETENT ADULT

Who

- Doctor in charge of patient's care/surgeon capable of performing the procedure should be the person gaining consent from the patient

Obtain correct forms

- Use a standard Trust consent form:
- **consent form 1** – for patient agreement to investigation or treatment
- **consent form 3** (short) – for patient agreement to investigation or treatment for procedures where consciousness is not impaired (i.e. no general anaesthetic required)
- Read notes on consent form carefully so that you are fully aware of content
- Complete box containing patient's details, and 'type of operation, investigation or treatment' which **must** state side of body/head **in full** (**right** or **left, not R** or **L**) where this is relevant

CONSENT ● 3/5

Identify patient correctly

- By name
- By date of birth
- By hospital number and/or NHS number

Essential information

- Allow patient to make a balanced decision about proposed procedure/treatment by giving sufficient information about material risks (i.e. would the patient attach significance to the risk?):
  - nature
  - purpose
  - benefits and material risks
  - alternatives
- Present information in an open and unbiased way (document in notes what leaflet provided)
- Ensure patient understands explanation. If patient does not speak English, do not proceed further until an approved interpreter is available. If an interpreter has been used document his/her identity on consent form/in medical records. In addition to patient, consent form must be signed by doctor and interpreter (unless interpretation via telephone). It is not appropriate to use a family member/friend to interpret
- After full discussion of procedure or operation with patient, allow him/her to read the consent form and leaflets provided
- Where a patient is unable to sign their name, a mark or sign made by the patient is adequate
- Where a patient is unable to physically sign a consent form but is able to express their wish, it is acceptable for an advocate (nurse) to witness the process and to sign the consent form to this effect

If patient is not offered much information, in a form s/he can understand, as reasonably required to make a decision, consent will not be valid and may be challenged

Training programmes

- If the patient does not wish to be involved in student training programmes, document this on consent form and in medical notes, and inform consultant responsible for care. Reassure patient that care is not compromised by this refusal

Document

- Document discussion in case notes, including risks and benefits explained
- Fill in consent form and make additional notes in the medical records
  - if patient satisfied with explanations given by you, fill in and sign part to be completed by doctor/dentist/healthcare professional
  - if explanation was given by a colleague and patient is satisfied with explanation from that colleague, document name of doctor/dentist/healthcare professional who explained procedure; to take consent, they should be capable of undertaking the procedure
  - a patient wishing to refuse some aspects of treatment or care (e.g. a Jehovah's Witness refusing blood transfusion) must list procedures that s/he does not want to receive. There is a space provided in the 'statement of the patient' section of the form
  - if patient agrees to procedure or operation with or without any documented refusals, s/he completes and signs 'statement of the patient' section of the form
  - doctor/dentist/healthcare professional signs form, having given detailed explanation of consequences of any refusals
  - make detailed record of this in patient's medical notes
- Ensure all team members, including surgeon and anaesthetist performing procedure or operation, are fully aware of any refusals and are able to comply with patient's wishes where there are practical matters to consider while performing the procedure or operation (e.g. Jehovah's Witness refusing blood transfusion/intra-operative cell salvage)

Give patient a copy of the consent form detailing nature, risks and benefits of procedure and patient leaflet where appropriate

VALID CONSENT FOR AN ADULT PATIENT WITHOUT CAPACITY

Decision maker

- Decisions whether to undertake treatment will be made by the 'decision maker' – the person proposing to take action on behalf of a patient who lacks capacity, usually the consultant. The decision maker must first determine what action would be in the 'best interests' of person lacking capacity and must take note of the statutory 'best interests' checklist under section 4 of the Mental Capacity Act
- If the treating consultant is unavailable, his/her staff grade doctor or senior trainee (but no one less senior) may deputise, provided that the decision is endorsed by consultant at the earliest opportunity

Whom to involve in decision

- Involve all relevant disciplines
- Discuss with those who have an interest in the patient's welfare or those with a statutory right to be involved (lasting power of attorney/court appointed deputy)
- If patient is judged to lack capacity has no one **other** than paid carers to look after them (i.e. no consultable friends or family), you must appoint an Independent Mental Capacity Advocate (IMCA)
- IMCA's duty is to try and ascertain what would have been the patient's wishes if s/he still had capacity. Information provided by IMCA must be taken account of by the decision maker when deciding what is in the patient's best interests but the IMCA cannot decide what treatment is given; this rests with the decision maker
- to appoint an IMCA, contact the Safeguarding Team
- Establish if patient has appointed an attorney under a 'Lasting Power of Attorney' (LPA) or a court-appointed deputy has been appointed (for health and welfare), for whatever reason, to act on patient's behalf. Legal advice may be needed to ascertain whether LPA is relevant to the situation
- where an attorney under an LPA has been appointed, it is his/her responsibility to inform clinicians

Advance decisions/directives

- A person may make an advance decision under the Mental Capacity Act if s/he is aged ≥18 yr and has the capacity to make the decision
- If the advance decision refuses life-sustaining treatment, it must be in writing, be signed and witnessed, **and state clearly that the decision applies even if life is at risk**
- ask about an advance decision (living will/advance directive – this will be called an advance decision and must be in writing as it applies to life-sustaining treatment) or an LPA. If there is evidence of any of these and you are unsure whether they apply, seek advice from Legal Services Department

Best interests

- Before reaching a conclusion about best interests:
- do not make assumptions about a person's best interests merely on the basis of his/her age, appearance, condition or behaviour which might leave others to make unjustified assumptions about his/her capacity (Sec 1 MCA)
- try to identify all matters and circumstances relating to decision in question, which are most relevant to person who lacks capacity
- consider whether person is likely to regain capacity. Can the decision wait until then?
- do whatever is possible to permit and encourage the person to participate, or to improve his/her ability to participate as fully as possible in making decision
- if the decision concerns provision or withdrawal of life-sustaining treatment, you must not be motivated by a desire to bring about the patient's death. Do not make assumptions about the person's quality of life
- Try to find out views of person lacking capacity, including:
- past and present wishes and feelings (and, in particular, any relevant written statement made when s/he had capacity)
- beliefs and values (e.g. religious, cultural or moral) that would be likely to influence the decision in question
- other factors that patient would be likely to consider if able to do so

- Consult other people, if it is practicable and appropriate to do so, for their views about patient's best interests and obtain any information about patient's wishes, feelings, beliefs or values. But be aware of patient's right to confidentiality
- In particular, seek views of:
- relatives and carers, partners, close friends, any person previously named by person lacking capacity as someone to be consulted, any person having reasonable claim to have his/her views taken into account and, if appointed, IMCA (see above), attorney of an LPA, court-appointed deputy
- healthcare professionals, including GPs and nursing homes, to establish premorbid health and quality of life, and 'best interests'

Deprivation of liberty

- In April 2009, Deprivation of Liberty Safeguards (DoLS) were introduced as an amendment to the Mental Capacity Act 2005 (MCA) and are designed to ensure that any person lacking capacity to consent to care or treatment is suitably protected against arbitrary detention. If the patient is under compete and effective control in respect of their care and movements, and not free to leave without permission, then an application should be made to the Local Authority for permission to deprive them of their liberty – for advice, contact the safeguarding team

Disagreement

- Application to court may be necessary. Seek advice from Legal Services Department, where there is:
- lack of unanimity among clinicians as to patient's condition, prognosis or 'best interests'
- lack of unanimity about whether treatment is appropriate
- evidence that patient, when competent, would have wanted treatment either to be given or not given and this is contrary to views of clinicians
- evidence that patient resists or disputes proposed treatment
- anyone with a reasonable claim to have their views or evidence taken into account (such as a parent, relative, partner, close friend or long-term carer) who asserts that the proposed course of treatment or failure to treat is contrary to patient's wishes or not in patient's best interests

Procedure when patient lacks capacity to give or withhold consent

- Never use standard consent forms for adult patients unable to consent for themselves
- If an adult patient does not have capacity to give or withhold consent for a significant intervention, document this fact in **consent form 4** (form for adults unable to consent to investigation or treatment), along with assessment of patient's capacity, why healthcare professional believes treatment to be in patient's best interests, and involvement of people close to the patient. Where second opinion sought, person giving second opinion should also sign form to confirm agreement with decision to proceed
- For more minor interventions, this information needs to be entered only in patient's notes

When an application to the court of protection is a legal requirement

- In some circumstances the Court of Protection must be asked to make a decision on behalf of the patient:
- the proposed withholding or withdrawal of artificial nutrition and hydration (ANH) from a person in a permanent vegetative state or minimally conscious state where there is disagreement about what is in the patient's best interests
- where it is proposed that a living person who lacks capacity to consent should donate an organ or bone marrow to another person
- the proposed non-therapeutic sterilisation of a person who lacks capacity to consent (e.g. for contraceptive purposes)
- where there is a dispute about whether a particular serious medical treatment will be in a person's best interests
- In the above circumstances, contact the Legal Services Department

ACCESSING IMAGING: INPATIENTS AND EMERGENCIES ● 1/1

- **Choosing the most appropriate scan**: www.irefer.org.uk (Royal College of Radiologists Referral guidelines)
- **Helpdesk**: (6)79285 Mon-Fri 0800–1800 hr, Saturday 0830–1630 hr
- **General advice**: (6)79285 0800–1700 hr weekdays only

	Normal hours	Emergency/out-of-hours[2]
X-ray	• Submit iCM request ◦ normal service: 0900–1700 hr weekdays only ◦ queries: (6)79298 ◦ images available to view 30 min after exposure • X-ray reporting (urgent reports only): ◦ imaging.clerical@uhns.nhs.uk; (6)79982/3; (6)75871	• Submit iCM request for out-of-hours X-rays ◦ queries/radiographer: (6)75900 ◦ images available to view 30 min after exposure • Out-of-hours reporting: ◦ very limited out-of-hours X-ray reporting service ◦ first discuss with patient's on-call SpR/consultant; or relevant on-call SpR/consultant only contact radiology SpR[1] if issue unresolved
Ultrasound	• Submit iCM request ◦ normal service: 0830–1700 hr weekdays, Saturday 0900–1600 and Sunday 0900–1230 [1300–1600 radiology registrar 72588 (A&E scan room)] ◦ queries: (6)79269 ◦ non-emergency inpatient scan performed within 24 hr	• **URGENT OOH** submit iCM request **and** call (6)79269[3] for ◦ deep venous thrombosis (DVT) ◦ emergency surgical admissions (SAU) ◦ gynaecology and early pregnancy admissions (EPAU) • **Immediately life-threatening indications** ◦ submit iCM request **and** contact on-call radiology SpR[1]
CT	• Submit iCM request ◦ normal service: 0800–1700 hr weekdays only ◦ queries: (6)79285/75881 ◦ non-emergency inpatient scan performed within 24 hr	• Only scans discussed with on-call radiology SpR[1] will be performed as emergency/out-of-hours ◦ submit iCM request **and** contact on-call radiology SpR[1] ◦ emergency CT scheduling queries: (6)75881 (after request accepted by radiology SpR)
MRI	• Submit iCM request ◦ normal service: 0800–2000 hr weekdays and weekends ◦ queries: (6)79285/75820	• Submit iCM request **and** contact on-call consultant radiologist via call centre (consultant-to-consultant referral)
Fluoroscopy	• Submit iCM request ◦ normal service: 0830–1700 hr weekdays only ◦ queries: (6)79285	• No emergency fluoroscopy service; in very limited emergency cases: ◦ submit iCM request **and** contact on-call radiology SpR[1]
Nuclear medicine	• Submit iCM request ◦ normal service: 0830–1630 hr weekdays only ◦ queries: (6)75912	• No service available
Vascular and non-vascular[4] intervention	• Submit iCM request ◦ normal service: 0800–1700 hr weekdays only ◦ queries: (6)79285	• Vascular intervention at all other times: ◦ consultant-to-on-call consultant vascular interventional radiologist via call centre • Non-vascular[4] intervention at all other times: ◦ consultant-to-on-call consultant general radiologist via call centre

Notes

1. Contact the on-call radiology SpRs via their **pager** through the call centre; referrals **must** be SpR-to-SpR or above
2. Only scans **essential to acute management** of a clinical condition (e.g. cannot wait until normal working hours), will be performed as soon as practicable
3. **Sonographers** are not contactable whilst scanning patients; go to **Lyme Building** ultrasound room to discuss scan request
4. Includes image-guided drain insertion and aspiration; out-of-hours drain service not always available currently

ON-CALL PATHOLOGY SERVICE ● 1/4

NORMAL WORKING HOURS

Monday–Friday	0830–1730 hr Histology 0900–1730 hr
Saturday	Histology no service Biochemistry 0830–1300 hr Haematology 0900–1300 hr Microbiology 0830–1700 hr Virology 0830–1300 hr
Contact microbiology if sending an urgent sample Microbiology contactable by bleep only from 1300 hr Saturday to 0830 hr Monday and Bank Holidays	
Clinical scientist holds biochemistry hospital bleep (389) for specialist advice	

OUT-OF-HOURS SERVICE

Monday	1730*–0830 hr Tuesday
Tuesday	1730*–0830 hr Wednesday
Wednesday	1730*–0830 hr Thursday
Thursday	1730*–0830 hr Friday
Friday	1730*–0830 hr Saturday
Saturday	1300–0900 hr Sunday Microbiology 1700–0830 hr
Sunday	0900–0830 hr Monday Microbiology 1700–0830 hr
Contact microbiology by bleep if sending an urgent sample	

*Haematology 1800–0830 hr

- Clearly mark all urgent requests '**urgent**'
- Request must include patient's name (or emergency ID), date of birth, unit number, consultant, ward and time of specimen. This is essential for electronic reporting of results
- All requests must contain clinical information relevant to investigation requested
- Where request or sample containers are inadequately completed/labelled or illegible, this may result in investigation(s) not being performed
- Results will be phoned only if delay likely in transmitting results to iPortal, biomedical scientist (BMS) has already agreed to phone, or results alert BMS to possibility that immediate action may be required

Investigations available out-of-hours by written request

- Do not bleep BMS unless results are clinically very urgent and need to be telephoned

For all urgent microbiology specimens except blood cultures, bleep microbiology. On-call BMS may not be on site

Department	Investigations available out-of-hours by written request
Blood transfusion	• Group and save • Direct Coombs test
Haematology	• Full blood count (FBC) including differential WBC • International normalised ratio (INR) • Activated partial thromboplastin time (APTT) • D-dimer for screening patients with suspected DVT or PE • ESR • Blood films for morphology • Malarial parasites • Infectious mononucleosis screen • D-dimer with fibrinogen for assessment of DIC • Fibrinogen

ON-CALL PATHOLOGY SERVICE ● 2/4

Department	Investigations available out-of-hours by written request
Biochemistry	• Amylase • Cardiac troponin • Liver function tests (LFT) • Uric acid • Serum or plasma U&E, osmolality • Bone • Thyroid function tests (TFT) • Urine U&E, osmolality • CRP • BNP • HCG • Magnesium • CSF protein and CSF glucose • Therapeutic drug monitoring e.g. digoxin, phenytoin, carbamazepine, theophylline, valproic acid, lithium. Toxicology investigations e.g. paracetamol, salicylate, iron
Microbiology	Limited routine service available • Weekdays 1730–1930 hr • Saturday 0900–1700 hr • Sunday 0900–1700 hr • contact laboratory during these times via external pager (speed dial 15822) • At all times, send samples (especially MRSA swabs) to laboratory promptly to ensure processing as soon as possible

Investigations available out-of-hours requiring prior discussion with BMS

- Be certain that investigation cannot wait and will influence immediate clinical management. If BMS is in any doubt about relevance of request, they will ask SpR or more senior doctor to contact clinician on-call for relevant laboratory specialty

Department	Investigation available out-of-hours
Blood transfusion	• Group and screen (G&S) and cross-match of red cells performed 24/7 • If urgent transfusion required bleep 390 • If massive haemorrhage activate MHP on bleep 78-175-ext no.-# – see **Massive haemorrhage protocol** on Trust intranet>Clinicians>Clinical guidance>Blood and blood products • Antenatal samples and direct antiglobulin test (DAT) processed during routine working hours unless discussed
Haematology	• Sickle cell screen in appropriate patients requiring urgent general anaesthesia – require 1 hr prior notification • ESR – for patients with suspected temporal arteritis or for paediatrics
Biochemistry	• CSF Xanthochromia • Ammonia • Lactate • Urinary myoglobin • Urinary PBG • Tumour markers • Parathyroid hormone • Refer other toxicology requests (e.g. drugs of abuse, ethylene glycol, methanol) directly to the Regional Toxicology Laboratory, City Hospital Birmingham (speed call 15056). For transport, call 4954/5651/2137, Requesting department will be charged

Department	Investigation available out-of-hours
Microbiology	After 2230 hr refer **all** requests to on-call consultant medical microbiologist except the following: • CSF samples • Intra-operative specimens taken in theatre where a microscopy is urgently required • Joint aspirates • Ascitic fluids if spontaneous bacterial peritonitis suspected Note: On-call biomedical scientist will only process samples that have been urgently requested by bleep • Antimicrobial monitoring assays – batched and run at approximately 1100 and 1530 hr on Saturday, Sunday and Bank holidays
Histology	• No out-of-hours service available

OUT-OF-HOURS CONTACT DETAILS

Biomedical scientists: First-line enquiries and requests for investigations

Biochemistry	(on-site)	hospital bleep	389
Haematology/blood transfusion	(on-site)	hospital bleep	390
Microbiology		external pager	15822 (speed call)
County blood transfusion 0630–0000 hr		bleep 4751 (including MHP)	

If issues with blood collection at County between 0000–0630 hr contact site manager

- If BMS does not answer (bleep 389) after 3 attempts, ward or theatre should contact on-call BMS in other department (bleep 390) to investigate and vice versa
- If microbiology BMS is not contactable contact the call centre who will have their home contact details. Remember they are unlikely to be on site and may be in transit

Clinical/medical staff – clinical advice/requests for some blood products and non-routine investigations

- Haematology/Biochemistry/Microbiology: via call centre (0) or 715444

Note – all other clinical biochemistry tests available only by consultant contact with on-call staff

TRANSPORT

Urgent samples

When	Contact	Instructions and collection points
Monday–Friday 0830–1630 hr	Request via transport supervisor's office	• State ward name or number and which collection point: ◦ maternity (back of reception) ◦ Lyme building reception ◦ A&E ◦ Children's A&E • State whether sample already at collection point or has yet to be dropped off there
Out-of-hours Monday–Friday 1630–0830 hr Friday 1630–Monday 0830 hr	Bleep 405 – expect delay in response as driver will respond from nearest Trust landline Alternatively, request via transport supervisor's office (be aware supervisor may be away from office) At County hospital take urgent samples to main hospital switchboard	• State ward name/ number and collection point ◦ maternity (back of reception) ◦ A&E ◦ children's A&E • State whether sample already at collection point or has yet to be dropped off there Transport of urgent samples from County Hospital via hospital main switchboard. Details on Trust intranet: Procedure for Requesting Out of Hours Microbiological Examinations at County Hospital

Transporting non-urgent samples

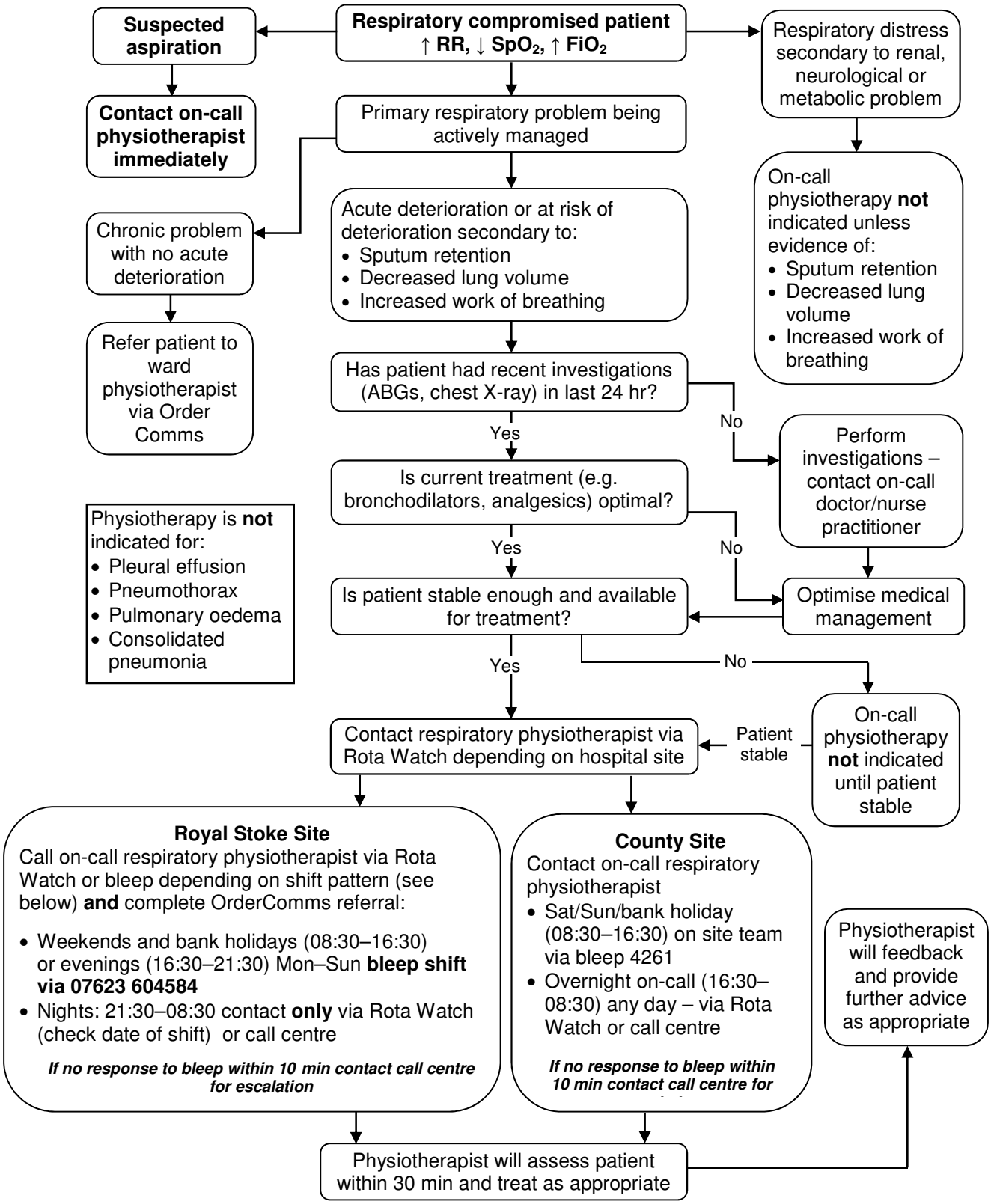
Monday–Friday 0830–1630 hr

- No necessity to call transport department, samples are collected periodically by pharmacy porters from all wards and taken to the following collection points:
- maternity reception
- A&E
- Children's A&E

For further details see pathology departmental handbooks available via intranet: clinicians/support-services/pathology/ or UHNM website

ON-CALL RESPIRATORY PHYSIOTHERAPIST – REFERRAL AND CONTACT GUIDANCE ● 1/1

Follow flowchart below before referral to the on-call respiratory physiotherapist



PREGNANT WOMAN WITH A NON-OBSTETRIC PROBLEM (MANAGEMENT OF) ● 1/1

INTRODUCTION

- Assessment and management of disease unrelated to the pregnancy are altered by the pregnancy
- The need to consider 2 patients (mother plus fetus) may change treatment decisions
- Anatomical and physiological changes in pregnancy result in altered:
- clinical features during CVS and respiratory system and abdominal examination
- biochemical and haematological values
- pharmacological management
- response to any systemic pathology
- protocols for the management of critical illness

AIM

- To ensure:
- every pregnant woman admitted is managed promptly
- communication link is established between admitting team and obstetric team so that the most appropriate care can be delivered

ACTIONS

Accident and emergency

- Ask apparently pregnant woman presenting to Emergency department for any reason (irrelevant of gestation) if she has booked for maternity care
- if not booked for maternity care, inform delivery suite co-ordinator, who can advise on appropriate follow-up and booking arrangements
- In cases of trauma or vaginal bleeding at any gestation, give consideration to woman's blood group and need for anti-D. If in doubt, discuss with on-call middle grade obstetrician (ST3–7 or equivalent e.g. staff grade, clinical fellow)

Nursing

- To prevent aortocaval compression, do not nurse women in the second and third trimester in supine position
- If the disease causes reduced mobility, consider VTE prophylaxis. Use local obstetric VTE assessment tool
- Use early warning scoring system (NEWS) to help in the timely recognition, treatment and referral of women who have or are developing critical conditions

Contact

- If ≥16 weeks' gestation, contact delivery suite co-ordinator, who will advise which healthcare professional(s) should review, if necessary after discussion with on-call obstetric middle grade obstetrician (ST3–7 or equivalent e.g. staff grade, clinical fellow)
- If any severely ill pregnant woman is admitted outside the maternity service:
- contact on-call middle grade obstetrician/consultant obstetrician
- if she is critically ill, or likely to need urgent surgery, refer early to critical care team and/or anaesthetist
- By giving consideration to the pregnancy and the fetus, maternity service providers can help with:
- assessment of maternal and fetal wellbeing
- investigations
- treatment
- Be aware of the significance of hypertension and proteinuria in pregnant women

Radiological investigations are not contraindicated during pregnancy where there is a significant clinical indication. Discuss with obstetric team

Documentation

- Document all communication (including inter-departmental) in maternal healthcare record, highlighting pregnant or newly delivered woman's attendance or admission to non-midwifery ward or department

NATIONAL EARLY WARNING SCORE (NEWS) ● 1/2

The National early warning score (NEWS) is an aid to clinical decision making, not a replacement for professional judgement in patient management. Senior clinical advice can be requested without reaching a NEWS trigger

INTRODUCTION

- National early warning scoring (NEWS) is a track and trigger protocol that monitors vital observations to detect subtle changes in patient physiology – see full **National early warning score (NEWS)** guideline in **Nursing** guidelines or via the Royal College of Physicians website: www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news-2
- Score will trigger responses in accordance with escalation strategy
- When taking patient observations, record on NEWS chart/VitalPac

NEWS SCORING

- Respiration counted over **1 full minute**
- Oxygen: must be prescribed
- SpO_2 scales:
  - scale 1 – patients without hypercania
  - scale 2 – Patients with hypercapnia (validated by a clinician and documented in patient's notes)
- oxygen therapy: during each set of observations rate and method of delivery to be validated by registered nurse
- Temperature
- Blood pressure
- Heart rate
- ACVPU score (Alert, Confusion, Voice, Pain, Unconscious) – new score for confusion

NEWS SCORE AND ESCALATION STRATEGY

- Any deterioration/sudden change will prompt patient review in accordance with the escalation strategy below. Patients with increased NEWS score are at risk of sudden deterioration and/or cardiac arrest

NEWS score	Actions
0	• Minimum 6-hrly observations • Any **new** irregular heart rate must be escalated
1–2	• Minimum 6-hrly observations • Inform registered nurse who must assess the patient • Check pulse for irregular heart rate – do ECG if irregular • Any new irregular heart rate must be escalated • Registered nurse to consider checking blood glucose • Consider sepsis screening tool if appropriate • Is the patient's condition causing concern? • Has the patient been assessed on the on the correct SpO_2 scale? • Registered nurse to assess if escalation is required
3–4	• Minimum 4-hrly observations • Inform registered nurse who must assess the patient • Check pulse for irregular heart rate – do ECG if irregular • Any **new** irregular heart rate must be escalated • Registered nurse to consider checking blood glucose • Consider sepsis screening tool if appropriate • Is the patient's condition causing concern? • Has the patient been assessed on the on the correct SpO_2 scale? • Registered nurse to assess if escalation is required

NATIONAL EARLY WARNING SCORE (NEWS) ● 2/2

NEWS score	Actions
Individual score of 3	• Extreme value • Inform registered nurse • Commence sepsis screening tool if not already done (consider a temperature of less than 36°C) • Consider oxygen, IV access and bloods • Check for irregular heart rate – consider ECG • Inform ward based team for review • Has the patient been assessed on the correct SpO_2 scale? • Is it a new confusion? • Assess frequency of observations
5–6	• Increase frequency of observations to a minimum of hourly • Inform registered nurse who must assess the patient • Registered nurse to urgently inform the appropriate nurse practitioner/team doctor or outreach team for an urgent review. Inform nurse in charge – if there is no response within 30 minutes escalate further i.e. registrar • Commence sepsis screening tool if not already done • Any **new** irregular heart rate must be escalated • Consider oxygen, IV access and bloods • Consider 12 lead ECG • Consider hourly fluid balance • Consider checking blood glucose • Has the patient been assessed on the correct SP02 scale? • Is it a new confusion? • Clinical staff to consider ceiling of care and suitability of CPR
7, 8, 9 or more	• Continuous observation as defined by treating clinician – consider monitoring in a higher area • Inform registered nurse who must assess the patient • Registered nurse to immediately inform the appropriate specialist registrar, nurse practitioner/team doctor or outreach team for an immediate patient review. Inform nurse in charge – if there is no response within 10 minutes escalate further i.e. registrar/consultant • Commence sepsis screening tool if not already done • Any **new** irregular heart rate must be escalated • Consider oxygen therapy • Consider IV access and bloods • Consider 12 lead ECG • Has the patient been assessed on the correct SPO_2 scale? • Consider hourly fluid balance • Is it a new confusion? • Arrange transfer of care to level 2–3 facility as agreed by senior clinicians/critical care doctor • Clinical staff to consider ceiling of care and suitability of CPR

PREVENTION OF CONTRAST INDUCED ACUTE KIDNEY INJURY ● 1/2

RECOGNITION AND ASSESSMENT

- Contrast induced acute kidney injury (CI-AKI) accounts for approximately 12% of all cases of hospital-acquired renal failure; defined when 1 of the following criteria is met:
- serum creatinine rises >26 µmol/L within 48 hr
- serum creatinine rises 1.5 fold from baseline value, which is known or presumed to have occurred within 1 week
- urine output is <0.5 mL/kg/hr for >6 consecutive hr
- If a baseline serum creatinine within 1 week is not available, use the lowest creatinine value recorded within 3 months of episode of AKI
- Creatinine typically peaks 3–5 days after contrast administration and returns to baseline within 2 weeks
- Only 1 in 200 patients requires renal replacement therapy
- AKI alert will be generated on all inpatients who have U&E and measure in line with the NHS England safety alert (June 2014)

IMMEDIATE TREATMENT

There is no specific treatment – management is supportive – see **Acute kidney injury (acute renal failure)** guideline

PREVENTION

- Extremely important as contrast induced acute kidney injury is associated with:
- risk of permanent renal impairment (in up to 30% of patients who develop CI-AKI)
- a greater than 5-fold increase in mortality
- prolonged hospital stay

Risk factors

Fixed (non-modifiable)

- Pre-existing renal insufficiency
- eGFR <60 mL/min increases risk significantly
- Diabetes mellitus
- Aged >75 yr
- Congestive cardiac failure [New York Heart Association (NYHA) Class 3–4 or ejection fraction <49%]
- Acute myocardial infarction
- Cardiogenic shock
- Renal transplantation
- Cirrhosis of the liver
- Myeloma

Modifiable risk factors

- Volume of contrast medium used
- Hypotension/volume depletion/sepsis
- Intra-aortic balloon pump
- Anaemia and blood loss
- ACE inhibitors
- Diuretics
- Nephrotoxic antimicrobials
- NSAIDs

PROPHYLAXIS

Requesting imaging

- When requesting imaging procedures that may require use of intravascular (particularly
- intra-arterial) contrast medium, indicate baseline serum creatinine or eGFR on the request. If patient acutely sick, notify imaging department if serum creatinine (eGFR) has changed since the request was made and ensure up to date result requested

PREVENTION OF CONTRAST INDUCED ACUTE KIDNEY INJURY ● 2/2

If eGFR <60 mL/min

- Review need for use of contrast and suitability of alternative media in discussion with radiologist and consultant in charge of patient's care
- vascular imaging may be possible using CO_2 as alternative contrast medium
- use of iso-osmolar contrast medium and reduced volumes may reduce risk
- to maximise image quality and reduce contrast dose a sodium chloride 0.9% flush should be used by imaging department

In patients at the extremes of age and body size with severe malnutrition, paraplegia, tetraplegia, known skeletal muscle disease or rapidly changing renal function, interpret eGFR with caution as it may underestimate the severity of renal impairment

Imaging with contrast essential

All patients

- Ensure adequate oral intake
- If patient nil-by-mouth or unable to drink adequately, give IV fluids before angiography
- Patients who are nil-by-mouth for planned anaesthesia to drink clear fluids until 2 hr before anaesthesia
- Review medication and, where clinically appropriate, omit potentially nephrotoxic drugs (see **Modifiable risk factors**) on day of scan

Additional preventative measures for high-risk patients

- Inpatients with eGFR <60 mL/min requiring any iodinated contrast
- Outpatients with eGFR <60 mL/min requiring intra-arterial contrast media
- Outpatients with eGFR <30 mL/min for any iodinated contrast scan
- Give sodium bicarbonate 1.26% 3 mL/kg (actual body weight) IV over 1 hr pre-contrast, followed by sodium bicarbonate 1.26% 1 mL/kg/hr IV for 6 hr post-contrast
- hydration with IV fluids is important in prevention of CIN. Omit/reduce diuretics on day of scan. If patient already on intravenous fluid replacement with sodium chloride 0.9% this is acceptable as prevention for CI-AKI
- if patient is on metformin and has eGFR ≤50 mL/min, omit it on day of scan and do not re-instate it for 48 hr afterwards
- if sodium bicarbonate 1.26% polyfusor not available, sodium bicarbonate 1.4% can be substituted. Prolonged regimes using intravenous sodium chloride 0.9% 12 hr pre- and post-contrast at a minimum of 1 mL/kg/hr is acceptable

Repeat exposure

- If further exposure to contrast agents required, because of need for repeat/additional procedure, and patient has no major risk factors, delay exposure for >48 hr – if major risk factors present, delay for >72 hr

MONITORING

- Daily monitoring of renal function for 48–72 hr after procedure

ASSESSMENT

Nursing staff must assess all patients nutritionally on admission and refer those 'at risk' to a dietitian. Nutritional status must be regularly reviewed, especially during a prolonged inpatient stay. Details of assessment are in the nursing admission forms

- Consider each patient on their own merits
- Provision of food and water by mouth is basic care and is mandatory
- Some patients wish to eat but are unable to because of difficulty chewing, poor appetite, apathy and depression, or weakness. Encourage and assist them to eat by offering them appetising food of the correct consistency in an appropriate way
- People at the end of their lives often eat little. Accept this natural phenomenon

NUTRITIONAL OPTIONS

Oral supplements – for patients unable/unwilling to eat sufficiently

- Obtain advice from ward dietitian
- Review patient regularly as individual requirements will vary with the changing clinical situation

Tube feeding – nasogastric (NG) tube for short-term or percutaneous endoscopic gastrostomy (PEG) for long-term

- If patient not eating sufficiently, consider tube feeding
- In end-stage dementia (e.g. when patient fully dependent for all activities of daily living), there is no evidence that artificial tube feeding is of benefit. If patient fails a swallowing assessment, consider a 2 week trial of NG tube feeding
- If no benefit likely from tube/PEG feeding, consider a trial of comfort feeding – offering appropriate food of the correct consistency (discuss with speech and language therapist and dietitian) – even though patient has failed a swallowing assessment

Tube feeding is a medical intervention and requires consent
PEG feeding does not prevent aspiration pneumonia
For an 'incompetent' adult – use a 2-doctor consent form 4 signed by two senior doctors, one of whom must be a gastroenterologist, the other normally being the consultant or GP looking after patient. Best practice suggests that any family or next-of-kin should countersign section D to confirm they have been involved/informed of decision – section 4 of the Mental Capacity Act provides a list of those who 'must' be consulted in cases where best interest decisions are being made

- Refer to ward dietitian and/or nutrition team
- Send all PEG referrals to the nutrition team (nutrition nurse specialist)
- Post-PEG care is detailed in guidelines held on every ward and on Trust intranet
- If any of the following occur, stop feeding/medication delivery immediately and seek senior advice urgently regarding CT scan, contrast study/tubogram or surgical review:
  - pain on feeding
  - prolonged or severe pain post-procedure
  - fresh bleeding
  - external leakage of gastric contents
- Patients must not be discharged unless they or their carers are competent in tube care

Indications for PEG insertion

- Dysphagia
  - neurological (e.g. stroke)
  - mechanical (e.g. oesophageal cancer)
- To supplement inadequate intake where alternative measures have failed:
  - cystic fibrosis
  - reluctance to eat – this is only rarely an indication for artificial nutritional support. If in doubt, contact nutrition team

Contraindications to PEG insertion

- **Absolute**
  - imminent demise
  - ascites
  - oesophageal or gastric varices
  - advanced dementia

- **Relative**
- gastric carcinoma
- gastric ulceration
- previous gastric surgery – each patient will be assessed individually
- physical deformity (e.g. severe kyphoscoliosis)
- clotting disorder/anticoagulation therapy (ensure INR <1.5)
- severe behavioural problems – each patient will be assessed individually

Intravenous feeding

- Patients are likely to benefit from total parenteral nutrition (TPN) only if this is needed for at least 7–10 days, as the risks of shorter term feeding outweigh the benefits
- Send all referrals to nutrition team who will assess and, where appropriate, take over nutritional care of patient for the duration of feeding

Indications

- Non-functioning gastrointestinal tract (ileus, obstruction)
- High gut fistulae
- Chylous leaks

Monitoring

- Further details on requirements, monitoring and complications of TPN – see **Artificial nutritional support** in **Surgical guidelines**

WITHDRAWING NUTRITION

- A professional carer has a duty to prolong life, but not inappropriately to prolong dying
- In ethical and legal terms, there is no difference between withdrawing and withholding artificial nutritional support
- Withhold tube feeding if it is futile (e.g. advanced cancer, end-stage dementia) but **consider each patient on their own merits**
- Withdraw tube feeding if, after a trial of feeding (e.g. nasogastric tube after CVA), there is no recovery and little or no likelihood of recovery or meaningful quality of life. This is an acceptable practice if the decision is taken in the patient's best interests. At this point it is likely a 'best interests' meeting is held. If there is concern that the patient may be in a persistent vegetative state (PVS) or a minimally conscious state (MCS), seek advice from Legal Services team
- Where a decision to withhold/withdraw nutritional support has been made, stop artificial hydration – a death from malnutrition takes a lot longer than one from dehydration
- If, at the end of life, a patient is at risk of aspiration but can still take some food orally, consider 'comfort feeding' after discussing risks with patient and/or family/IMCA. This may lead to better palliation than being nil-by-mouth

ETHICS AND CONSENT

Make sure you document the decision-making process at the time it happens, in detail

- Consent must be obtained for any nutritional intervention or withdrawal. Read the **Consent** guideline carefully and follow the steps contained therein. Where patient lacks capacity to make decisions about their treatment, decisions should be made in the patient's best interests in accordance with the Mental Capacity Act; if in doubt seek advice from the Legal Services team

VERIFICATION OF DEATH • 1/2

PROCEDURE

- Assess patient's condition against following criteria:
- no heart beat heard and no carotid pulse felt for full 5 minutes simultaneously
- no breath sounds heard and no chest movement seen for full 5 minutes simultaneously
- pupils fixed and dilated
- corneal reflex absent

Information to be recorded in patient's medical notes

- Confirm identify of the patient, cross reference with notes and wrist band, and document in the notes:
- date and time of examination of body
- Entry stating that:
- last observed breath (date/time) by whom (person's full name)
- no heart beat heard and no carotid pulse felt for full 5 minutes
- no breath sounds heard and no chest movement seen for full 5 minutes
- pupils fixed and dilated
- corneal reflex absent
- Patient verified as dead
- Signature, name, designation and contact number of verifier

LEGAL ISSUES

- A doctor who has attended a deceased person during his/her last illness is required to issue a medical certificate stating cause of death 'to the best of his/her knowledge and belief'
- To issue a certificate, doctor is not obliged to view the body but good practice requires that, if he/she has any doubt about fact of death, he/she should satisfy himself/herself in this way
- As the doctor is not obliged in law to see the body in order to issue a certificate, appropriately trained nurses may expand their role into verification of expected death
- It is the hospital doctor's responsibility to:
- inform the Coroner where necessary
- issue death certificate
- inform deceased's GP

THE CORONER

When registering the death at the registration office, ask whether Coroner must be informed. The registrar is regularly updated with Coroner's requirements. Circumstances of death about which Coroner must be informed include:

- **Unknown cause:** cause of death is unknown
- **? Natural causes:** It cannot readily be certified that the cause of death is due to natural causes
- **No medical attendance:** deceased either not attended by a doctor during his last illness **or** was not seen within the last 14 days
- **Suspicious/violent:** suspicious circumstances **or** a history of violence
- **Accident:** death due to some form of accident (e.g. fall, road traffic collision, incident at work or in the home etc.) Consider whether an old injury may have caused/contributed to death years later
- **Self neglect/neglect by others:** any suggestion of self-neglect/neglect by others – can include lack of medical care (e.g. bed sores not properly treated. If bed sores are level 1 or 2 these do not need reporting – unless other reasons for doing so)
- **Prison/police custody:** death occurred during/shortly after release from prison, young offenders institution or police custody (even if cause of death due to natural causes)
- **Mental Health Act 1983:** deceased detained under the Mental Health Act. There is no longer a requirement to report deaths of persons who were subject of a DoLS
- **Abortion:** death linked to an abortion (includes both maternal deaths and infant deaths where infant has drawn breath, even if abortion legally performed under the Abortion Act)
- stillbirths do not need to be reported if doctor satisfied that infant has not drawn breath
- **Self harm:** death may have been due to the actions of the deceased, overdose, solvent abuse, alcohol related deaths, self-injury etc.

VERIFICATION OF DEATH ● 2/2

- **Industrial disease:** give details if the deceased had industrial/disability/war pensions. Pensions for white finger and hearing loss do not qualify under this section
- pneumoconiosis/chronic bronchitis and emphysema/pulmonary fibrosis (including Farmer's Lung)/mesothelioma/asbestosis – give details of any known employment and smoking history
- chronic obstructive pulmonary/airways disease – only report if a history of coal mining
- **Recent operations/procedures/medicines:** It may be wise to report any death where there is an allegation of medical mismanagement
- report deaths which are suspected to be due to/exacerbated by medical intervention/medicines (e.g. GI bleeds due to warfarin, aspirin, NSAIDs etc. pseudomembranous colitis due to antibiotics, or deaths attributable to chemotherapy, immunosuppressive drugs, steroids etc.
- deaths where there has been surgery under general anaesthesia within 12 months of death or where more distant surgery has led to the death
- do not report minor surgical procedures (e.g. gastroscopies, endoscopies, biopsies, cataracts etc.) unless complications arose from procedure
- **Admission within 24 hr:** death occurs within 24 hr of admission to hospital (unless admission was for terminal care)
- **Falls, fractures, cerebral haemorrhage, CVA, CVD:**
- any fractured limbs within 12 months of death
- cerebral, subdural or extradural haemorrhage **unless** certifying doctor satisfied that haemorrhage due to entirely non-traumatic reasons e.g. CVA, CVD. **But** if bleed due to/exacerbated by drugs e.g. warfarin, heparin etc. report death
- falls without serious injury which have not contributed to death do not need to be reported
- **Cancer related deaths:**
- bladder cancer in a person born before 1935 (especially if any suggested link with Michelin) or where dye works may be implicated
- carcinomatosis – unknown primary
- neutropenic sepsis from chemotherapy treatment
- **Failures, obstructions, bronchopneumonia, sepsis and peritonitis:** any which are not adequately qualified. Unqualified cardiac arrest, congestive cardiac failure and brain hypoxia are similarly unacceptable unless adequately qualified
- **Old age:** an acceptable cause of death in a person aged ≥80 yr but generally better to include co-morbidities in part 2 if no specific medical cause of death which would better describe the death and therefore does **not** need to be reported
- **Miscellaneous:** any death where there are unusual or disturbing features

The Coroner must be contacted to discuss any case where there is doubt regarding any of the above circumstances

- All staff are advised to read 'Guidance for doctors certifying cause of death' from the Office for National Statistics Death Certification Advisory Group, April 2005 www.gro.gov.uk/medcert

A copy of 'Reportable deaths – a guide' can be obtained from the Coroner

STANDARD INFECTION PREVENTION MEASURES ● 1/2

CLINICAL AREAS

Standard precautions are the essential infection prevention measures necessary to reduce the risk of transmission of infectious agents to patients, staff and visitors

Standard precautions are to be used by all staff, for all patients in all care settings at all times on the assumption that all contact with blood, body fluids, secretions and excretion (except sweat), non-intact skin and mucous membranes, along with contact with the healthcare environment may result in the transmission of infectious micro-organisms

Staff

All healthcare workers must be aware of their individual responsibility for infection prevention

- Carry out regular and thorough hand hygiene and follow the World Health Organisation "5 moments for hand hygiene" – see **Hand hygiene** section of the Infection Prevention Questions and Answers Manual IP01b
- Cover all cuts and grazes with waterproof dressings
- All healthcare workers must ensure that their hepatitis B status is known and that they are up-to-date with all vaccinations, including influenza vaccination which is offered to all staff
- Any healthcare workers who develop symptoms of diarrhoea and/or vomiting (which cannot be explained) should report these symptoms to occupational health and should remain off work until symptom-free for 48 hrs
- Staff who develop vomiting and/or diarrhoea (which cannot be explained) while on duty, please inform the staff member in charge of the area. Inform your line manager and return home until 48 hr after your symptoms have stopped
- Report any skin lesions or recurrent infections to occupational health

Patients

- Patients must be promptly assessed for infection risk on admission, before admission if possible and throughout their stay the assessment should influence placement decisions in accordance with clinical needs. Check iPortal for any infection prevention alerts. Assess risk in all patients, isolating patients with conditions that increase the risk of spreading micro-organism to others (e.g. suspected or known infectious diarrhoea, exfoliative skin condition, large open wound, productive cough)
- Patients should be encouraged and must be offered the opportunity to clean their hands before meals; before taking oral medication; after using the toilet commode or bedpan/urinal; and at other times as appropriate

Environment

- Maintain clean and dust-free environment
- Increase levels of cleaning in outbreak situations – infection prevention team (IPT) will advise domestic services/Sodexo services and ward manager on frequency and type of cleaning required for outbreak situations
- Use Virusolve 5% for daily cleaning of hard surfaces in all adult areas (or Tristel fuse and Tristel Jet disinfectant at County Hospital)

General equipment

- Use single patient use or disposable equipment where possible
- Never attempt to decontaminate or reuse single use items
- Decontaminate reusable equipment after use
- Follow manufacturers' instructions for cleaning
- A number of cleaning products are available: refer to decontamination policy

Protective equipment

- See **Use of personal protective equipment section of the Infection Prevention Question and Answers Manual IP01b**
- For invasive procedures, during contact with sterile sites, non-intact skin and mucous membranes, and when handling sharps and contaminated equipment, wear gloves
- When there is a risk that clothing or uniform will become contaminated, or there is close contact with a patient, wear disposable apron

STANDARD INFECTION PREVENTION MEASURES ● 2/2

- Use fresh apron and gloves for each patient and for each different care activity on the same patient
- If risk of extensive splashing, wear full-body fluid-repellent gown
- If there is a risk of splashing into eyes or mouth, wear eye and face protection
- For multi-drug resistant pulmonary tuberculosis, SARS, you must wear an FFP3 mask and must previously have been fit-tested to ensure it is effective
- See Personal protective equipment section of the Infection Prevention Questions and Answers Manual IP01b for the use of FFP3 masks during aerosol generating procedures

Linen, waste and sharps

- Wear appropriate personal protective equipment
- Handle linen and waste correctly
  - place soiled linen in skip at bedside
  - place clinical waste in orange bag
- Needle safety devices should be used where there are clear indications that they will provide safer systems of working for healthcare staff
- Take sharps box (with blue tray) to point of use and dispose of the sharp directly immediately into the sharps container after use
- Never leave sharps for someone not involved in procedure to clear away
- Never re-sheath needles
- Dispose of needles attached to syringes as a single unit
- **Do not** fill sharps containers above the manufacturers marked line which indicates that they are full

Microbes isolated

- If alerted to identification of specific organism, follow appropriate guidelines. See flowcharts in guidelines for **Meticillin-Resistant *Staphylococcus Aureus* (MRSA), Extended Spectrum Beta-Lactamase producing Gram-negative bacilli (ESBL), *Clostridium difficile*** and **Carbapenemase-producing Gram-negative bacilli**

Antimicrobials

- Use antimicrobials rationally. See appropriate guideline in **Medical, Surgical** or **Antimicrobial prescribing** guidelines

INFECTION PREVENTION TEAM

- If in doubt, contact IPT for advice
- Pooh help-line
  - during normal working hours: call infection prevention nurses or bleep via call centre
  - out-of-hours: contact on-call microbiologist via call centre

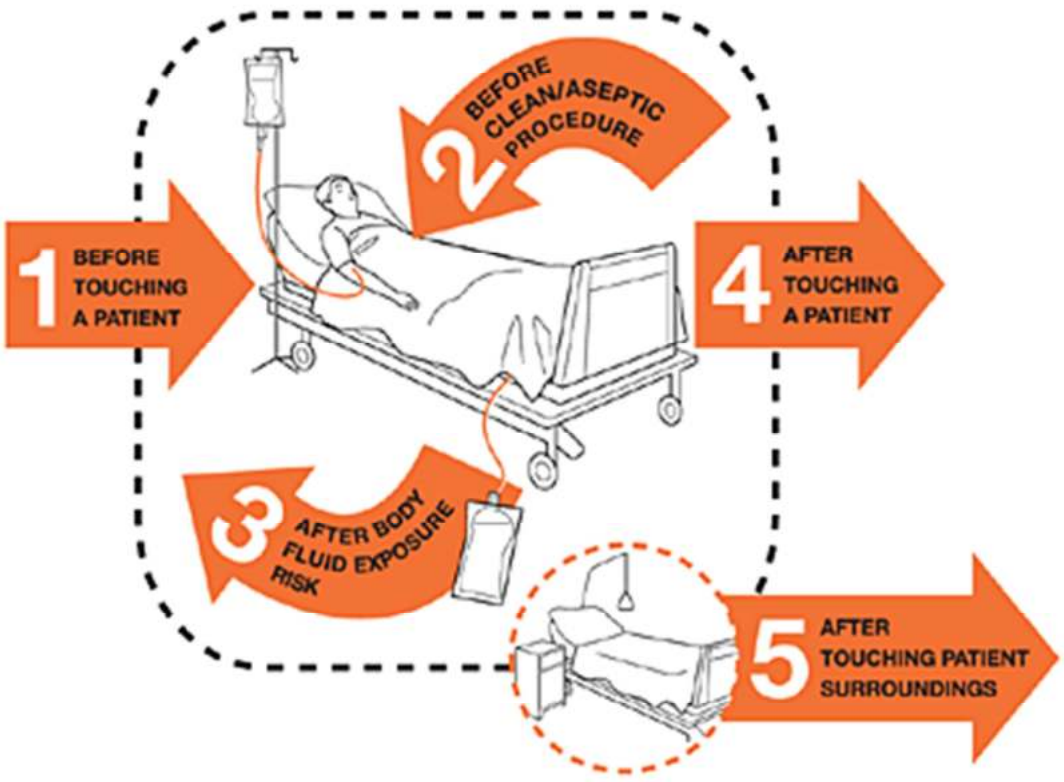
HAND HYGIENE • 1/4

Hand hygiene is a term used to describe cleaning and/or decontamination of hands by using soap and water, antiseptic wash or by using an alcohol hand rub solution
Good hand hygiene is the most effective way to prevent spread of infection. Use this safe method of working at all times to protect staff, patients and others from infection.
All practitioners are personally accountable for their hand hygiene practices
Refer to the latest version of the **Hand hygiene section of the Infection Prevention Question and Answers Manual IP01b**

ASSESSMENT OF NEED TO DECONTAMINATE HANDS

Hands must be decontaminated at critical points before, during and after patient care to prevent cross infection of micro-organisms. The World Health Organisation (WHO) "5 moments for hand hygiene" has been adopted as a standard model for hand hygiene compliance guidance

- **Hand decontamination must be carried out at the 5 moments of care regardless of whether or not gloves have been worn**
- before touching a patient
- before and after clean/aseptic procedure
- after body fluid exposure
- after touching a patient
- after touching patient surroundings



- **Hands must also be decontaminated**
- on arrival at and before leaving a ward or department
- after visiting the toilet
- before serving/preparing food or drinks
- after any activity or contact that potentially results in hands becoming contaminated
- on entering and leaving an isolation cubicle
- after removal of gloves

CHOICE OF HAND HYGIENE PREPARATIONS

- Alcohol hand rub: is an effective method of hand decontamination on visibly clean hands but is not recommended when hands are visibly dirty

Alcohol hand rub alone must not be used after caring for patients (or their equipment/environment) who have suspected or known infectious diarrhoea such as* Clostridium *difficile or* Norovirus*, regardless of whether gloves are worn

- Hand washing with liquid soap and water removes dirt, organic matter and transient flora by mechanical action and should be used
- when hands are visibly dirty or visibly soiled with body fluids or other organic matter
- when caring for patients with suspected or confirmed diarrhoea and/or vomiting, patients with *Clostridium difficile* or Norovirus and during outbreaks of these organisms on wards or in bays
- after several consecutive applications of alcohol hand rub
- after visiting the toilet
- Liquid soap alone does not provide sufficient hand disinfection before invasive procedures and surgery
- For aseptic non touch technique (ANTT) it is recommended that hand washing with liquid soap is followed by the use of alcohol hand rub before and, if required, during procedure
- Use of preparations containing antiseptic (chlorhexidine, povidone iodine) is required in situations where prolonged reduction in micro-organisms on the skin is necessary i.e. surgery, some invasive procedures or in outbreak situations

TECHNIQUE FOR HAND HYGIENE

- Bare below elbow for all staff working within clinical areas (e.g. no sleeves below elbow, no wrist watches, wrist jewellery or plaster casts/wrist splints)
- Do not wear false nails, nail extensions, gel nails or nail varnish
- Keep nails short and clean
- Before clinical work shift begins, remove stoned rings, wrist watches or other wrist jewellery
- Cover cuts and abrasions on hands and arms with waterproof dressings

Washing with soap and water

- Turn on taps using elbows if possible
- Wet hands under warm running water before applying soap or antiseptic detergent, lather well and rub vigorously for a minimum of 10–15 sec, paying particular attention to tips of fingers, thumbs and between fingers
- Use technique that covers all surfaces of hands and wrists (see **Figure 1** or Trust Hand hygiene section of the Infection Prevention Question and Answers Manual IP01b)
- Rinse thoroughly
- Turn of taps using elbow where applicable (some taps are sensor operated)
- Dry hands with a disposable paper towel
- Hand dryers are not recommended in clinical areas
- Dispose of paper towel in bin using foot operated mechanism to prevent contamination of hands

Using alcohol-based hand gel

- Apply alcohol-based gel paying particular attention to tips of fingers, thumbs and between fingers, and rub hands together until solution has evaporated and hands are dry
- ensure all areas of hands and wrists are covered and rub hands together (see **Figure 2** or Trust Hand hygiene section of the Infection Prevention Question and Answers Manual IP01b)

SKIN PROTECTION

- Apply an emollient hand cream regularly to protect skin from damaging effects of regular hand washing and use of alcohol-based hand gel

If any lesions or recurrent skin infections, or if any decontamination product causes skin irritation, contact occupational health

Figure 1


How to wash hands
WITH SOAP AND WATER
40-60 secs
1
Wet hands with water
2
Apply one shot of soap
3
Rub hands palm to palm
4
Rub back of each hand with the palm of other hand with fingers interlaced
5
Rub palm to palm with fingers interlaced
6
Rub backs of fingers to opposing palms with fingers interlocked
7
Rub each thumb clasped in opposite hand using rotational movement
8
Rub tips of fingers in opposite palm in a circular motion
9
Rub each wrist with opposite hand
10
Rinse hands with water
11
Use elbow to turn off tap
12
Dry thoroughly with a single-use towel

Figure 2


How to sanitise hands
WITH ALCOHOL SANITISER
20-30 secs
1a
1b
Apply one shot of the product in a cupped hand
2
Rub hands palm to palm
3
Rub back of each hand with the palm of other hand with fingers interlaced
4
Rub palm to palm with fingers interlaced
5
Rub backs of fingers to opposing palms with fingers interlocked
6
Rub each thumb clasped in opposite hand using rotational movement
7
Rub tips of fingers in opposite palm in a circular motion
8
Rub each wrist with opposite hand

USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) ● 1/2

As it is not always possible to identify individuals with an infection, adopt this safe method of working at all times to protect staff, patients and others from infection.
PPE is equipment to help protect staff, patients and visitors from the risk of infection. It includes items such as gloves, aprons, gowns, masks, eye, facial protection, head cover and fluid repellent footwear e.g. Wellington boots. Refer to the latest Personal protective equipment sections of the Infection Prevention Question and Answers Manual IP01b

Selection of personal protective equipment will follow a risk assessment which will be carried out by the person performing the procedure and must be based on:

- Risk of transmission of the micro-organism to patient or healthcare worker
- Risk of contamination of the healthcare workers clothing or skin by the patient's blood or body fluid
- Suitability of the personal protective equipment for proposed use

GLOVES

When

Wear disposable gloves (see **Choice** below) for:

- Invasive procedures
- Performing aseptic non touch technique (ANTT)
- Contact with sterile sites, non-intact skin or mucous membranes
- Managing surgical wounds
- Anticipated contact or exposure to blood, body fluids, secretions and excretions
- Handling sharp or contaminated instruments
- Application of topical preparations
- Contact with cytotoxic agents
- Contact with chemicals
- When decontaminating equipment

How

- Use non-latex gloves
- Gloves should be put on immediately before required and removed as soon as activity is completed
- Following removal of gloves, decontaminate hands
- Change gloves between care activities for different patients or between different care activities on the same patient
- gloves are single-use items

Choice

- Choice of sterile or non-sterile will depend on the intended procedure. A range of CE-marked gloves of different sizes and suitable for the task should be available in all clinical areas

FLUID-REPELLENT GOWNS AND PLASTIC APRONS

Fluid-repellent gowns

- If there is a risk of extensive splashing of blood and body fluids (e.g. dealing with major trauma or during major surgical procedures, or for certain infections), wear a full-body fluid-repellent gown

Plastic aprons

- If there is a risk that clothing or uniform may be exposed to blood, body fluids, secretions and excretions, wear a disposable plastic apron
- When caring for patients with certain infections e.g. *Clostridium difficile*
- Change plastic aprons between patients and between different care activities on the same patient
- aprons are single-use items

MASKS, EYE AND FACE PROTECTION

When

- Depends on known or suspected infectious status of patient, presenting symptoms and task involved
- Protective eyewear and face shields must be worn when it is anticipated that secretions, excretions or blood may be splashed or sprayed towards the face, for example, during delivery procedures, surgical/invasive procedures, severe trauma or other patient care activities, e.g. suctioning, chest physiotherapy
- Regular spectacles are not considered as eye protection
- During resuscitation/intubation and exubation of a patient with suspected/confirmed serious infection e.g. meningitis
- Masks are single-use items and should be discarded in the clinical waste bins

USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) ● 2/2

Splash and droplets

- **Droplets**: expelled from the respiratory tract of an infected individual e.g. during coughing and sneezing may fall directly onto mucous membrane of a susceptible individual. A distance of 1 m has been used to define the need for droplet precautions; however, this distance is recommended as the minimum rather than an absolute distance
- Protection: barriers to protect eyes, nose, mouth and upper respiratory tract of those exposed
- **Surgical face masks with eye protection:** provide a barrier to splashes and droplets impacting on the wearer's nose, mouth and respiratory tract. They **do not** provide protection against airborne (aerosol) particles. Surgical masks must be fluid resistant to protect against infection
- Aerosol generating procedures can break droplets into small enough particles that can remain suspended in the air for longer periods of time and travel longer distances; these are called droplet nuclei (see **Airborne transmission**)

Airborne transmission

- Aerosol particles that may contain infectious agents: generated from respiratory tract during coughing, sneezing and during **aerosol generating procedures**, particles can remain in the air for long periods of time and carried over long distances by air currents
- See Personal Protective Equipment section of the Infection Prevention Questions and Answers Manual IP01b for a list of aerosol generating procedures
- FFP3 (respirator) masks provide respiratory protection from airborne transmitted organisms and during aerosol generating procedures; FFP3 masks are available with/without a valve
- Before using a FFP3/respirator mask, it must be verified that each user has a mask that is suitable for the their face shape and that they can put it on so that it leaves no gaps between the mask and their face for air to pass through unfiltered. This process is known as '**fit testing**'
- it is a legal requirement that staff who are required to wear a FFP3 (respirator) mask be fit tested by a competent person and that the results are satisfactory, and those results are recorded and available
- mask fit key trainers are available throughout the Trust. Mask fit testing should form part of the ward/departments local induction training of staff

REMOVAL OF PERSONAL PROTECTIVE EQUIPMENT

Remove personal protective equipment in the following sequence:

1. Gloves
2. Apron/gown
3. Decontaminate hands
4. Eye protection
5. Mask/respirator
6. Decontaminate hands

SCREENING FOR MRSA/SA AND MGNB/ESBL/CPE • 1/3

For details, see Trust policy on Infection Prevention IP01b – Infection Prevention Manual Questions & Answers*, Chapter 3: *Prevention of Infections caused by specific pathogens

WHO, WHEN AND HOW

- Screen for Meticillin-resistant *Staphylococcus aureus* (MRSA) all admissions aged >16 yr for overnight stay regardless of portal of entry or whether emergency/elective admission
- Before an **elective** procedure **at high risk of *Staphylococcus aureus* (SA) infection** (see **Table 1** below): if **not** admitted from home* then screen for SA 7 days before; if patient admitted from home then screen for SA *at least 2 weeks before procedure
- If **elective** SA infection high-risk procedure is urgent (<7 days), see **Table 3** below
- Screen for MGNB at transfer or emergency admission if indicated, see **Table 2** below

Definitions used in screening for MGNB/ESBL/CPE

- MGNB = Multi-drug resistant Gram-negative bacilli (GNB); includes GNB that are resistant to 3 classes of antimicrobials, e.g. resistant to piperacillin/tazobactam, gentamicin and ciprofloxacin
- ESBL = Extended Spectrum Beta-Lactamase-producing Gram-negative bacilli; these are resistant to co-amoxiclav, piperacillin/tazobactam, and ceftriaxone, may be resistant to other classes of antimicrobials, but are sensitive to carbapenems
- CARB = Carbapenem-resistant Gram-negative bacilli; these GNB may be more multi-drug resistant than ESBL, and may be fully resistant to meropenem; this group includes Multi-Drug Resistant *Acinetobacter baumannii* (MDRAB) that may be pan-resistant, and CPE
- CPE = Carbapenemase-producing Entero bacteriaceae; CPE are a subgroup of CARB, and include carbapenem-resistant *Klebsiella pneumoniae*, *E. coli* and *Enterobacter cloacae;* the common types of carbapenemase gene in CPE are: OXA-48, KPC, and NDM

Table 1: Summary of screening for MRSA and SA (that is both MRSA and Meticillin-Sensitive *Staphylococcus Aureus)*, before elective admission or SA infection high-risk procedure in area for overnight stay, except Maternity

Area	Reason for elective admission or type of elective procedure	Screen for MRSA carriage only (MRSA screen) See Table 3	Screen for MRSA and SA carriage (STAPH screen) See Table 3
Area for overnight stay, except Maternity; Day-case area if co-located with overnight stay area (e.g. orthopaedics)	Any implant surgery, or any other SA infection high-risk procedure viz: • Joint replacement • Major cardiothoracic surgery • Intra-cranial neurosurgery, including insertion of VP shunt • Spinal surgery • Vascular surgery with implants • Breast implants in conjunction with reconstructive surgery • Major reconstructive surgery • Insertion of long-term dialysis lines • Insertion of Hickman lines • Insertion of feeding tubes into stomach and jejunum (PEGs and PEJs) • Insertion of permanent pacemakers • Interventions to existing pacemakers or other existing implants without complete removal	No	Yes
	Admission to adult area for surgery other than above	Yes	No
	Admission to adult area for reason other than above including all medical admissions	Yes	No

SCREENING FOR MRSA/SA AND MGNB/ESBL/CPE ● 2/3

TRANSFER OR EMERGENCY ADMISSION

Table 2: Summary of screening for MRSA or MGNB on transfer or emergency admission

Area	Patient admitted from; to	Screen for MRSA carriage See Table 3	Screen for MGNB carriage See Table 3
Adult area for overnight stay, except Maternity	Nursing or residential home to UHNM	Yes	Yes
	Other hospital to UHNM	Yes	Yes
	Home to UHNM, or transfer from Maternity to other adult area for overnight stay	Yes	Yes if: • Had >24 hr stay in care home or healthcare facility other than UHNM (UK or abroad) in previous 12 months, **or** • Had multiple >24 hr hospital admissions in previous 12 months • ESBL/MGNB/CARB alert present on iPortal, **or** • Long-term urinary catheter present
	General ward to high risk area for MRSA infection e.g.: Critical Care, high dependency units, SSCU, burns and plastics ward, renal unit, cardiothoracic wards, orthopaedic wards, neurosurgical wards and oncology and haematology wards Screen transfers to these areas on arrival if not screened for MRSA in last 24 hr	Yes	Yes

- If an emergency admission has a **history** of MRSA in previous 6 months (patient has red MRSA infection prevention alert in iPortal), or aged >65 yr **AND** transferred from a care home or other hospital, start blind MRSA decolonisation treatment, including nasal cream, immediately after taking samples for MRSA screening. Stop decolonisation as soon as all MRSA screening reports state 'MRSA not detected'

WHEN AND HOW TO SAMPLE

Consent

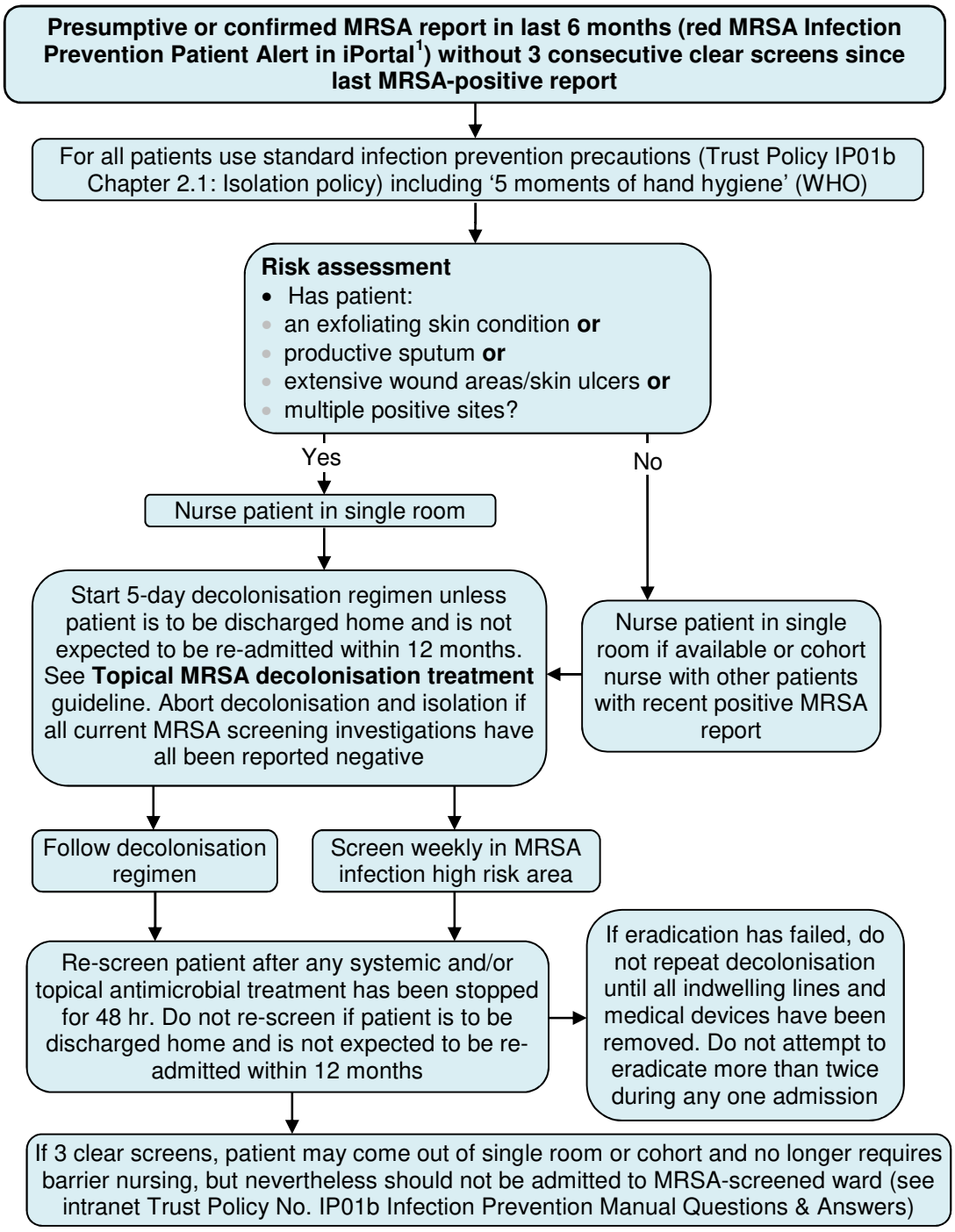
- Explain reason for taking swabs and obtain patient's consent

SCREENING FOR MRSA/SA AND MGNB/ESBL/CPE ● 3/3

Table 3: When and how to sample

Sampling for	Timing	How
Elective MRSA screen	• If patient at home, screen 2–4 weeks (maximum 6 months) before elective admission • If patient not at home and not in UHNM, screen 7 days before transfer (include perineum swab) and again on admission • **If undergoing MRSA decolonisation or other antimicrobial treatment, delay screening until >48 hr after completion**	• Swab anterior nares • Swab any skin lesion or ulcer • If long-term catheterised, add CSU • If productive cough, add sputum • Add swab from perineum: ◦ if patient tagged for MRSA on iPortal, or ◦ if patient is to be admitted to 'MRSA screened patient' area • Tick MRSA SCREEN on request card • It should be clear who is responsible for checking results and informing consultant if MRSA detected
Elective STAPH screen (MRSA and SA infection high-risk procedures only) see **Table 1** for definitions	• If patient at home, screen 2–4 weeks (maximum 8 weeks) before SA infection high-risk surgery • If patient not at home and not in UHNM, screen 7 days (6–8 days) before transfer/procedure and again on admission • If patient in UHNM, send samples for STAPH SCREEN 7 days before elective SA high-risk surgery • **If undergoing MRSA decolonisation or other antimicrobial treatment, delay screening until >48 hr after completion**	• Swab anterior nares, perineum, throat, and any skin lesion or ulcer ◦ if long-term catheterised, add CSU ◦ if productive cough, add sputum • Tick STAPH SCREEN on microbiology request card
Screening for MRSA on transfer or emergency admission	• Immediate **unless undergoing MRSA decolonisation or any other antimicrobial treatment, in which case delay screening until >48 hr after completion of all antimicrobial treatment**	• Swab anterior nares and perineum (swab from throat instead of perineum acceptable if consent for perineum swab cannot be obtained in acute admission area) • Swab all ulcers and skin lesions ◦ if long-term catheterised add CSU ◦ swab any IV line that is impractical to change and record VIP score 8-hrly ◦ if productive cough, add sputum • Tick MRSA SCREEN on microbiology request ◦ if renal dialysis line *in situ*, request STAPH SCREEN instead
Screening for MGNB (includes screening for ESBL and CARB/CPE)	• Immediate	• Rectal swab (if stoma or unable to obtain rectal swab, send swab from stool sample) ◦ ensure that swab has visible faecal material ◦ if long-term catheterised add CSU • Tick MGNB SCREEN on microbiology request • In addition, if a patient has been identified as a close contact of a patient with confirmed CPE by IP team, contact microbiology and request a Copan rectal swab; submit the Copan rectal/stool swab, with visible faecal material, requesting "CPE PCR test"

MANAGEMENT OF HOSPITALISED PATIENTS WITH MRSA (METICILLIN-RESISTANT S. AUREUS) ● 1/1



MRSA infection high risk areas:

- Critical care unit/PICU/SCBU
- Burns and plastics
- Vascular surgery
- Renal unit
- Cardiothoracic wards
- Orthopaedic wards
- Neurosurgical wards
- Oncology/haematology wards

For detailed information see Trust Policy IP01b:
Chapter 2.1: Isolation policy
Chapter 3.1: Procedure for screening for MRSA
Chapter 3.5: Control of MRSA

[1] If iPortal unavailable, check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA

TOPICAL MRSA DECOLONISATION TREATMENT ● 1/1

WHO

- Decolonise all patients in UHNM found to be colonised with MRSA unless patient about to be discharged home, unlikely to be re-admitted within 12 months and at low risk of *Staph. aureus* (SA) infection (skin intact, no diabetes, no malignancy and not on immunosuppressive treatment)
- If an emergency admission (any age) has a **history** of MRSA in previous 6 months (in iPortal: infection prevention patient alert for MRSA present) **or** transferred from a care home or other hospital, start blind full MRSA decolonisation treatment immediately after taking samples for MRSA screening. Stop decolonisation as soon as all reports state 'MRSA not detected'

WHEN

- Before surgery
- If patient has a wound or ulcer infected with MRSA (not just colonised), carry out decolonisation of the patient once infection has improved, unless patient about to be discharged home and unlikely to be re-admitted within 12 months
- If there is a medical device *in situ* that breaches skin or mucous membranes (central venous catheter, tracheal cannula, drain, external pacemaker), or a urinary catheter
  - carry out decolonisation treatment while device *in situ* and again after all devices have been removed, since topical treatment in the presence of any such device may reduce colonisation but is unlikely to achieve complete eradication
- Otherwise start immediately

HOW

- Nasal mupirocin 2% 8-hrly for **5 days.** For mupirocin-high level resistant MRSA, use chlorhexidine 0.1% with neomycin 0.5% (Naseptin®) nasal cream topically to each nostril **6-hrly** for **10 days**
- Wash body once daily for **5 days**, and hair **twice in 5 days**, with chlorhexidine gluconate solution 4% (Hibiscrub®) or alternative product (e.g. Octenisan® or Triclosan®)
  - if chlorhexidine gluconate solution 4% not tolerated or patient not self-caring, use octenidine (Octenisan®) instead

Eradication is known to fail if 5 days (10 days for Naseptin) topical treatment are not completed

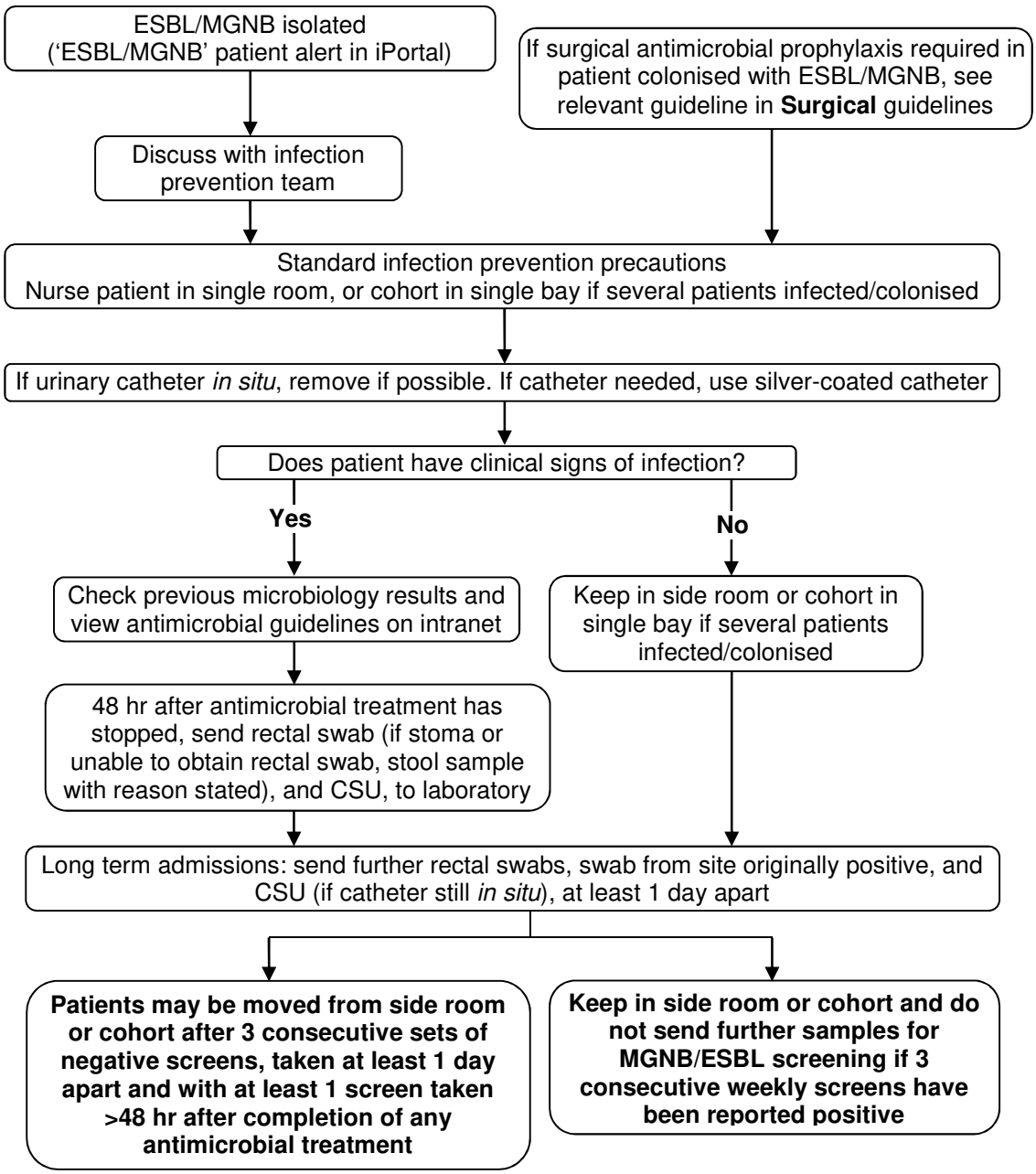
REPEAT SCREENING

- Take screening swabs **2 days** after completion of topical decolonisation and any other antimicrobial treatment, unless patient about to be discharged home, unlikely to be re-admitted within 12 months and at low risk of SA infection (skin intact, no diabetes, no malignancy and not on immunosuppressive treatment)
  - results of MRSA screening will be available after 1–3 days
  - if swabs positive, repeat course of topical decolonisation but do not give more than 2 courses during a single inpatient or outpatient episode

Do not use mupirocin for prolonged periods or repeatedly (for more than 2 courses of 5 days during an admission) as this can encourage resistance

MANAGEMENT OF PATIENTS WITH EXTENDED SPECTRUM BETA-LACTAMASE-PRODUCING BACILLI (ESBL) OR OTHER* MULTI-RESISTANT GRAM-NEGATIVE BACILLI (MGNB) ● 1/1

* For **Carbapenemase-producing Gram-negative bacilli (CARB) see separate** guideline



CARBAPENEMASE-PRODUCING GRAM-NEGATIVE BACILLI (CARB) INCLUDING CPE ● 1/1

Isolation flowchart

Patient to be admitted for overnight admission (emergency/elective, any age)

↓

Check for patient alerts on iPortal

↓

iPortal: Patient has 'CARB' IC alert

- **Strict contact isolation in single room with en-suite; use gowns and gloves**
- Send screening samples for multi-resistant gram-negative bacilli (MGNB); this will screen for Carbapenemase-Producing Enterobacteriaceae (CPE) and for Extended Spectrum Beta-Lactamase (ESBL)-producing *E. coli* and *Klebsiella pneumoniae*:
  - rectal swab (if unable to obtain rectal swab due to stoma, neutropenic patient etc., send swab from stool specimen instead)
  - catheter specimen of urine if long-term urinary catheter *in situ*
  - sputum if a productive cough present
- Contact infection prevention team (IPT) before moving patient to any other ward
- If considering empirical antimicrobial treatment for a presumed **infection**, check previous microbiology reports
- Once CPE/CARB has been reported, **patient should remain isolated for the entire duration of hospital stay** irrespective of subsequent negative screens

iPortal: Patient does not have a 'CARB' IC alert

- Has patient:
  - had a >24 hr stay in any healthcare facility or care home **outside Staffordshire, in UK or abroad** In the last 12 months**?**
  - had multiple hospital admissions in the last 12 months
  - a history of ESBL/MGNB in last 2 yr (iPortal: infection prevention patient alert)

If answer is yes, screen for MGNB as outlined in adjacent box and **isolate patient in single room** with gowns and gloves pending the screening results. If considering empiric antimicrobial treatment for a presumed **infection**, check antimicrobial guidelines on intranet

1. Patient transferred from hospital or care home **within Staffordshire**
2. **Long-term urinary catheter** *in situ*
3. In the last 12 months, has worked as a healthcare worker in a healthcare facility in UK or abroad with an increased prevalence of ESBL or CPE

If answer is yes to 1, 2 or 3, screen for MGNB as outlined in adjacent box

Patient with history of carbapenemase-producing *Acinetobacter*

- check microbiology results and send screening samples (outlined in box above)
- **add** swab from any wound, chronic ulcer or skin lesion, tracheostomy site, requesting 'screen for carbapenemase-producing *Acinetobacter'*

CLOSTRIDIUM DIFFICILE INFECTION (CDI) ● 1/3

If a patient with Clostridium difficile infection is identified on your ward, contact infection prevention team (IPT)

PREVENTION

- A reduction of diversity of normal gut flora and/or immunity is associated with an increased risk of CDI following recent acquisition of toxigenic *C. difficile* and in chronic carriers of toxigenic *C. difficile*
- almost all antibiotic classes reduce the diversity of gut flora following oral or intravenous administration, including antibiotics used to treat CDI (metronidazole and vancomycin)
- other drugs such as used in chemotherapy may also reduce the diversity of the gut flora
- CDI is associated with administration of an antimicrobial in the previous 3 months in most cases, and the risk of CDI further increases with the number of antibiotic courses received in this period
- the diversity of normal gut flora may take months or years to recover
- Use antimicrobials appropriately. Follow hospital antimicrobial formulary and prescribing guidelines available on Trust intranet: Clinicians>Clinical guidance>Clinical guidelines>Antimicrobial, and in "MicroGuide" App (Android/iPhone/iPad)
- When prescribing antimicrobials, always document clinical indication and reason for choice in patient notes, and clinical indication, route and duration on prescription chart
- Use narrow spectrum agents whenever possible and in conjunction with microbiology results, since a broad spectrum is more likely to select for CDI and antibiotic resistance
- Review antimicrobial prescriptions on all ward rounds (senior SpR or above)
- Switch IV antimicrobials to oral route after 48 hr where possible, and stop antimicrobials after a total of 5 days treatment (including IV treatment) unless a specific infection justifies an extended duration of treatment – see Antimicrobial guidelines on Trust intranet
- Gastric acid suppression increases risk of acquisition of *C. difficile* during hospital admission. All patients prescribed gastric acid suppression e.g. proton pump inhibitors (PPI) should have the indication reviewed by a consultant or registrar
- if there is a compelling indication to prescribe acid suppression such as H_2 antagonist (preferred) or proton pump inhibitor in a hospitalised patient at risk of CDI, minimise dose and duration to the safest minimum, since the risk of CDI has been shown to be dose-dependent
- Other risk factors for CDI: advanced age, prior hospitalisation, duration of hospitalisation, care home residency, abdominal surgery, and nasogastric tube
- Risk factors for recurrent CDI: prior episode of CDI in last 6 months, antibiotic use (concomitant or post CDI), advanced age, prolonged or recent stay in healthcare facility, severity of underlying illness, and PPI
- Note: in a patient who has suffered a recurrent episode of CDI within 6 months (iPortal: 'Rdiff' Patient Alert present), the risk of further recurrence is 40–60%. Clinicians should bear this in mind if considering prescribing an antimicrobial or proton pump inhibitor in these patients
- As a precaution, isolate patient with recurrent CDI in a single room even if no longer symptomatic for CDI, until 6 months after last episode or until discharge, and again on re-admission if within 6 months of last episode

Always discuss management of severe or life-threatening CDI with consultant microbiologist/consultant in infectious diseases. If a patient with mild or moderate CDI deteriorates, or if diarrhoea fails to respond to antimicrobial treatment of CDI for >5 days, seek advice from microbiologist or consultant in infectious diseases.
In general, avoid giving successive uninterrupted courses of different antimicrobials for any indication

DIAGNOSIS

- >1 watery, loose of unformed stools within ≤24 hr coupled with a diagnostic CDI test as described below
- ±WBC↑; ±signs of colitis (physical examination/X-rays/CT-scan abdomen)
- If the diarrhoea may be caused by laxative or antibiotic treatment, stop laxative and if possible stop antibiotics and for 24 hr follow impact on diarrhoeal symptoms before submitting a diarrhoeal sample for diagnostic testing to microbiology laboratory
- If the diarrhoea stops – no need to submit a stool sample

- If the diarrhoea continues – submit a diarrhoeal sample for testing. A diarrhoeal sample is a stool sample that takes the shape of the container. The laboratory will not test formed stool
- Laboratory tests for CDI include a *C. difficile* GDH antigen screening test, a toxin EIA test, and a PCR test for *C. difficile* toxin B gene if the former 2 tests are discrepant. A Laboratory Comment is provided with all test reports to aid interpretation
- A positive *C. difficile* GDH antigen screening and a positive toxin EIA result, in the context of continuing diarrhoea, supports the diagnosis of CDI
- A positive *C. difficile* GDH antigen screening and a negative toxin EIA may either represent the presence of non-toxigenic *C. difficile* (no CDI), or a false-negative toxin EIA test result. To distinguish, a PCR test for *C. difficile* toxin B gene is performed on the same or next working day
- If the *C. difficile* GDH antigen screening test and toxin EIA are both negative, or if the GDH antigen screening test is positive, and the toxin EIA and toxin B gene PCR test are both negative, consider alternative diagnosis. Do not send a repeat sample within 72 hr
- A positive PCR test for *C. difficile* toxin B gene in itself cannot distinguish between a patient with CDI and a carrier of toxigenic *C. difficile* with diarrhoea by alternate cause, and hence clinical signs and symptoms and other investigation results should be taken into consideration
- The gold standard for diagnosis of *C. difficile* colitis or pseudomembranous colitis is histology on tissue biopsy obtained during lower gastrointestinal endoscopy; however this is invasive and in severe colitis may increase the risk of perforation. Contact gastro-enterologist in case of doubt about diagnosis

TREATMENT

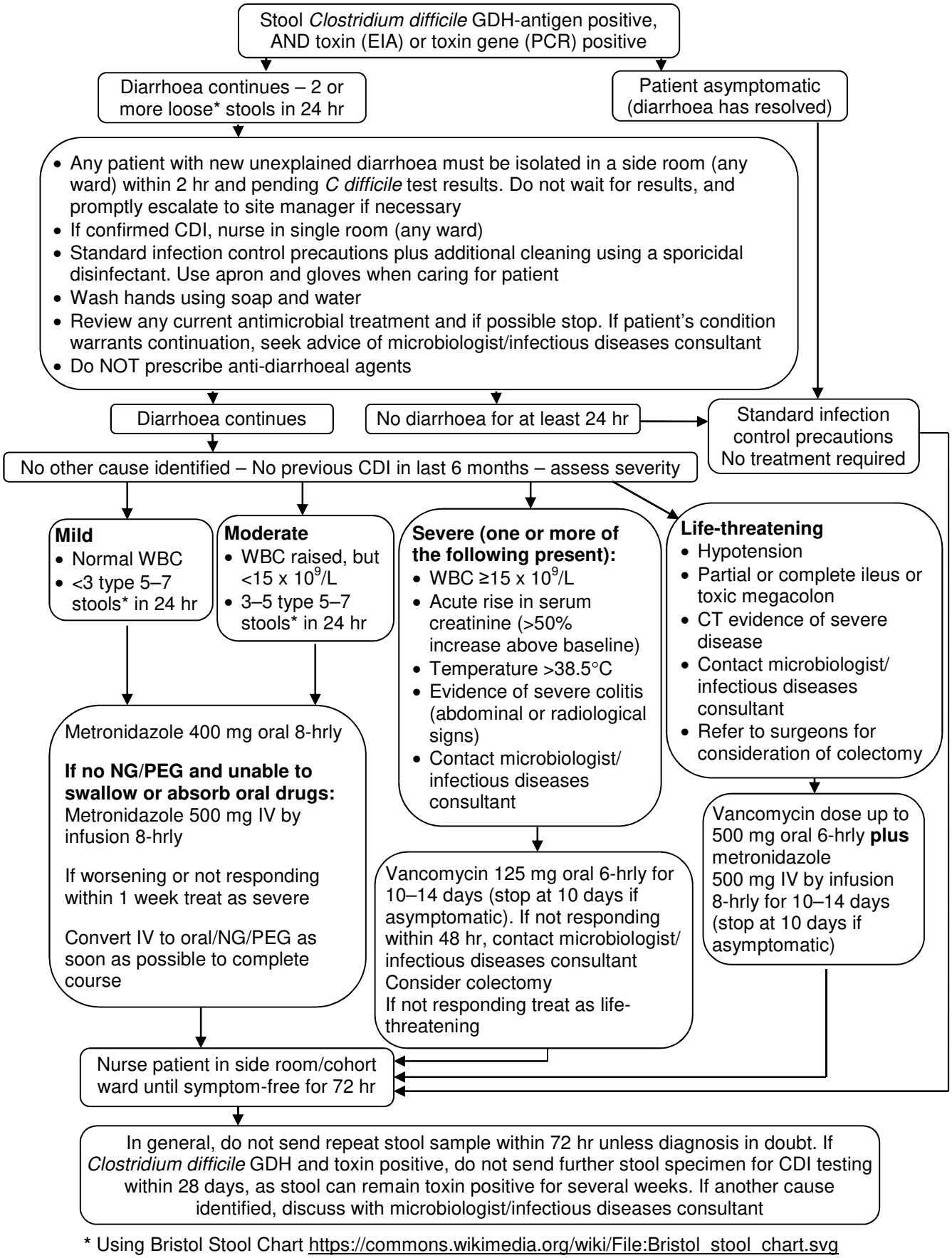
For treatment – see **flowchart on next page**

RECURRENCE/NON-RESPONDER

- Recurrent CDI: keep in side room irrespective of symptoms until hospital discharge or until 6 months have elapsed since last CDI diagnosis; whichever occurs first
- Review any current antimicrobial treatment and if possible stop
- If life-threatening colitis, refer to surgeons for consideration of colectomy
- First recurrence within 6 months, or if no response to oral vancomycin within 2–5 days: treat with fidaxomicin 200 mg 12-hrly for 10 days
- Subsequent recurrence within 6 months (3rd or further episode of CDI): commence fidaxomicin 200 mg 12-hrly, to be given for 10 days if patient is not a candidate for Human Probiotic Infusion (HPI) or if HPI is not available
- Human Probiotic Infusion (HPI) is a novel treatment for a 3rd or further episode of CDI. HPI aims to restore the diversity of the gut flora by infusion of a filtrate of gut flora derived from healthy donor faeces
- obtain patient's consent for administration of HPI
- contact a duty microbiologist if patient is a candidate for HPI
- complete HPI order form for microbiologist to obtain standardised, filtered, frozen, and then thawed preparation of stool from pre-screened universal donors from the West Midlands Public Health England laboratory, which will arrive in 3–4 days
- stop all antibiotic treatment (including for CDI) on the day before HPI is to be administered
- prepare patient for administration either via nasogastric, naso-jejunal tube or PEG, or via colonic infusion by a gastroenterologist if other routes are not an option
- patients with recurrent CDI treated with HPI demonstrated a 91% primary cure rate with symptoms usually resolving within 48 hr, and with a reduced risk of recurrent CDI in the following months provided that the patient does not receive further antibiotics

CLOSTRIDIUM DIFFICILE INFECTION (CDI) ● 3/3

Flowchart: Treatment



* Using Bristol Stool Chart https://commons.wikimedia.org/wiki/File:Bristol_stool_chart.svg

HIV INFECTION TESTING • 1/3

INTRODUCTION

- HIV is a treatable medical condition and the majority of those living with the virus in the UK are well
- Many are unaware (approximately 25%) of their HIV infection but their own health remains at risk and they may pass the virus unwittingly to others
- Late diagnosis is the most important factor associated with HIV-related morbidity
- HIV testing should occur in a wide variety of settings and all doctors should be able to obtain informed consent for an HIV test in the same way they do for any other medical investigation

HIV testing remains voluntary and confidential

WHO SHOULD BE OFFERED A TEST?

- Patients presenting with clinical features compatible with HIV, including primary HIV infection, as a differential diagnosis (see **Table**)
- Anyone exposed to HIV risk e.g. needlestick injury, both the person exposed and potential source

Primary HIV infection (PHI)

- Symptomatic PHI occurs in approximately 80% of individuals infected by HIV, typically 2–4 weeks after infection
- Typical symptoms include a combination of any of:
- fever
- rash (maculopapular)
- myalgia
- pharyngitis
- headache/aseptic meningitis
- Resolves spontaneously within 2–3 weeks
- If PHI suspected, contact on-call genito-urinary physician via call centre

Table: Clinical indicator diseases for adult HIV infection

	AIDS-defining conditions	Others where testing should be offered
Respiratory	• Pneumocystis pneumonia • Tuberculosis	• Bacterial pneumonia • Aspergillosis
Neurology	• Cerebral toxoplasmosis • Primary cerebral lymphoma • Cryptococcal meningitis • Progressive multifocal leucoencephalopathy	• Aseptic meningitis • Space occupying lesion of unknown cause • Guillain-Barré syndrome • Transverse myelitis • Peripheral neuropathy • Dementia • Leucoencephalopathy
Dermatology	• Kaposi's sarcoma	• Severe/recalcitrant • seborrhoeic dermatitis/psoriasis • Multidermatomal or recurrent herpes zoster
Gastroenterology	• Persistent cryptosporidiosis	• Oral candidiasis • Oral hairy leukoplakia • Chronic diarrhoea/weight loss of unknown cause • *Salmonella, Shigella* or *Campylobacter* • Hepatitis B/C infection
Oncology	• Non-Hodgkin's lymphoma	• Anal cancer/intraepithelial dysplasia • Lung/head and neck cancer • Seminoma • Hodgkin's lymphoma • Castleman's disease
Gynaecology	• Cervical cancer	• Vaginal intraepithelial neoplasia • Cervical intraepithelial neoplasia Grade 2 or above
Haematology		• Any unexplained blood dyscrasia
Ophthalmology	• Cytomegalovirus retinitis	• Infective retinal diseases

	AIDS-defining conditions	Others where testing should be offered
ENT		• Lymphadenopathy of unknown cause • Chronic parotitis • Lymphoepithelial parotid cysts
Other		• Mononucleosis-like syndrome • Pyrexia of unknown origin • Anyone with a mother who is HIV positive no matter what age • Anyone who has a partner who is HIV positive • Men who have sex with other men • Female sexual contacts of men who have sex with men • Patients reporting use of injecting drugs • Anyone from a country of HIV prevalence >1% • Anyone who has had sex in a country of HIV prevalence >1% • Anyone who has had sex with someone from a country of HIV prevalence >1% • All pregnant women

HOW

Who can test?

- Doctor, nurse, midwife or trained healthcare worker

Pre-test discussion

- Primary purpose of pre-test discussion is to establish informed consent for HIV testing
- Lengthy pre-test HIV counselling is not a requirement unless patient requests or needs this
- Address patient issues and concerns. It is important that information given about the test and the virus is adequate to enable patient to make an informed decision
- If patient refuses test, explore reasons for refusal to ascertain that this is not because of misunderstanding about the virus or the consequences of testing
- If patient raises concerns about insurance cover or criminal prosecution for transmission of the virus as reason for not testing, explore further and correct any factual inaccuracies (see http://www.bhiva.org/guidelines.aspx)
- Some patients may need additional help to make a decision (e.g. English not their first language). It is essential to:
- ensure they have understood what is proposed and why
- establish they understand what a positive/negative HIV result means (some patients could interpret 'positive' as good news)
- Children and young people, and those with learning difficulties or mental health problems, may need additional support and time to understand what is proposed and to make a decision (see below)
- Discuss and agree arrangements for communicating result with patient at time of testing (particularly if test performed in outpatient or emergency care setting)

Testing where patient lacks capacity to consent (including unconscious patient)

- See **Consent** guideline – **Valid consent for an adult patient who is found to lack capacity**
- Discuss with consultant in genitourinary medicine or ID service
- Assessment of capacity relates to the specific issue in question (i.e. consent to HIV testing)
- Start from presumption that patient has capacity to make this decision
- Consider whether they understand what decision they are being asked to make and can weigh up the information relevant to the decision
- If patient lacks capacity to consent to an HIV test, consider whether this is temporary or permanent. If temporary, defer testing until they regain capacity, unless testing is immediately necessary to save patient's life or prevent serious deterioration of their condition
- If lack of capacity likely to be permanent, seek a decision from any person with relevant powers of attorney or follow the requirements of any valid advance statements. If patient has not appointed an attorney or there is no advance directive, HIV testing may be undertaken where this is in patient's best interests

HIV INFECTION TESTING • 3/3

The source patient in a needlestick injury or other HIV risk exposure

- Consent must be obtained from source patient before testing
- If source patient lacks capacity, discuss with infectious diseases or genitourinary medicine consultant
- The person obtaining consent must be a healthcare worker other than person who sustained the injury (see **Post-exposure prophylaxis** guidance available on Trust intranet: Clinicians>Clinical guidance>Clinical guidelines>Antimicrobial)

Documentation

- Document offer of an HIV test in patient's notes together with any relevant discussion:
- if patient refuses test, document reasons
- Written consent is usually not necessary (no longer necessary on electronic requests)

Confidentiality

- Testing clinician (or team) must give result of HIV test (if positive) directly to patient and not via any third party (including relatives or other clinical teams) unless patient has specifically agreed to this

POST-TEST DISCUSSION

- Clear procedures as to how patient will receive result must be in place, especially where result is positive
- Face-to-face provision of HIV test results is strongly encouraged for:
- ward-based patients
- patients more likely to have an HIV-positive result
- those with mental health issues or risk of suicide
- those for whom English is a second language
- young people <16 yr
- those who may be highly anxious or vulnerable

HIV negative result – post-test discussion

- Inform all patients of genitourinary clinical services and provide telephone number for self-referral
- If still within window period after a specific exposure, discuss need to repeat test at 3 months to definitively exclude HIV infection
- Seek specialist advice from/referral to genitourinary medicine or ID service see Trust intranet: http://uhns/media/744916/HIV%20Service%20UHNM%20Intranet.pdf
- In the following situations:
- those at higher risk of repeat exposure to HIV infection who may require advice about risk reduction or behaviour change, including post-exposure prophylaxis
- if reported as reactive or equivocal, refer to genitourinary medicine or ID service (may be undergoing seroconversion)

HIV positive result – post-test discussion

Non-genitourinary/ID specialist must discuss follow-up programme with infectious diseases/genitourinary specialist before informing patient of positive result

- For all new HIV positive diagnoses, test a second sample
- Testing clinician must give result personally to patient in a confidential environment and in a clear and direct manner
- If patient's first language not English, consider using an appropriate confidential translation service
- Refer to genitourinary medicine or ID service who will arrange appointment within 72 hr
- Genitourinary medicine/ID specialist team will perform more detailed post-test discussion (including assessment of disease stage, proposed treatment and partner notification)

Further information

www.bhiva.org

AGGRESSIVE AND VIOLENT PATIENTS ● 1/4

PREVENTION

- Very minor incidents can escalate into a violent situation. Communicate clearly to minimise escalation

RECOGNITION

Warning signs of impending violence

- Spontaneous self-reporting of angry or violent feelings or fluctuating levels of consciousness with prominent persecutory ideas
- Carers warn of imminent violence:
- increased restlessness, bodily tension, pacing, arousal
- increased volume of speech, erratic movements
- facial expression tense and angry, discontented
- refusal to communicate, withdrawal
- unclear thought processes, poor concentration
- delusions or hallucinations with violent content
- audible threats, or aggressive gestures
- recognition of signs apparent in earlier episodes

Context

- Aggression or agitation can occur in:
- psychiatric illness
- physical illness
- substance abuse
- personality disorder
- confusional state irrespective of underlying cause
- patients who have received drugs affecting CNS

PERSONAL (STAFF MEMBER'S OWN) BEHAVIOUR

- Maintain adequate distance
- Move towards safe place, avoid corners
- Explain intentions to patient and others
- Be calm, self-controlled, confident
- Ensure own body language is non-threatening
- Avoid sudden movements

SAFETY

- Do not attempt to deal with a violent patient on your own
- Keep other patients clear
- Keep other staff clear but within helping distance
- If possible, move patient to a quiet area

ASSESSMENT

Assessment must be by a fully registered doctor (FY2 or above). FY1 doctors are not qualified to assess mental capacity and must not attempt to do so. Inform senior member of medical team (SpR or consultant). If there are signs of impending violence, inform site manager who will identify any staff on duty who have been trained in restraint techniques

Assess using verbal de-escalation

- Engage in conversation, acknowledge concerns and feelings
- Ask for reasons for disquiet, encourage reasoning
- Ask for any weapon to be put down (not handed over)
- If patient too disturbed for such measures, or fails to respond:
- consider physical restraint by trained staff and/or police (see below)

History

- Try to take a history from the patient and those who know the patient
- ask whether this has happened before and how it was handled
- ask about any regular psychotropic medication

Mental state examination

- Carry out a mental state examination by noting:
- general appearance and behaviour of patient
- speech
- attention and concentration
- mood: subjective and objective
- thought: evidence of loosening of association, irrelevant thoughts, delusions, thoughts of self-harm or harm to others
- hallucinations
- evidence of cognitive impairment
- insight

Assess mental capacity

Be aware of Mental Capacity Act (2005)

- Capacity assessment is task/decision specific. The legal definition of someone who cannot make autonomous decisions is one who is unable to undertake the following:
- understand information about proposed treatment, its purpose and why it is being proposed
- retain that information long enough to be able to make a decision
- use or weigh that information as part of decision-making process
- communicate his/her decision – by any means possible (e.g. talking, using sign language or other means)

Where there is any doubt or disagreement whether patient has capacity, an application to the court will be necessary. You must seek advice, in office hours Monday–Friday, from Legal Services department or from medical director or executive director on-call via hospital call centre (0)

Physical examination

- If safe to do so, gain patient's consent and attempt a thorough physical examination, looking for sources of infection and/or neurological deficits
- if unsafe, document reasons and carry out examination once stable, or hand over to subsequent team if transferring patient to another ward or specialty

Assess risk factors for violence

- Young, male, history of violence
- Alcohol or other substance misuse, irrespective of other diagnosis
- Poor compliance with suggested treatments
- Antisocial, explosive or impulsive personality traits
- Active symptoms of schizophrenia or mania, in particular with:
- delusions or hallucinations focused on a particular person
- delusions of control, particularly with a violent theme
- specific preoccupation with violence
- agitation, excitement, overt hostility or suspiciousness

IMMEDIATE TREATMENT

Principles

- If acute mental illness suspected (e.g. schizophrenia or hypomania), refer to the RAID team or on-call psychiatrist via call centre
- If patient elderly with acute confusion, see **Delirium (acute confusional state) in older people** guideline
- If patient has symptoms and signs of alcohol withdrawal, see **Alcohol withdrawal** guideline
- If patient intoxicated, but fit to be arrested and taken into custody, request police assistance (if urgent, dial 9–999; if non-urgent, dial 08453 302010)
- If none of the above applies, options available depend on patient's mental capacity – see **Capacity** section in **Consent** guideline

Capable of making decisions

- Hold patient accountable for his/her actions
- Manage underlying cause of agitation
- **Do not administer medication without patient's consent**

Patient lacks capacity

Always ensure that any intervention used is the least harmful or restrictive of patient's basic rights and freedom, immediately necessary, reasonable, and in their best interest

- Conduct multidisciplinary discussion to decide whether rapid sedation is safe and appropriate
- Take all necessary means to prevent injury to self, other staff or patients, or damage to property
- consider use of physical restraint and/or medication – see below
- Manage underlying cause of agitation

PHYSICAL RESTRAINT

The use of any physical holding is the last resort. Once staff attempt to restrain a patient, a threatening situation may turn violent. Medical and nursing staff should not attempt to physically restrain the individual, but should request assistance from any staff on duty trained in physical restraint techniques and who have completed the clinical holding course/update

Under the Mental Capacity Act for a person lacking capacity, the person taking action must reasonably believe that restraint is necessary to prevent harm to the person who lacks capacity or staff and other patients

- When patients are restrained, it is done under 'common law' to maintain the safety of patient, staff and other patients. Any holding must be reasonable and proportional to the circumstances
- Use restraint only if there are sufficient staff to achieve this effectively and you perceive imminent danger because patient is:
- displaying prolonged and serious verbal abuse, threatening staff, or disrupting ward
- threatening or attempting self-injury
- at risk of prolonged over-activity with risk of exhaustion
- at risk of serious accident to self and/or others
- attempting to abscond if detained under Section and in an open ward. Best practice guidance decrees that there be a minimum of 2 staff to hold someone and 3 staff if the person is held on the floor
- Do not, under any circumstance, inflict deliberate pain
- Wherever possible, avoid holding someone on the floor (particularly in the prone position). Holding in any position should be for the minimum amount of time possible to manage the prevailing or perceived level of risk
- If no suitably trained staff available, or patient is making significant physical attacks or serious efforts to destroy property, leave the scene immediately and request police assistance (dial 9–999 and say clearly 'I am in fear for my safety')

The police will always respond to a call for assistance, but are not allowed to assist in restraining patients for treatment

MEDICATION

If new brain damage suspected, avoid medication until after CT scan.
Check prescription chart for previously prescribed drugs.
Reduce dosages of medication appropriately in the elderly or infirm

If patient is elderly refer to* Delirium (acute confusional state) in older people *guideline instead, especially for doses of medication bearing in mind that olanzapine and risperidone can cause serious side effects including strokes in older patients. Unless dose for elderly is specified below, doses of medication should be halved for older people

- In cases of substance misuse, treat any symptoms suggestive of withdrawal – see **Withdrawal of drug(s) of dependence** guideline
- Try to persuade patient to accept oral medication
- if this is not possible, use parenteral route (**do not mix two drugs in a syringe**)

- Recommended medication options are:
- lorazepam (prefer as first choice) 1 mg oral/IM repeated 6-hrly if necessary – adult maximum dose 4 mg in 24 hr (elderly 0.5–1 mg; maximum 2 mg in 24 hr). For IM injection, dilute lorazepam with an equal volume of water or sodium chloride 0.9%
- Use IM only when oral route not available
- If no response 1 hr after oral lorazepam, give oral olanzapine 10 mg (elderly 5 mg) or risperidone 1–2 mg (elderly 0.5–1 mg)
- If oral medication fails, consider IM treatment. If 1–2 mg of lorazepam (elderly 0.5-1 mg) used, have flumazenil to hand in case of respiratory depression. Alternatives are aripiprazole 9.75 mg, promethazine 50 mg **or**
- As a last resort, **and only after an ECG has been checked**, consider haloperidol 5 mg
- do not use haloperidol in patients with Parkinson's disease, heart disease or if patient is taking other drugs that prolong QT interval; a prolonged QT interval is a contraindication for prescribing haloperidol. The normal range of QTc interval is up to 440 milliseconds. QTc prolongation defined as >450 milliseconds for men and >470 for women
- In elderly patients do not use aripiprazole, promethazine or haloperidol 5 mg – see **Delirium (acute confusional state) in older people** guideline for treatment guidance
- If no response to 2 forms of medication, seek advice from RAID or on-call psychiatry team
- **Do not** prescribe beyond BNF limits, and be aware of the cumulative effect of combination medications and, if using haloperidol, the impact of first-pass metabolism and acute dystonia
- if using haloperidol, have procyclidine available in case of dystonic reaction

SUBSEQUENT MANAGEMENT

- Monitor vital signs
- Record BP, pulse, respiratory rate, hydration, pulse oximeter and level of consciousness as agreed by multidisciplinary team until fully conscious
- Record further care plan

Documentation

- Record incident clearly and fully afterwards
- Complete an adverse incident/Datix report with witness statements

Once stable

- Continue close observation as inpatient for at least 24 hr
- Reassess mental state and review patient's status under Mental Health Act
- Continue management of underlying condition
- When transferring patient between units, send details of:
- incident
- medication management
- subsequent management plan
- any unwanted effects
- any advance directives

ACUTE ANAPHYLAXIS • 1/4

RECOGNITION AND ASSESSMENT

Anaphylaxis is a **severe** systemic allergic reaction. Consider whenever there has been a rapid onset of respiratory difficulty and/or hypotension, especially if rash and/or angioedema present

Symptoms and signs

Airway

- Upper airways obstruction due to angioedema:
- swelling of tongue/throat
- stridor
- feeling of throat closing
- hoarse voice

Breathing

- Lower airways obstruction:
- wheeze
- increased respiratory rate
- cyanosis

Circulation

- Signs of shock:
- impaired capillary refill (capillary refill time >2 sec)
- tachycardia
- hypotension

Disability

- Confusion
- Agitation
- Loss of consciousness

Exposure

- Skin and mucosal changes (may not be present in all patients):
- redness or blotchy rash
- urticaria
- itching
- angioedema
- rhinitis and conjunctivitis

Other systems affected

- Gastrointestinal:
- abdominal pain
- vomiting
- diarrhoea

INVESTIGATIONS

- Mast cell tryptase – sample serum (7 mL red top bottle) at following times and send to immunology:
- as soon as possible after emergency treatment has started
- at 1–2 hr from onset of symptoms. No later than 4 hr
- Patient may present late. Take as many serum samples as time since presentation allows
- indicate time and date clearly to allow interpretation of results
- Inform patient that a final sample will be necessary to measure baseline levels in follow-up

DIFFERENTIAL DIAGNOSIS

- Syncope (rapid recovery) with bradycardia in vagal reaction
- Septic shock with a petechial or purpuric rash
- Acute cardiac event
- Panic attack with hyperventilation (unlikely to be hypotensive)
- Acute severe asthma
- Other causes of central airways obstruction
- idiopathic non-allergic urticaria and angioedema

IMMEDIATE TREATMENT

- See **Anaphylaxis algorithm** below
- Lay patient flat and elevate feet to restore/maintain BP. Do not stand patient up
- if this causes respiratory distress, sit patient up
- For hypotension or respiratory distress with stridor or wheezing, give adrenaline:
- 500 microgram (0.5 mL of 1:1000 solution) **IM** into midpoint of anterolateral aspect of thigh. If an adult EpiPen® is more readily available give this (delivers 300 microgram dose of adrenaline)
- If hypotension and respiratory distress do not respond within 5 min:
- give further dose of adrenaline 500 microgram **IM** (0.5 mL of 1:1000 solution). Can be repeated at 5 min intervals according to BP, heart rate and respiratory function
- monitor vital signs continuously
- If concerned about patient's respiratory effort/airway obstruction, contact anaesthetist
- Oxygen at high flow rate (10–15 L/min) – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Establish IV access. If systolic BP <100 mmHg give fluid challenge of compound sodium lactate (Hartmann's) 500 mL as quickly as possible, see **Fluid resuscitation** guideline
- Chlorphenamine 10 mg by IM or **slow** IV injection
- if there is bronchospasm, give salbutamol 5 mg via oxygen driven nebuliser
- for further treatment of bronchospasm, see **Acute severe asthma in adults** guideline
- If patient has been taking a non-cardioselective beta-blocker [e.g. propranolol, oxprenolol, sotalol, timolol (including eye drops)], severity of anaphylaxis may be increased and response to adrenaline antagonised. Consider giving salbutamol by slow IV injection – see **Salbutamol IV** guideline

Severely ill patient

- When patient severely ill and there is real doubt about adequacy of circulation and absorption after IM injection, call critical care staff to attend urgently
- transfer to critical care **as soon as possible**

Further treatment under critical care supervision

- Consider giving adrenaline 50 microgram (0.5 mL of the dilute 1:10,000 adrenaline injection) by **slow** IV injection, no faster than 1 mL/min while monitoring cardiac rhythm. Repeat according to response
- if multiple doses required, give adrenaline as **slow** IV infusion, stopping when response obtained

IV adrenaline is hazardous, use only with extreme care, and under critical care supervision, for those in profound shock that is immediately life-threatening

MONITORING

Monitor (including ECG) continuously all patients experiencing severe anaphylaxis until condition stabilised and then every 15 min for 1 hr until completely stable. Continue to record hourly:

- Heart rate
- Blood pressure
- Respiratory rate
- If possible, peak expiratory flow (PEF)
- SpO_2

SUBSEQUENT MANAGEMENT

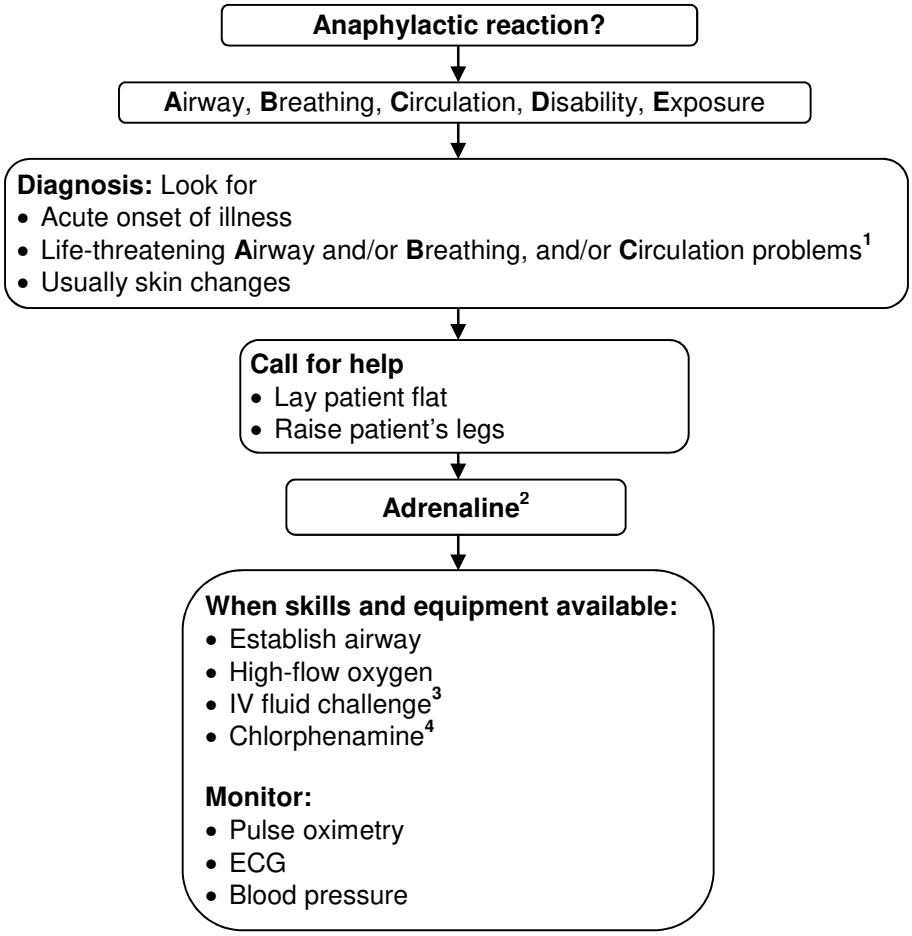
- Record time of onset of symptoms and identify possible allergens e.g. drugs, foods (within previous hour), insect stings, latex
- Consider prednisolone 30 mg oral daily until all allergic symptoms have subsided completely
- Chlorphenamine 4 mg oral 6-hrly (for at least 24–72 hr to prevent relapse) or until all allergic symptoms have subsided completely
- Warn patient of possible early recurrence and keep under observation for at least 6 hr. Likelihood of early recurrence increased in patients:
- with slow-onset severe reaction resulting from idiopathic anaphylaxis
- with severe asthma
- at risk of continued absorption of allergen
- with previous history of biphasic reactions
- Consider prolonged observation for patients who:
- developed symptoms during night, who may not be able to respond to any deterioration in clinical condition
- live in areas where access to emergency care difficult

DISCHARGE AND FOLLOW-UP

- All patients must be reviewed by a senior clinician before discharge and given clear instructions to return to hospital if symptoms return
- Advise avoidance of allergen if appropriate and management plan to include use of anti-histamines for any allergic symptoms and EpiPen® and 999 call for life-threatening symptoms of dyspnoea or faintness
- Prescribe 2 auto-injector devices containing adrenaline 300 microgram. Instruct patient on when and how to use
- Give patient contact details for SOS Talisman (0208 554 5579 or www.sostalisman.co.uk) or MedicAlert® (01908 951045 or www.medicalert.org.uk) to obtain alert jewellery containing vital information on their condition in case of emergency
- Give patient contact details of Anaphylaxis Campaign, 1 Alexandra Road, Farnborough, Hampshire GU14 6BU (01252 546100) www.anaphylaxis.org.uk
- Send outpatient referral (available on intranet in clinicians/clinical services/Accident & Emergency) to Dr Goddard, clinical immunologist

Instructions for use of EpiPen®

ANAPHYLAXIS ALGORITHM



[1]Life-threatening problems	
Airway	Swelling, hoarseness, stridor
Breathing	Rapid breathing, wheeze, fatigue, cyanosis, SpO_2 <92%, confusion
Circulation	Blotchy and red, clammy, low blood pressure, faintness, drowsy/coma

[2] Adrenaline (IM unless experienced with IV adrenaline)	
IM dose of 1:1000 (repeat after 5 min if no improvement)	
Dose*	500 microgram IM (0.5 mL)
Adrenaline IV to be given only by experienced specialist Titrate: 50 microgram (using dilute 1:10,000)	

[3] IV fluid challenge	
Dose*	500 mL
Stop IV colloid if this might be cause of anaphylaxis	

	[4] Chlorphenamine (IM or slow IV)
Dose*	10 mg

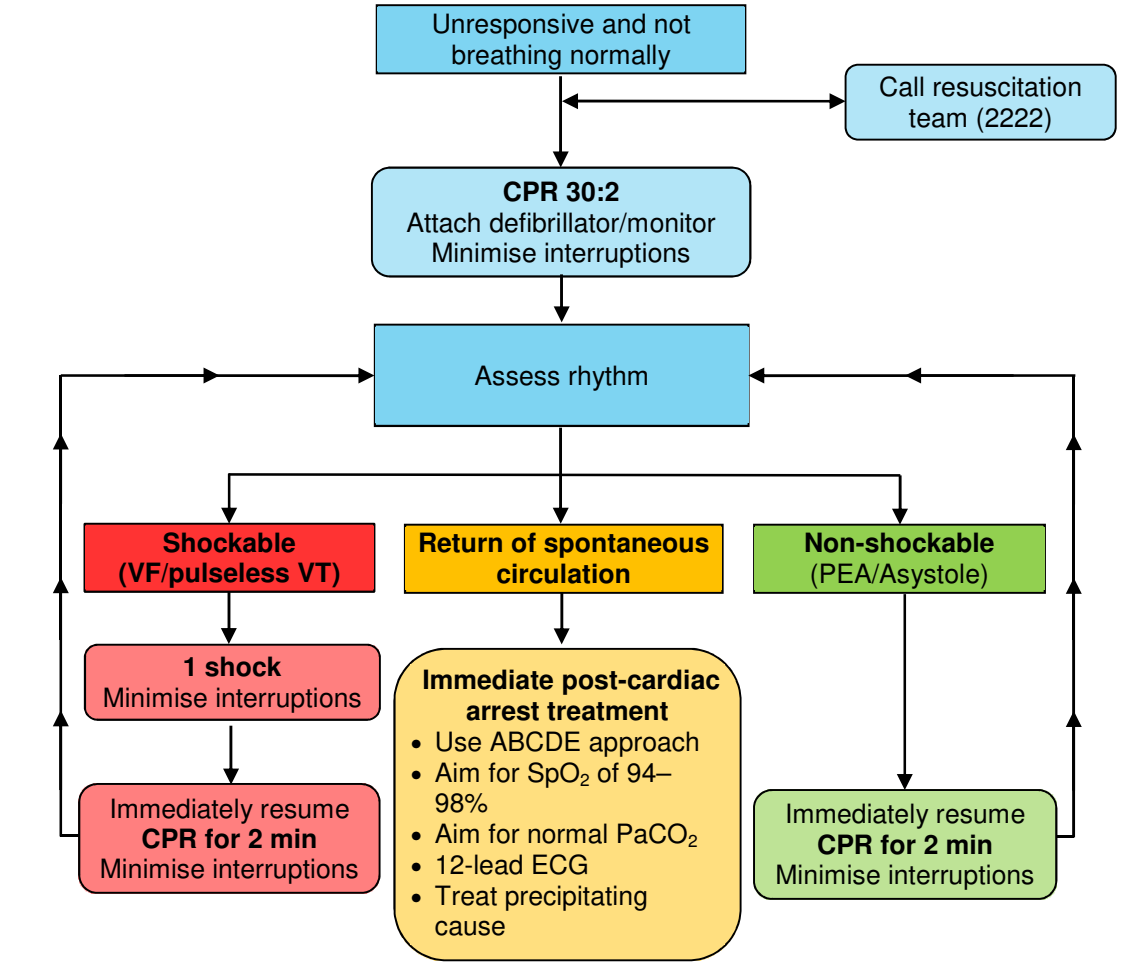
***Note:** These are adult doses – for children's doses, see **Paediatric guidelines**

CARDIOPULMONARY RESUSCITATION – LIFE SUPPORT PROCEDURE ● 1/2

PROCEDURE FOR IN-HOSPITAL RESUSCITATION

This algorithm is an aide-memoire for hospital personnel trained in Advanced Life Support (ALS). For full review of ALS – see Trust intranet: Clinicians>Clinical services>Accident and Emergency

Adult advanced life support algorithm



During CPR

- Ensure high quality chest compressions
- Minimise interruptions to compressions
- Give oxygen
- Use waveform capnography
- Continuous compressions when advanced airway in place
- Vascular access (intravenous or intraosseous)
- Give adrenaline every 3–5 min
- Give amiodarone after 3 shocks

Treat reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis – coronary or pulmonary
- Tension pneumothorax
- Tamponade – cardiac
- Toxins

Consider

- Ultrasound imaging
- Mechanical chest compressions to facilitate transfer/treatment
- Coronary angiography and percutaneous coronary intervention
- Extracorporeal CPR

Algorithm reproduced by permission of Resuscitation Council

CARDIOPULMONARY RESUSCITATION – LIFE SUPPORT PROCEDURE ● 2/2

DEFIBRILLATION ENERGIES

- Deliver the first shock with an energy of at least 150J
- Shock energy for a particular defibrillator should be based on manufacturer's guidance

DRUG DELIVERY

Peripheral administration

- Drugs administered peripherally must be followed by a flush of at least 20 mL sodium chloride 0.9% to aid entry into central circulation

Adrenaline

Shockable rhythm

- Give first dose of adrenaline 1:10,000 (100 microgram/mL) 1 mg (10 mL) by IV/IO injection after delivery of third shock
- give subsequent doses of adrenaline after alternate 2-min loops of CPR (which equates to every 3–5 min) for as long as cardiac arrest persists

Non-shockable rhythm

- Give adrenaline 1 mg IV/IO as soon as intravascular or intraosseous access is achieved
- give subsequent doses of adrenaline after alternate 2-min loops of CPR (which equates to every 3–5 min) for as long as cardiac arrest persists

Amiodarone

- Amiodarone 300 mg by IV/IO injection from a prefilled syringe or diluted in 20 mL glucose 5% to be given after third shock
- if VF/VT persists, or recurs, an additional dose of amiodarone 150 mg can be given by IV/IO injection after 5 defibrillation attempts

POST-ARREST MANAGEMENT

- Immediate goals of post-resuscitation care are to:
- provide cardiorespiratory support to optimise tissue perfusion, especially to brain
- transport patient to appropriately equipped critical care unit
- attempt to identify precipitating causes of arrest
- initiate measures to prevent recurrence (e.g. anti-arrhythmic therapy). See **Cardiac arrhythmias** guideline

Establish cause of cardiac arrest and treat underlying diagnosis – if in doubt, seek advice from on-call medical SpR

- Patients with ventricular tachycardia or ventricular flutter/fibrillation, occurring ≥48 hr after acute myocardial infarction or with no obvious reversible factors, should be considered for implantation of an implantable cardioverter defibrillator (ICD). Seek advice of cardiology team

IMMEDIATE POST-ARREST INVESTIGATION

- Blood gases
- U&E, glucose
- Chest X-ray
- 12 lead ECG

DISCHARGE AND FOLLOW-UP

- Dependent upon underlying cause

CARDIOPULMONARY RESUSCITATION CLINICAL JUSTIFICATION • 1/2

Cardiopulmonary resuscitation (CPR) is mandatory when any person suffers a cardiorespiratory arrest unless there is a valid 'Do not attempt cardiopulmonary resuscitation' (DNACPR) order written in patient's medical record

Discuss DNACPR status with patient, if he/she has capacity, and/or family and carers and document in the medical record. If an emergency, document but discuss with them as soon as possible. Document clearly – see below for format

DO NOT ATTEMPT CARDIOPULMONARY RESUSCITATION (DNACPR)

- DNACPR order applies solely to cardiopulmonary resuscitation and does not affect any other aspect of treatment

Anticipate the likelihood of cardiopulmonary arrest and, if CPR may be inappropriate, discuss DNACPR status with patient

Clinical justification

- Prolonging a patient's life usually provides a health benefit to that patient. Nevertheless, it is not appropriate to prolong life at all costs with no regard to its quality or to the potential burdens of treatment for the patient
- A DNACPR order is 'in the best interests of the patient' if one or more of the following applies:
- patient is irreversibly close to death
- despite successful CPR, there would be an unacceptably high probability of death or severe brain damage
- length and quality of life after resuscitation are unlikely to be valued by patient
- patient, who has mental capacity, has expressed consistent desire not to be resuscitated

ETHICS AND CONSENT

Consent process must be followed before DNACPR order.
Make sure you document the decision-making process at the time it happens, in detail.
Read the* Consent *guideline carefully and follow the steps contained therein

DOCUMENTATION

- Once decision not to attempt resuscitation has been made the decision must be clearly recorded in the patient's medical and nursing records. **Doctor** (registrar or above) must complete Trust DNACPR form. Once DNACPR form has been completed:
- red bordered DNACPR document must be placed prominently in the front of the patient's medical notes (this red bordered copy is the patient copy and must travel with the patient on discharge)
- grey bordered DNACPR document must be placed in the medical notes at the chronological point the decision was made and must remain within the notes following discharge
- Senior doctor and nurse must inform clinical colleagues

Review

- Doctor making decision to review the DNACPR order writes prominently in the medical record at the chronological point the decision is reviewed

Patient admitted to UHNM or community hospital with community DNACPR order

- Review DNACPR status as soon as is clinically possible
- Community DNACPR remains valid until a consultant review is completed

DNACPR decision rescinded

- Doctor making the decision to rescind the DNACPR order must document decision clearly in patient's medical record – the word "RESCINDED" and date of the decision must be written in the medical record at the point of the original decision, ensuring original information is not obscured
- The **red bordered** DNACPR document should be removed from the patient's medical notes and destroyed
- Senior nurse in charge updates the nursing records and informs clinical colleagues of the change in status

CARDIOPULMONARY RESUSCITATION CLINICAL JUSTIFICATION ● 2/2

DISCHARGE

- If patient discharged from hospital with active DNACPR order, the red bordered form is removed from the notes and a copy scanned and emailed to the patient's GP
- Communicate resuscitation status of patient to community nursing team/nursing home before discharge and to the ambulance service when booking transport
- The original copy of the red bordered form is to be given to the patient/carers or shown to the ambulance crew if being discharged/transferred via ambulance
- Advise patient/carers:
- to keep the red bordered form in a safe and prominent place at home
- to make any healthcare professionals aware of the form and to bring it with them if re-admitted

HYPOTENSION ● 1/3

ASSESSMENT OF THE HYPOTENSIVE PATIENT

Approach from a physiological standpoint

- Mean arterial pressure (MAP) = cardiac output (CO) x systemic vascular resistance (SVR)
  CO= heart rate (HR) x stroke volume (SV)
- Therefore MAP=HR x SV x SVR
- SV depends on preload (intravascular volume), contractility and afterload but afterload is difficult to assess at the bedside
- Important parameters to consider are:
- heart rate
- preload (intravascular volume)
- contractility of heart
- SVR

CLINICAL RECOGNITION AND ASSESSMENT

- Systolic BP <100 mmHg mean arterial pressure<60 mmHg or fall in systolic BP >40 mmHg in a hypertensive patient's usual pressure
- Tachycardia/bradycardia
- Drowsiness/altered mental state
- Nausea/vomiting
- Cold, clammy peripheries

Causes

Hypovolaemia

- Bleeding from wound, within GI tract, into chest/abdomen/pelvis or into soft tissue (e.g. fractures)
- Gastrointestinal losses – vomiting, diarrhoea, into bowel lumen when obstructed
- Polyuria or inappropriate diuretic treatment
- Increased insensible losses – from skin in burns, respiratory tract in tachypnoea, sweating in pyrexia or hot/dry environments
- Reduced intake of fluid

Cardiac failure – intrinsic cardiac defect

- Valvular disease
- Myocardial infarction
- Bradycardia or other arrhythmia
- Cardiomyopathy

Cardiac failure – mechanical flow defect

- Cardiac tamponade
- Pulmonary embolism
- Tension pneumothorax

Vasodilated state

- Sepsis, particularly Gram negative sepsis, see **Sepsis management** guideline
- High spinal or epidural anaesthesia
- Neurogenic shock e.g. high spinal cord injury
- Anaphylaxis
- Adrenal failure (also leads to volume depletion)

Drugs

- Common examples include:
- abrupt withdrawal of corticosteroids (or failure to increase dosage in stressed patients who are unable to mount their own stress response)
- angiotensin-converting enzyme (ACE) inhibitors/angiotensin II receptor antagonists
- anti-anginal agents
- antihypertensive agents
- diuretics
- phenothiazines

HYPOTENSION ● 2/3

Hypotension category	Heart rate	JVP or CVP	Peripheries
Cardiac	• Moderate tachycardia • Severe bradycardia or tachycardia in arrhythmia induced hypotension	Raised or normal	Cold
Hypovolaemic	• Tachycardia unless on rate limiting drugs	Decreased	Cold
Distributive Sepsis, neurogenic, anaphylaxis	• Tachycardia	Decreased	Warm
Obstructive Cardiac tamponade Pulmonary embolism Tension pneumothorax	• Tachycardia	Markedly increased	Cold

Timing of hypotensive episode

- Bleeding much more likely to occur soon after surgery – see **Post-operative haemorrhage** guideline in the **Surgical guidelines**
- Thromboembolism is a late complication of surgery
- Pneumothorax, especially important to consider after thoracic surgery/central venous catheter placement
- Septic shock can occur at any time and is associated with fluid extravasation and hypovolaemia

Examination

- Temperature, pulse (rate, volume , character) and BP
- Check for visible bleeding – see **Post-operative haemorrhage** guideline in the **Surgical guidelines**
- Jugular venous pressure (JVP) and examine for tracheal deviation
- If central line in place, check CVP
- Chest examination for pneumothorax, pulmonary oedema, infective pathology and heart sounds
- Check urine output hourly via catheter

Investigations

- FBC
- U&E
- ABG to assess acid-base status and, where available, Hb, lactate and electrolytes
- ECG – look for myocardial infarction, pulmonary embolism or cardiac arrhythmia
- Chest X-ray – look for pneumonia, pneumothorax, pulmonary oedema or cardiac enlargement
- If high probability of pulmonary embolism, follow **Pulmonary embolism** guidelines

IMMEDIATE TREATMENT

Immediate treatment and investigations must run simultaneously

- Ensure airway patency. If necessary, open and protect airway and support respiration
- Commence oxygen therapy – see **Oxygen therapy in acutely hypoxaemic patients** guideline – **Critical section**
- Establish reliable intravenous access; preferably two
- Unless clear evidence suggests a cardiac problem, give compound sodium lactate (Hartmann's) solution or sodium chloride 0.9% 500 mL IV as quickly as possible – see **Fluid resuscitation** guideline
- If severe bleeding suspected to be the underlying cause for hypotension, activate Major haemorrhage protocol – see Major haemorrhage protocol on Trust intranet: clinicians/clinical-guidance/blood-and-blood-products/
- Establish underlying cause and treat/refer as appropriate (e.g. thrombolysis for massive PE; needle thoracentesis for tension pneumothorax, cardiology input, surgical/intervention radiology for haemorrhagic hypotension, fluids and vasopressors for vasodilated and septic patients)
- Stop/omit any contributing drugs
- Catheterise if not already catheterised
- Involve senior colleague or intensive care at an early stage if initial treatment not effective
- If patient does not respond to simple measures and requires invasive monitoring (e.g. CVP), refer to critical care

HYPOTENSION ● 3/3

MONITORING

- Pulse, BP and respiratory rate every 15 min initially; until stability achieved
- Urine output hourly
- Arterial blood gases to monitor lactate and base excess 1–2 hrly initially until stability achieved
- Consider invasive monitoring in the form of arterial pressure and central venous pressure monitoring in a high dependency area if problems persist

SUBSEQUENT MANAGEMENT

- Treat underlying cause promptly if not addressed already
- Give further IV fluid as indicated in **Fluid resuscitation** and **Maintenance fluid therapy** guidelines
- For ongoing haemorrhage give blood and blood products – see **Blood and blood products** section of **Medical** guidelines or **Transfusion** section of **Surgical** guidelines

SEPSIS MANAGEMENT ● 1/4

AIM

- To improve outcomes for adult patients presenting with sepsis or developing sepsis whilst an inpatient
- Early identification and intervention to save lives, reduce hospital stay and need for critical care admission
- For neutropenic sepsis in cancer patients – see **Neutropenic sepsis** guideline
- For sepsis management in children – see **Paediatric** guidelines
- For peri-natal sepsis – see **Obstetric** and **Neonatal** guidelines

DEFINITIONS

- **Sepsis** – a life-threatening organ dysfunction due to dysregulated host response caused by an infection. It is a medical emergency
- **Organ dysfunction –** an acute increase in total Sequential Organ Failure Assessment (SOFA) score by ≥2 points consequent to infection (see **Table 1**) which has been used in critical care as a guide to predict sepsis-related morbidity and mortality
- **Septic shock** is associated with a higher risk of mortality (>40%) and refers to patients with sepsis who:
- remain hypotensive despite adequate fluid resuscitation and require vasopressors to maintain a mean arterial pressure (MAP) ≥65 mmHg
- have persistently elevated serum lactate (≥2 mmol/L)

Table 1: Sequential organ failure assessment (SOFA)

Organ	Measure	0	1	2	3	4
Respiratory	PaO_2/FiO_2	≥53.3	<53.3	<40	<26.7	<13.3
Coagulation	Platelets ($x10^9$/L)	≥150	<150	<100	<50	<20
Liver	Bilirubin (µmol/L)	<20	20–32	33–101	102–204	>204
Cardiovascular	MAP (mmHg)	≥70	<70		NA ≤0.1*	NA >0.1*
CNS	GCS	15	13–14	10–12	6–9	<6
Renal	Creatinine (µmol/L)	<110	110–170	171–299	300–400	>440

FiO_2 = Inspired oxygen concentration (%)
*NA = noradrenaline, dose in µg/kg/min

SCREENING

- All patients who have a NEWS ≥5 (or) any individual NEWS element ≥3, screen for sepsis by completing Trust Sepsis Proforma

Identification of red flag signs

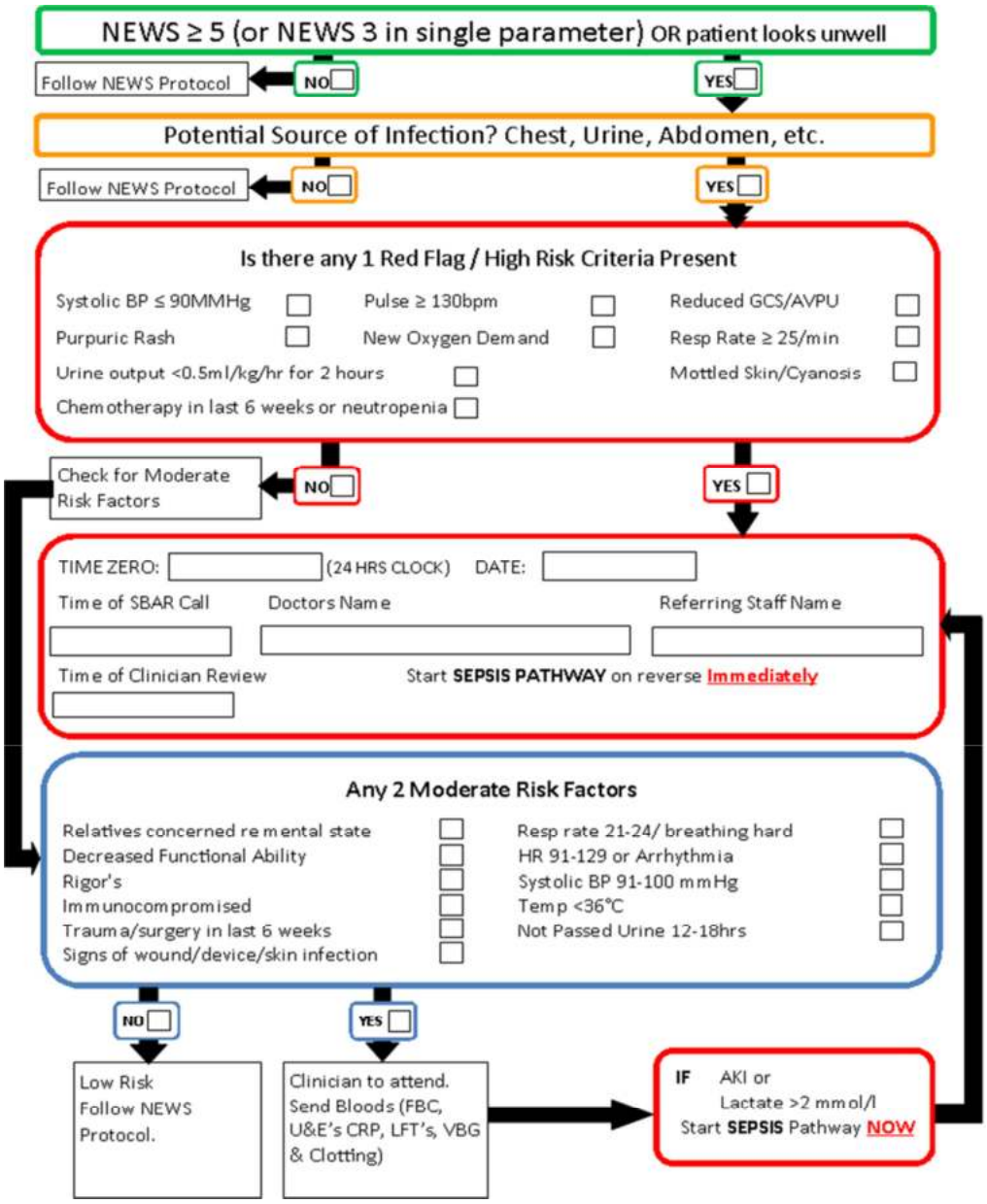
- Assess whether screened patient has red flag signs and therefore classed as high risk for sepsis
- If patient has 1 red flag sign – start on **Sepsis Six** bundle within 1 hr of screening

Moderate risk factors

- Patient screened for sepsis and negative for any red flag signs: assess for moderate risk factors and if appropriate start on **Sepsis pathway** immediately

SEPSIS MANAGEMENT • 2/4

Flowchart



IMMEDIATE MANAGEMENT

- Start **Sepsis Six** if the patient satisfies 1 of the following:
- presence of 1 red flag sign **or**
- presence of 2 moderate risk factors along with AKI and/or lactate ≥2

Record observations at least every 30 min			
1	**Give oxygen** • Aim O_2 saturations 94–98% (if CO_2 retainer 88–92%)	**4**	**Give IV fluids** • 500 mL over 15 min • Review and repeat as needed (Hartmann's or sodium chloride 0.9%)
2	**Take blood cultures (regardless of temperature)** • FBC, U&E, LFT, clotting • CXR, urine sample • Do not delay antimicrobials	**5**	**Measure lactate** • Repeat after 2 hr of therapy
3	**Give antimicrobials** • Site specific if possible • Follow Trust guidelines • Check allergies	**6**	**Measure urine output** • Commence fluid balance chart • Hourly monitoring

Antimicrobials

- ***Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.***
- ***True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission.***
- ***If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases***

Type of patient	First line	Alternative (penicillin allergy)
Patient **not** tagged for ESBL or MGNB, and no high risk of MRSA (see below)	Piperacillin/tazobactam 4.5 g IV 8-hrly	Aztreonam 1 g IV 8-hrly **plus** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline
High risk of MRSA: recent history of MRSA (check iPortal[1]), patient in other hospital/nursing home in last 12 months, sepsis likely to be hospital-acquired, or line infection suspected	Piperacillin/tazobactam 4.5 g IV 8-hrly **plus** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline	Aztreonam 1 g IV 8-hrly **plus** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline
ESBL or MGNB tag on iPortal[1]: history of ESBL-producing or multi-resistant Gram-negative Bacilli	Meropenem 1 g IV 8-hrly alone	Meropenem 1 g IV 8-hrly alone **If penicillin allergy is anaphylaxis:** discuss with consultant in infectious diseases or microbiologist
ESBL or MGNB tag and high risk of MRSA	Meropenem 1 g IV 8-hrly **plus** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline	Meropenem 1 g IV 8-hrly **plus** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline **If penicillin allergy is anaphylaxis**, discuss with consultant in infectious diseases or microbiologist
Subsequent management	**If improving:** • Adjust antimicrobials to cover organism(s) and sentititivieis reported. Change to oral route after resolution of symptoms and signs of sepsis and continue for an appropriate length of treatment for the organism found or diagnosis reached • If *S. aureus* bacteraemia, identify focus; treat with at least 2 weeks IV antimicrobial **If not improving:** • Reassess, reconsider diagnosis, discuss with critical care if appropriate	

[1] Check iPortal for IC alert under patient alerts. If iPortal not available, then check previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL; if CARB present discuss with microbiologist for empirical treatment

Septic shock

- Consider patient in **septic shock** if any of the following are present despite 30 mL/kg of fluid resuscitation within first 3 hr
- patient's systolic blood pressure ≤90 mmHg **or**
- mean arterial blood pressure ≤65 mmHg **or**
- serum lactate persistently elevated >2 mmol/L on repeated measurements

In such cases, immediate escalation to senior clinician (registrar and above) and/or to critical care team is warranted

CODING FOR DIAGNOSIS OF SEPSIS

- Correct coding of sepsis enables local and national data to accurately reflect the incidence of sepsis
- Evidence suggests localised infections (non-septic infections) are being documented in medical record as sepsis (e.g. terms like urosepsis, biliary sepsis, chest sepsis etc., may be inaccurately coded as systemic sepsis)
- Current consensus definition clearly states that there needs to be "organ dysfunction" and dysregulated host response secondary to an infectious source
- It remains difficult to objectively clarify the matter; therefore good practice would be for a responsible consultant to confirm that initial diagnosis of sepsis is a "true sepsis". However, if responsible consultant confirms the terms used in the medical record indicate only a localised infection present (rather than generalised sepsis), **code as a localised infection only or a "non-septic infection"**

ACUTE HOT JOINT, SEPTIC ARTHRITIS AND GOUT ● 1/3

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Acutely painful, swollen joint
- Warm, tender, swollen joint (+/- effusion)

Patients with a short history of a hot, swollen, tender joint with restricted range of movement should be assumed to have septic arthritis until proven otherwise

If clinical suspicion is high it is imperative to treat as septic arthritis even in the absence of a fever

Pyrexia may not be a feature of septic arthritis, especially in the elderly or immunocompromised, or in patients with diabetes, renal failure or rheumatoid arthritis

In patients with prosthetic joint and pyrexia of unknown origin (PUO) – consider prosthesis infection

Investigations

Immediate

- Urgent joint aspiration for synovial fluid analysis (polarised microscopy), Gram stain and culture – see **Knee aspiration** guideline. (If prosthetic joint, orthopaedic team aspirate in theatre)
- contact on-call orthopaedic team (bleep) for urgent joint aspiration +/- arthroscopic washout and further management. For medical inpatients, also contact on-call rheumatology team (contact via bleep; note – rheumatology team are not on-site at RSUH)
- FBC
- U&E
- Microbiology:
- Gram stain and culture of synovial fluid
- blood cultures – see **Collection of blood culture specimens** guideline
- swab from any infected skin lesion
- urine dipstick with MSU if positive for nitrites and/or leucocytes
- if gonococci suspected, swab rectum, urethra and throat, and contact genitourinary medicine at Cobridge – 0300 790 0165

Within 24 hr

- ESR
- CRP
- Serum uric acid
- X-ray of affected joint

Differential diagnosis

- Septic arthritis
- Crystal arthritis, including gout
- Acute inflammatory arthritis (e.g. reactive arthritis or rheumatoid arthritis)
- Haemarthrosis

If patient has acute arthritis affecting more than one joint, discuss case with on-call rheumatologist (page via call centre)

IMMEDIATE TREATMENT

Supportive

- Adequate analgesia for joint pain: naproxen 500 mg single oral dose, then 250 mg oral 6-hrly (if not contraindicated) plus:
- step 1: paracetamol 1 g oral 6-hrly
- step 2: if paracetamol alone not adequate, add codeine phosphate 30–60 mg oral 6-hrly
- step 3: if codeine phosphate not adequate, substitute morphine sulphate solution 10 mg oral 4-hrly
- Refer to physiotherapists for ice pack and splint on joint
- Rehydrate – see **Maintenance fluid therapy** guideline
- If patient already taking low-dose corticosteroids, consider increasing to prednisolone 10 mg oral daily

Antimicrobial therapy

- Start as soon as joint aspirated. Review choice after Gram stain result
- Most common microbe causing septic arthritis is *Staphylococcus* spp (including MRSA), other causes include *Steptococcus* spp and Gram negative bacilli

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction. True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Type of patient	First line	Alternative (penicillin allergy)
Immunocompetent patient with no risk factors for atypical organisms **and** not tagged for MRSA in iPortal	Flucloxacillin 2 g IV 6-hrly **plus** sodium fusidate tablets 500 mg oral 8-hrly	Vancomycin IV by infusion – see **Vancomycin** guideline **plus** sodium fusidate tablets 500 mg oral 8-hrly
Tagged for MRSA in iPortal	Vancomycin IV by infusion – see **Vancomycin** guideline **plus** sodium fusidate tablets 500 mg oral 8-hrly	
High risk of Gram-negative organisms (e.g. elderly, frail, recurrent UTI, recent abdominal surgery)	**Add** piperacillin/tazobactam 4.5 g IV 8-hrly to above regimens	**Add** aztreonam 1 g IV 8-hrly to above regimens
Duration	At least 4–6 weeks total IV – continue for at least 2 weeks If good clinical response to IV therapy, CRP falling **and** good information on organism and its sensitivities after that time, switch to oral therapy. Contact consultant microbiologist if required **Do not stop treatment until symptoms (e.g. fever) and signs (e.g. joint effusion) resolve, and WBC and CRP return to normal**	

Check iPortal for IC alerts under patient alerts. If iPortal not available, check previous 12 months microbiology reports. If MRSA present treat as tagged for MRSA; if ESBL present treat as tagged for ESBL; if CARB present discuss with microbiologist for empirical treatment

If patient immunocompromised or has prosthesis, contact consultant in infectious diseases or consultant microbiologist for advice

- If gonococci isolated and strain sensitive:
- refer patient to genitourinary medicine
- ceftriaxone 1 g IV or IM daily or if anaphylaxis to penicillin, ciprofloxacin 500 mg oral 12-hrly for 7 days
- if strain resistant to ciprofloxacin, contact consultant microbiologist
- If severe sepsis present, refer to **Sepsis management** guideline and treat with appropriate IV antimicrobials

MONITORING TREATMENT

- Pulse, BP, temperature 4-hrly until patient stable
- While effusion persists, repeat culture of joint effusion daily (see below)
- WBC, ESR, CRP, U&E every 48 hr
- If using sodium fusidate or rifampicin, liver function tests weekly

SUBSEQUENT MANAGEMENT

Septic arthritis

- Supportive treatment, as above
- Refer to physiotherapists for passive exercise and rehabilitation
- Perform regular aspiration of the joint to dryness +/- arthroscopic lavage while a significant effusion persists
- If patient able to be managed at home and on IV antimicrobials, refer to outpatient antibiotic therapy service (bleep via call centre) for IV antimicrobials at home

Antimicrobial therapy

- Adjust antimicrobials once results of therapy and bacterial sensitivities available
- If no bacteria isolated, consider stopping antimicrobials but note that neither the absence of organisms on Gram stain nor a negative subsequent synovial fluid culture excludes the diagnosis of septic arthritis (discuss with rheumatology team – page on-call SpR or refer via iPortal)
- If infection likely or proven, continue IV antimicrobials for at least 2 weeks. If good clinical response to IV therapy, CRP falling and good information on organism and its sensitivities after that time, switch to oral therapy. Contact consultant microbiologist if required
- Continue antimicrobials for a 4–6 weeks total. Do not stop treatment until symptoms (e.g. fever) and signs (e.g. joint effusion) resolve, and WBC and CRP return to normal

Failure to respond to therapy

- Reconsider diagnosis
- Repeat cultures
- If no response within 48 hr, contact rheumatology team (discuss with rheumatology team – page on-call SpR or refer via iPortal)

Confirmed gout

- Gout is confirmed by microscopic identification of urate (negatively birefringent) crystals in synovial fluid
- Rehydrate – see **Maintenance fluid therapy** guideline. Consider stopping diuretics
- An NSAID (e.g. naproxen 750 mg single dose then 250 mg oral 8-hrly) at maximum dose or colchicine in doses of 500 microgram 2–4 times daily (max 6 mg per course) is the drug of choice when there are no contraindications. Choice of first-line agent will depend on patient preference, renal function and co-morbidities. Patients on NSAIDs or cyclooxygenase-2 inhibitors (coxibs) should be co-prescribed a gastro-protective agent. See BNF for further dose guidance
- Intra-articular and systemic corticosteroids are effective in acute gout but use **only** under rheumatologist guidance

Do not start allopurinol in acute gout

- In difficult or resistant cases, contact rheumatology team (page on-call SpR or iPortal referral)

DISCHARGE AND FOLLOW-UP

- If patient already under follow-up because of arthritis, review existing follow-up arrangements
- Refer new cases to a consultant rheumatologist

CELLULITIS ● 1/3

RECOGNITION AND ASSESSMENT

- Acute spreading bacterial infection below skin surface

Symptoms and signs

- Unilateral limb redness
- in patients with bilateral red legs a diagnosis of bilateral cellulitis is extremely unlikely, consider other diagnoses – refer to Integrated red leg service or dermatology
- Erythema
- Warmth
- Swelling – may be fluctuant
- Tenderness/pain
- Demarcation
- Crepitus
- Pyrexia

Non-severe

- Systemically well with temperature 36–38°C
- Cellulitis not involving face or hand
- Not previously treated with adequate oral antimicrobials for the same complaint

Severe

- If any of the following present:
- lesion spreading rapidly
- systemic features (e.g. temperature >38°C or <36°C, hypotension, tachycardia)
- cellulitis involving face or hand
- progression despite adequate doses of appropriate oral antimicrobials
- significant co-morbidities (e.g. asplenia, neutropenia, cirrhosis, immunocompromised, cardiac or renal failure, or pre-existing oedema)
- blistering/bullae superficial haemorrhage into blisters, dermal necrosis. Lymphangitis and lymphadenopathy may occur

Likely organisms

- *Staphylococcus aureus*
- Streptococcus group A
- Anaerobes, particularly in patients with diabetes and/or ischaemic limbs

Those at risk

- Lymphoedema/chronic oedema
- Diabetes mellitus
- Intravenous drug user
- Immunocompromised
- Peripheral vascular disease

Investigations

- FBC
- U&E
- CRP
- ESR
- If systemically unwell and/or history of MRSA in previous 2 yr:
- blood culture specimen – see **Collection of blood culture specimens** guideline
- Swab from:
- portal of entry or aspirate of pus
- cannula site and tip for culture (if source)
- if skin broken – swab for microbiology
- screen for MRSA if not screened in prior 7 days
- If osteomyelitis suspected – plain X-ray (if X-ray normal this does not rule out osteomyelitis; consider MRI scan)
- If necrotising fasciitis suspected, seek **urgent** advice from surgical assessment unit
- Outline periphery of erythema with pen (indelible ink if possible)
- If bloods are normal it is unlikely to be cellulitis

Differential diagnosis

- If upper or lower limb involved, consider DVT in the presence of any of the following:
  - entire limb swollen for <3 months
  - previously documented DVT
  - active cancer (treatment within 6 months, ongoing or palliative)
  - paralysis, paresis or recent immobilisation
  - local tenderness along distribution of deep venous system
  - calf circumference >3 cm larger than asymptomatic leg (measured 10 cm below tibial tuberosity)
- If bilateral with no systemic malaise consider:
  - varicose eczema (bilateral with crusting, scaling, itch or other eczema)
  - contact dermatitis (as above but with clear demarcation often below knee where bandaging may have been *in situ*)
  - acute liposclerosis (pain, redness and swelling but patient systemically well)
- Lymphangitis
- Abscess
- Ulcers
- Necrotising fasciitis
- Osteomyelitis
- Thrombophlebitis

IMMEDIATE TREATMENT

- Baseline observations:
  - temperature
  - pulse
  - blood pressure
  - blood glucose
- If systemic sepsis, see **Sepsis management** guideline
- Treat underlying cause (e.g. portal of entry such as tinea pedis)
- Remove source of infection (e.g. cannula)

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.
True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Severity	First line	Alternative (penicillin allergy)
Simvastatin contraindicated in combination with clarithromycin (see current BNF for other interactions)		
If history of MRSA in previous 2 yr (see alerts on iPortal[1])	Vancomycin IV by infusion – see **Vancomycin** guideline If improving after 48 hr, discuss suitable alternative oral agents with microbiologist or consultant in infectious diseases	
Non-severe Local infection – slow progression	Flucloxacillin 1 g oral 6-hrly	Doxycycline 200 mg oral first day **then** doxycycline 100 mg oral daily
Severe Local infection +/- systemic symptoms and/or rapid progression If patient unwell, has pain out of proportion to local findings or shows evidence of marked systemic toxicity, consider necrotising fasciitis – request senior review and consider **urgent** surgical opinion	Flucloxacillin 2 g IV 6-hrly Fluid resuscitate if necessary – see **Fluid resuscitation** guideline **Oral stepdown:** Flucloxacillin 1 g oral 6-hrly [once apyrexial and skin lesions improving (e.g. 50% reduction in extent of initial erythema) **unless** blood culture has become positive]	Vancomycin IV by infusion aiming for vancomycin levels of 15–20 mg/L – see **Vancomycin** guideline **If no improvement within 48 hr/ patient becoming more septic or necrotising fasciitis suspected, discuss with consultant microbiologist/in infectious diseases** **Oral stepdown:** Doxycycline 200 mg oral first day **then** doxycycline 100 mg oral daily [once apyrexial and skin lesions improving (e.g. 50% reduction in extent of initial erythema) **unless** blood culture has become positive or organism resistant to doxycycline has been reported]
Orbital cellulitis	Seek urgent ophthalmology opinion and discuss choice of antimicrobials with consultant microbiologist/in infectious diseases	
Duration	Non severe 5–7 days total Severe 7–14 days total (including IV treatment) unless blood culture has become positive Consider referral to outpatient antimicrobial therapy (OPAT) service	

[1] Check iPortal for IC alert under patient alerts: if MRSA present treat as tagged for MRSA; if CARB present then discuss with microbiologist for empirical treatment

MONITORING

- Outline and monitor size of affected area daily
- If no response after 24 hr of antimicrobial treatment, discuss with microbiologist

DISCHARGE AND FOLLOW-UP

- If patient does not require admission or is fit for discharge but needs IV antimicrobials, refer to OPAT service for IV antimicrobials at home
- If redness is bilateral (or unilateral and DVT has been excluded) with no systemic malaise, refer to Integrated Red Legs Service (IRLS). Referral form available from Trust intranet Clinicians>clinical services>cancer services>support services>lymphoedema

COMMUNITY-ACQUIRED MENINGITIS ● 1/3

Interval between patient's arrival and commencement of lumbar puncture (if indicated) and antimicrobial treatment ('door-to-needle time') should not exceed 1 hr. The 'Gold standard' investigation is lumbar puncture and if there are no clinical contraindications it should not be delayed. If there are no clinical contraindications to LP, CT scan is not indicated (this is supported by recent BIA guidance). If bacterial meningitis strongly suspected, contact a consultant in infectious diseases via call centre

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Headache, neck stiffness, photophobia
- Fever
- Impaired consciousness, coma and fits
- Clinical features of septicaemia or severe sepsis

In the elderly, confusion can occur as the only symptom of meningitis in the absence of meningism or even of fever

Life-threatening features

- Altered consciousness
- Focal neurological deficit
- Raised intracranial pressure
- Convulsions
- Concurrent evidence of sepsis

Investigations

- CSF – see **Flowchart**
- FBC, differential WBC and coagulation screen
- U&E, glucose and CRP
- Throat swab (this is not for MRSA screening. Include suspected meningococcal meningitis in clinical details. Take separate swabs for MRSA screening)
- Blood culture
- Chest X-ray
- Meningococcal/pneumococcal PCR (EDTA tube to microbiology)
- Urinary pneumococcal antigen

Differential diagnosis

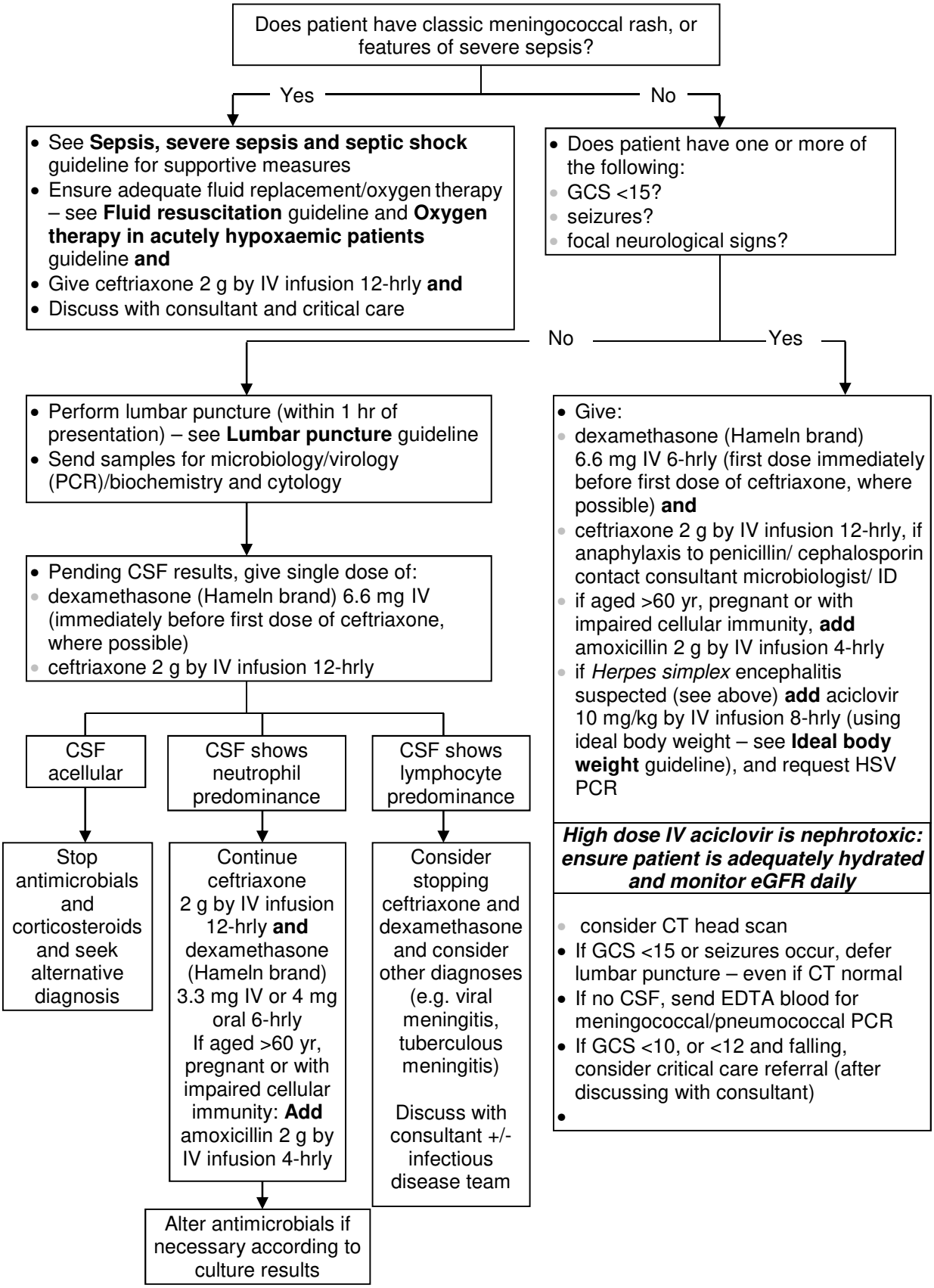
- Subarachnoid haemorrhage
- Other intracranial sepsis
- Systemic sepsis
- Other causes of confusion or of raised intracranial pressure
- Encephalitis
- look for symptoms of confusion, seizures, dysphasia or reduced conscious level
- Malaria in travellers

IMMEDIATE TREATMENT

- Cases of suspected community-acquired meningitis must be notified immediately to consultant in communicable disease control (out-of-hours via switchboard), to discuss need for prevention of secondary cases
- See **Flowchart**

COMMUNITY-ACQUIRED MENINGITIS ● 2/3

Flowchart – Initial management



MONITORING TREATMENT

- Neurological observations, including GCS, every 15 min in severe cases initially, then at decreasing intervals as recovers

SUBSEQUENT MANAGEMENT

- If bacterial meningitis proven or probable, continue antimicrobial treatment for 7 days, then review
  - if meningococci isolated, treat for 7 days, then review
  - if pneumococci isolated, treat for 14 days, then review
  - if other organisms isolated see Trust Antimicrobial guidelines
- Withdraw dexamethasone after 48 hr unless specific indication to continue (e.g. TB meningitis)
- If encephalitis is not/no longer suspected, it is not necessary to continue aciclovir until a negative HSV PCR test result has been received

DISCHARGE AND FOLLOW-UP

- Follow-up in clinic to check for hearing loss
- Refer patients with persisting neurological deficit to appropriate specialist for rehabilitation:
  - aged <65 yr – rehabilitation department
  - aged ≥65 yr – consultant geriatrician linked to medical firm

FEVER IN THE RETURNING TRAVELLER ● 1/3

Be aware of MRSA and ESBL/MGNB/CARB tags[1]. If such a tag present, ensure appropriate account is taken in the choice of empiric antimicrobials (see Management below) and infection prevention precautions

[1] Check iPortal/ICE for IC alert under patient alerts. If unavailable, check previous 12 months of microbiology reports: if MRSA present treat as tagged for MRSA; if ESBL present treat as tagged for ESBL

RECOGNITION AND ASSESSMENT

Initial assessment is aimed primarily at early detection and treatment of falciparum malaria, which can be rapidly fatal. 10% of patients with falciparum malaria are afebrile at presentation

Some conditions e.g. Ebola and other viral haemorrhagic fevers or Middle East Respiratory Syndrome Coronavirus (MERS-CoV) may require immediate isolation if suspected

Symptoms and signs

- Temperature >37.5°C in patient presenting after recent overseas travel (e.g. malaria occurring 6 months after travel)
- Rigors or night sweats imply fever; myalgia or arthralgia do not
- Diarrhoea is non-specific and consistent with malaria, pneumonia, enteric pathogen or any other infective process

Travel history

- **Where?** – Country and specific locations (e.g. city vs rural)
- **Why?** – Business, holiday, visiting relatives
- **Accommodation?** (e.g. 5-star hotel vs camping)
- **When?** – Dates of departure and return, and their relation to onset of symptoms
- viral haemorrhagic fevers (VHF) can be excluded if onset of symptoms >21 days after leaving endemic area – see http://www.hpa.org.uk/HPA/Topics/TopicsAZ/ and select viral haemorrhagic fevers; for advice regarding Ebola infection see https://www.gov.uk/government/collections/ebola-virus-disease-clinical-management-and-guidance
- for advice regarding Middle East Respiratory Syndrome Coronavirus (MERS-CoV) see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/585569/MERS-CoV_case_algorithm.pdf
- symptoms of falciparum malaria take at least 6 days to manifest after arrival in endemic area. Symptoms usually occur within 2 months of exposure, but may not present for up to 6 months
- Differential diagnosis can be narrowed by considering incubation periods – see **Table 1**

Table 1: Incubation periods

Incubation period	Infection
Short (<10 days)	• Acute gastroenteritis (bacterial, viral) • Respiratory tract infection (bacterial, viral including avian influenza) • Meningitis (bacterial, viral) • Arboviral infections (e.g. dengue, Chikungunya) • Rickettsial infection (e.g. tick typhus, scrub typhus) • Relapsing fever (borrelia)
Medium (10–21 days)	**Protozoal** • Malaria (*Plasmodium falciparum)* • Trypanosomiasis *(Trypanosoma rhodesiensae)* • Acute Chagas' disease **Viral** • HIV, CMV, EBV, VHF (including Ebola Virus Disease) • Middle East Respiratory Syndrome Coronavirus (MERS-CoV) **Bacterial** • Enteric fever (typhoid and paratyphoid fever) • Brucellosis • Q Fever • Leptospirosis
Long (>21 days)	**Protozoal** • Malaria (including *Plasmodium falciparum)* • Amoebic liver abscess • Visceral leishmaniasis **Viral** • Viral hepatitis • HIV

- **What?** – Risk activities
- sexual history – HIV – see **HIV testing** guideline
- swimming in fresh water – schistosomiasis (Africa) or rickettsial disease (eastern Europe, Asia and South America)
- tick bites – rickettsial disease (North and South America, sub-Saharan Africa, coastal Mediterranean)
- animal/bird contact – avian influenza
- sickness occurring in fellow travellers or contacts: what? when? – especially important in outbreak situations
- for information on outbreaks, visit www.who.int/csr/don/en

Pre-travel history

- Pre-travel immunisations, antimalarials and adherence to them
- Any previous medical history, specifically conditions/treatments that can induce immunosuppression

EXAMINATION

- Confirm presence of fever
- Look for rashes, bites, jaundice, lymphadenopathy, hepatosplenomegaly – see http://wwwnc.cdc.gov/travel/yellowbook/2016/post-travel-evaluation/fever-in-returned-travelers

INVESTIGATIONS

Recommended initial investigations in returning travellers presenting with (undifferentiated) fever*

Investigation	Interpretation
Malaria film +/- dipstick antigen test (RDT)	• Perform in all patients who have visited a tropical country within 1 yr of presentation • Sensitivity of a thick film read by an expert is equivalent to that of an RDT. However, blood films are necessary for specification and parasite count • Three thick films/RDTs over 72 hr (as outpatient if appropriate) to exclude malaria with confidence • Blood films (thick and thin) to reference laboratory for confirmation
FBC	• Lymphopenia: common in viral infection (dengue, HIV) and typhoid • Eosinophilia (>0.5 x 10^9/L): incidental or indicative of infectious (e.g. parasitic, fungal) or non-infectious cause • Thrombocytopenia: malaria, dengue, acute HIV, typhoid, also seen in severe sepsis
Blood culture	• Two sets before administering antimicrobials • Sensitivity of up to 80% in typhoid
U&E	
LFT	
Serum save	• Offer HIV test to all patients with pneumonia, lymphocytic meningitis, diarrhoea, unexplained fever – see **HIV testing** guideline • If indicated, other serology (e.g. arboviral, brucella)
EDTA for PCR	• Consider if other features suggestive of arboviral infection, VHF
Urinalysis	• Proteinuria and haematuria in leptospirosis • Haemoglobinuria in malaria (rare)
Chest X-ray	
CRP	

Thrombocytopenia present in >75% of patients with falciparum malaria, but also seen in dengue and other infections
Neutrophilia suggests bacterial infection and eosinophilia may suggest parasitic infection

MANAGEMENT

Contact infectious diseases team on same or next working day

- Unless minor upper respiratory tract infection apparent, admit for assessment and exclude falciparum malaria in those who have travelled to endemic areas. Three negative films taken 12–24 hr apart are required to exclude malaria
- If avian influenza or haemorrhagic fever suspected at time of GP referral or on admission out-of-hours, contact on-call microbiologist
- if avian influenza suspected refer to guideline – http://www.hpa.org.uk/HPA/Topics/TopicsAZ/ and select avian influenza
- if malaria confirmed, follow British Infection Society guidelines – https://www.britishinfection.org/guidelines-resources/published-guidelines/
- If malaria identified but doubt about type, treat as falciparum especially if patient has returned from a falciparum endemic area

Imported fever service

- The imported fever service hosted jointly by Liverpool and London tropical medicine schools can be contacted for further advice – but **only after discussion with local microbiology or infectious disease services**

If Gram-negative bacilli grown in blood of patient returning from a typhoid endemic area (e.g. Indian sub-continent), give ceftriaxone 2 g IV by infusion daily; do not use ciprofloxacin as many strains of* Salmonella typhi *are resistant

- Resistance patterns among pathogens vary according to locality (e.g. pneumococcal penicillin resistance in Spain)
- If patient displays features of sepsis/severe sepsis, seek immediate advice from senior colleague and critical care – see **Sepsis management** guideline

NEUTROPENIC SEPSIS ● 1/3

RECOGNITION AND ASSESSMENT

Infections are a significant cause of morbidity and mortality among neutropenic patients. Infections may be bacterial (Gram-positive or Gram-negative) or viral. Immunosuppressed patients can also harbour fungal infections. The likelihood of infection depends on both severity and duration of neutropenia

Neutropenic sepsis is potentially life-threatening and requires emergency treatment. In any patient with neutropenic fever, obtain appropriate blood culture(s) and administer appropriate antimicrobials as soon as possible and certainly WITHIN ONE HOUR of presentation. If patient 'tagged' on iPortal/iCM for an 'alert organism' (e.g. MRSA, ESBL) ensure that this organism is covered in the initial empirical therapy (see Table below)

Risk of infection is proportional to duration of neutropenia (risk increases with prolonged neutropenia) and how far and how fast neutrophil count falls. Consider infection in any unwell neutropenic patient even if no fever

Symptoms and signs

- Fever or abnormally low temperature
- Oral or tympanic membrane temperature ≥38°C with neutrophil count $<0.5 \times 10^9$/L
- Significant deterioration in clinical state [e.g. development of rigors, shock (systolic BP <90 mmHg) or falls of normal blood pressure by >50 mmHg]
- Signs consistent with infection of respiratory tract, urinary tract, or central venous catheter/Hickman line/PICC line
- Severely ill patient with no obvious other explanation for clinical state
- If suspicion of infection (even in the absence of a fever), start treatment for sepsis
- If there is a suspicion of sepsis and patient is at risk from neutropenia (e.g. has had recent chemotherapy), treat for neutropenic sepsis **without waiting for blood results**, and adapt treatment later if necessary

Even if other causes possible, always treat fever in neutropenic sepsis as if caused by infection. Treat with the utmost urgency any patient with features of severe sepsis

History and examination

- Take full history and carry out full examination immediately

Possible sites of infection

- Enquire about, and look for, inflammation/infection at following sites and sample as appropriate:
  - teeth, gums, pharynx
  - ears, nose, sinuses
  - eyes, including fundi
  - lungs – cough, shortness of breath, sputum
  - upper gastrointestinal tract
  - lower gastrointestinal tract – if diarrhoea present, consider isolation and discuss with infection prevention team
  - perineum, especially anal area (**avoid PR examination**)
  - skin – consider fungal, pseudomonas, generalised herpes and varicella zoster infections
  - genito-urinary tract
  - vascular access sites, especially central venous line insertion sites, bone marrow aspiration sites, nail margins, skin tunnels and surgical incision sites
- Enquire whether central venous line used or flushed within preceding 24 hr

Timing of chemotherapy

- Establish type of chemotherapy administered and date of last dose (refer to patient alert card)
- Estimate expected onset and anticipated duration of neutropenia by establishing time elapsed since first day of current cycle of chemotherapy
- Assume that any patient who has received chemotherapy within the last month, or whose last recorded blood counts on iCM/iPortal show neutropenia may be neutropenic
- If a subsequent blood count result shows no neutropenia, choice of antimicrobial can be revised at that time if necessary in discussion with the appropriate specialist team

If any of this information not available, do not delay start of antimicrobial therapy. The safest option is to commence antimicrobial treatment and revise later, if necessary

Investigations

General

- FBC including differential WBC
- CRP
- U&E
- LFT
- Lactate
- Blood cultures – peripheral **and** central (through IV catheter lumens) (take blood through each lumen of Hickman/PICC line). Do not access Hickman/PICC line unless trained to do so
- Coagulation screen
- MSU/CSU

Specific

- If varicella zoster suspected, consider swabs for viral culture and PCR
- Appropriate swabs [e.g. throat, mouth, wound, skin/peri-anal area (do **not** perform PR), Hickman line/central venous catheter/PICC line exit site, if appropriate]
- If chest signs and/or SpO_2 <92% on air, chest X-ray
- If GI symptoms (e.g. diarrhoea and abdominal pain), send stool sample for culture/sensitivity and *Clostridium difficile* toxins
- If urinary symptoms or patient catheterised, urinalysis and culture
- Respiratory secretions for rapid testing for viral antigens by immunofluorescence, viral cultures or PCR (e.g. throat swab – see below). Direct viral detection is preferred method for diagnosing respiratory viral infections. This is particularly important in testing for influenza
- During influenza outbreaks (usually autumn or winter), assume that any neutropenic or otherwise immunosuppressed haematology or oncology patient presenting with suggestive symptoms (fever with cough, other upper respiratory tract symptoms or myalgia) may have influenza. This can be a very serious infection in these patients
- Complete MASCC score https://www.qxmd.com/calculate-online/hematology/febrile-neutropenia-mascc

IMMEDIATE TREATMENT

Discuss management of patients admitted with neutropenic fever with acute oncology specialist nurse (contact details on rota watch)

Alternatively, haematology advice can be obtained on pager 15723 (0900–1700 Monday to Friday) and via call centre at other times
Oncology advice is available from on-call oncologist, via call centre at all times

- Commence antimicrobials recommended in the **Table** (see below)
- Review any recent microbiology culture results. If these reveal a multi-resistant organism, ensure this will be covered by empiric antimicrobial treatment selected
- In cases of varicella zoster, adopt infection control precautions to protect staff and other patients – discuss with infection prevention team
- If influenza appears likely on clinical grounds, ensure viral throat swab taken (see above) and consider immediate treatment with antiviral medication in addition to the antimicrobial treatment recommended above. Choice of antivirals determined by national guidance. If uncertainty, seek advice of on-call microbiologist. Isolate patient to reduce risk of spread to others
- if viral swab subsequently reveals no evidence of influenza infection, discontinue empirical treatment

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.
True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Severity	First line	Alternative (penicillin allergy)
Haemodynamically stable	Piperacillin/tazobactam 4.5 g IV 8-hrly given as a short infusion (30 min)	**No history of anaphylaxis with penicillin:** Meropenem 1 g IV 8-hrly **If anaphylaxis to penicillin,** discuss with consultant microbiologist/consultant in infectious diseases
Hypotensive or other evidence of organ dysfunction	Piperacillin/tazobactam 4.5 g IV 6-hrly given as a short infusion (30 min) **plus** gentamicin 7 mg/kg – see Gentamicin calculator and **Intermittent dosing** in **Gentamicin** guideline	
Tagged for ESBL in iPortal	Meropenem 1 g IV 8-hrly	
Tagged for MRSA in iPortal **or** Patient has central venous catheter/Hickman line/PICC line **and** clinical evidence suggests line might be source of infection [e.g. erythema around exit site or symptoms (e.g. fever, rigors) appeared shortly after line flushed]	**Add** vancomycin IV by infusion – see Vancomycin calculator and **Vancomycin** guideline	
Duration	Depends on source of infection	

[1] Check iPortal for IC alert under patient alerts. If iPortal not available, then check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL; if CARB present then discuss with microbiologist for empirical treatment

Colony-stimulating factors

- Discuss use of colony-stimulating factors (Filgrastim 300 microgram SC daily) with consultant oncologist or haematologist

If a patient who has had an allogeneic stem cell transplant is admitted febrile or unwell, admitting doctor must contact on-call haematology specialist trainee or consultant immediately after initial assessment

SUBSEQUENT MANAGEMENT

- Subsequent management 24–72 hr after initiating antimicrobial treatment depends on blood culture results and clinical condition. Always discuss subsequent management plan with consultant haematologist or consultant oncologist

MONITORING TREATMENT

- FBC, U&E and CRP daily until recovery
- LFT 2–3 times weekly until recovery (unless significant abnormalities discovered on admission sample)
- Coagulation screen on admission
  - if normal, no further routine repeats necessary
  - if abnormal, seek advice from consultant haematologist or consultant oncologist
- If fever persists, repeat blood cultures based on clinical assessment
- If clinically indicated, repeat chest X-ray
- If fever not resolved after 72–96 hr, urgent high-resolution chest CT – discuss with consultant radiologist
- Infections in neutropenic patients typically take 2–7 days to respond to antimicrobial therapy

DISCHARGE AND FOLLOW-UP

Discharge patients only after consultation with acute oncology specialist nurse, haematology or oncology team

Table 1: Substance misuse contact numbers

Royal Stoke alcohol liaison nurses (ALN)	Stoke community drug and alcohol service	Staffordshire services Drug and alcohol One Recovery	
Ward pager: 07623676286	01782 283113	Edward Myers Unit:	01782 441715
A&E pager: 07623611822		Leek:	01538 384361
Office: 01782 672703		Newcastle:	01782 637658
Referrals on OrderComms		Stafford/south of county:	01785 270080
		Weekends: HALT	01782 637658

RECOGNITION AND ASSESSMENT

- Alcohol withdrawal can be a presenting feature or occur as an unexplained development in a patient who has been admitted for other reasons and deprived of alcohol. Untreated, it carries a 15% mortality rate. Mild withdrawal generally begins 6–8 hr after last drink, but can be sooner or considerably delayed. Moderate-severe withdrawal occurs about 48 hr after last drink. Pay particular attention if frequent attendance at hospital (e.g. upper GI symptoms)

Symptoms and signs

- Anxiety
- Sweating
- Tremor
- Ataxia
- Confusion
- Assess severity using Clinical Institute Withdrawal Assessment of Alcohol Scale (revised CIWA-Ar) form – see Trust intranet>Clinicians>Clinical guidance>Alcohol. Ask specific questions shown for each category and use CIWA-Ar form to derive score from answers or observations
- scores <10: do not need medication for withdrawal
- scores ≥10: will need benzodiazepines for symptom control [see **Alcohol withdrawal assessment (based on CIWA-Ar scale) and symptom control** section]
- For advice on assessment, contact alcohol liaison nurse (see **Table 1** for contact numbers)
- Patients who attend intoxicated but have a high degree of tolerance towards alcohol are at risk of developing alcohol withdrawal symptoms even while their alcohol level may still seem high

Guidance for alcohol history

- Complete Alcohol screening tool (AUDIT) (available to download from Trust intranet – Clinicians>Clinical guidance>Alcohol)
- Quantity, frequency and highest daily alcohol use
- Previous treatment for alcohol misuse
- Previous abstinence
- Triggers for drinking
- Psychiatric problems
- Motivation

Routine investigations

- If decompensated alcoholic liver disease (ascites, encephalopathy) or a GI bleed, blood cultures
- FBC
- U&E
- LFT
- INR
- Bone profile plus magnesium and phosphate
- Blood glucose

Optional investigations

- Arterial blood gases (severe withdrawal or severe systemic upset)
- Urine drugs of abuse screen (if illicit drug use suspected). Some of the newer drugs ('legal highs') may be difficult to identify
- Breath/blood alcohol
- Gamma-glutamyl transpeptidase test (GGT)

Differential diagnosis

- See **Delirium (acute confusional state) in older people** guideline
- Acute alcoholic hepatitis with hepatic encephalopathy
- Withdrawal of intoxication with drug(s) of misuse – see **Withdrawal of drug(s) of dependence** guideline

Alcohol related brain damage (ARBD)

- Consider ARBD if patient presents to ED appearing intoxicated, confused, 'off legs'
- Alcohol related brain damage (ARBD) is an umbrella term used to describe a spectrum of brain disorder that include alcohol related dementia, alcohol amnesic syndrome and Wernicke's-Korsakoff's syndrome. If left untreated can lead to irreversible brain damage, disorders of the nervous system and death
- Diagnosis is supported by the presence of the following:
- alcohol related hepatic, pancreatic, gastro-intestinal, cardiovascular or renal damage
- ataxia or peripheral neuropathy
- evidence on neuro imaging of brain atrophy

UHNM admission criteria

- Confusion or hallucinations
- Epilepsy or history of fits
- Undernourished
- Severe vomiting or diarrhoea
- Uncontrollable withdrawal symptoms
- Acute physical illness requiring admission
- Decompensated liver disease

If patient does not meet criteria for admission but shows signs of, or is at risk of alcohol withdrawal

- Advise patient to avoid sudden reduction in alcohol intake
- Refer to alcohol liaison team or give information on local alcohol support services
- Give a dose of Pabrinex IV as per guidance. If the patient remains in the department (i.e. CDU) for observational purposes, continue with Pabrinex IV 8-hrly as per guideline

IMMEDIATE MANAGEMENT

Alcohol withdrawal assessment (based on CIWA-Ar scale) and symptom control

1. Assess vital signs and record on NEWS chart (review alongside CIWA-Ar assessments)
2. Complete assessment using CIWA-Ar scale (form available on Trust intranet> Clinicians>Clinical guidance>Alcohol)
3. See **CIWA-Ar Flowchart** for assessment guidance
4. If CIWA-Ar score ≥10, commence symptom triggered treatment with oral benzodiazepines
5. Prescribe diazepam unless patient is frail elderly, unable to tolerate diazepam, showing signs of delirium tremens, has respiratory failure or severe liver impairment (e.g. INR >2 and bilirubin >200 or hepatic encephalopathy) in which case use lorazepam
6. Administer as required medication as directed by CIWA-Ar assessments and record doses given on drug chart and CIWA-Ar chart
7. If patient scores 11–12 on AUDIT-C or requires CIWA-Ar monitoring, refer to alcohol liaison team
8. If patient usually on a regular benzodiazepine e.g. temazepam 10 mg at night, continue this with additional diazepam or lorazepam prescribed as required to manage alcohol withdrawal symptoms

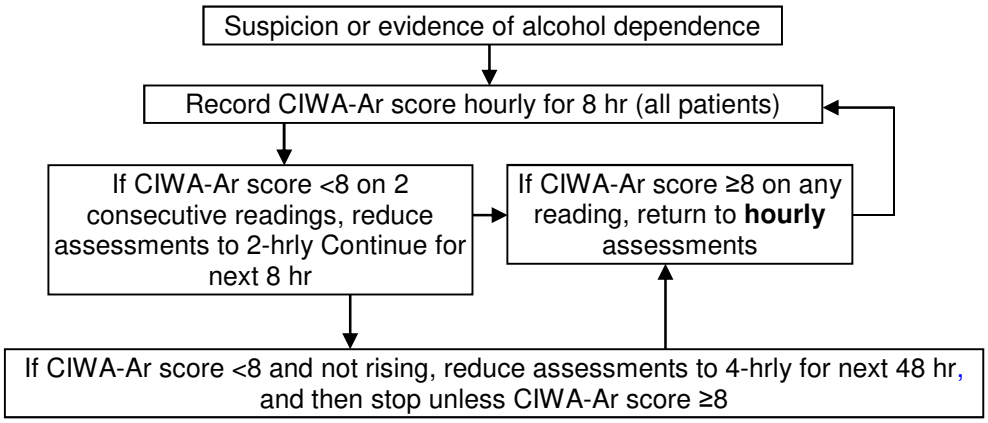
Alcohol withdrawal in pregnancy

Commence CIWA-Ar symptom assessment and discuss with alcohol liaison team, substance misuse midwife and Edward Myers Unit regarding tapered reduction of benzodiazepines

The aim is to prevent features of withdrawal without over sedation. Individual dose requirements vary considerably and can be decided only by assessing response regularly and omitting or adding doses as necessary. Lorazepam and diazepam normally given orally

ALCOHOL WITHDRAWAL ● 3/4

CIWA-Ar Flowchart



CIWA-Ar score	Medication
<10	Nil
10–15	5 mg diazepam **or** 0.5 mg lorazepam
≥16	10 mg diazepam **or** 1 mg lorazepam

Note: Some patients may require higher than BNF recommended limits of benzodiazepines if severe withdrawal symptoms

Case discussion with senior medical staff is appropriate if:

- Patient has required 3 mg lorazepam or 30 mg diazepam over 3 hr
- CIWA-Ar score >35
- Evidence of Delirium Tremens (which should be viewed as a medical emergency)
- Reassess patient – check conscious levels, respiratory status and alcohol withdrawal symptoms, and look for any evidence of other organic pathology
- If withdrawals persist consider changing from diazepam to lorazepam
- Consider use of parenteral lorazepam 1 mg (preferably IV into a large vein) with interval between doses of at least 15 min (IV) and 30 min (IM) if unable to tolerate oral benzodiazepines or symptoms of severe hallucinations or agitation
- Do not use IM route in patients with bleeding/clotting disorders
- Haloperidol 1–5 mg can be added to enhance sedative effects of benzodiazepines (see BNF for contraindications)
- If total dose of lorazepam has reached 8 mg and patient still agitated – discuss with critical care

Other indications for discussion with critical care

- Respiratory depression
- Patient in state of extreme agitation

Fluids and electrolytes

- Monitor and replace electrolytes, magnesium and phosphate and give adequate hydration – see **Maintenance fluid therapy** guideline (defer glucose infusions until after first dose of Pabrinex given as it can precipitate Wernicke's encephalopathy)

Vitamin therapy

- Most effective when given parenterally as oral absorption is poor; IV route is preferable but if this is not available, use IM route

All patients

- Give parenteral thiamine as Pabrinex IV high potency injection **2 pairs** of ampoules (mixed) by IV infusion in sodium chloride 0.9% 100 mL over 30 min **8-hrly**
- if IV route not available, give **1 pair** of ampoules deep **IM** into gluteal muscle **12-hrly.** Use Pabrinex preparation specific to IM injections
- Patients with decompensated liver disease, malnourishment or significant weight loss or memory disturbance, are at risk of Wernicke's encephalopathy, continue Pabrinex for 72 hr at frequency stated above
- **In all other** patients 72 hr of Pabrinex is not essential e.g. if patient is considered medically fit for discharge within this time it does not need to be continued

- If Wernicke's encephalopathy is suspected or confirmed and physical symptoms persist beyond 72 hr but patient is improving symptomatically, give **1 pair** of ampoules IV or deep IM **once daily** for as long as symptoms continue to improve and for a **minimum of 5 days** in total
- Prescribe **oral thiamine 100 mg 8-hrly** for all patients on discharge and advise GP via discharge letter to continue this for 3 months in the community
- **Note** vitamin B Compound strong tablets are **not indicated** in alcohol dependent patients. **Do not** discharge patients on vitamin B compound and ensure it is **stopped** in those admitted on vitamin B solely for the reason of alcohol dependency unless malnourished
- If patient malnourished refer to dietitian and discuss need for ongoing vitamin supplementation

MONITORING THERAPY

- If drowsy, confused or there is concern about previous readings, blood glucose 2-hrly

SUBSEQUENT MANAGEMENT

Seizures

- Manage seizures, see **First seizure** guideline and **Cluster seizures** guideline. However, withdrawal seizures alone **do not** signify epilepsy and maintenance anticonvulsant therapy is unnecessary

DISCHARGE AND FOLLOW-UP

- **Where possible liaise with alcohol liaison nurses to plan discharge**
- Ensure all patients have been assessed for alcohol dependency with the AUDIT alcohol screening tool (available from Trust intranet>Clinicians>Clinical guidance>Alcohol)
- Alcohol liaison team may advise prescribing Acamprosate:
- body weight ≥60 kg – 666 mg 8-hrly
- body weight <60 kg – 666 mg at breakfast, 333 mg at midday and 333 mg at night
- to be continued on discharge and reviewed by GP or community alcohol service

Further community support

Refer patients living in Stoke-on-Trent to Stoke community drug and alcohol service, refer patients living in the rest of Staffordshire to One Recovery – see **Table 1** for contact numbers

Screening results (AUDIT score)

- <8: no action required
- 8–19: advice and offer referral to community alcohol services
- 20+: refer to alcohol liaison nurse (see **Table 1 for** contact numbers)

Supported home detoxification (Royal Stoke only)

- Patients assessed by a consultant as medically fit for discharge, who have received in-patient detoxification for ≥72 hr, but still have CIWA-Ar scores ≥8, may be suitable for continued home detoxification
- This service is **only available to those assessed by alcohol liaison nurses** and deemed suitable
- Detoxification will be supervised and patients given appropriate follow-on support
- Generate discharge letter for GP and advise any alcohol intervention and follow-up requirements

Additional advice on discharge

- Advise patient to contact the DVLA and car insurance provider, and that with alcohol related illness they should not drive for 6 months; with alcohol withdrawal they should not drive for 12 months

WITHDRAWAL OF DRUG(S) OF DEPENDENCE ● 1/4

Table 1: Substance misuse contact numbers

Royal Stoke alcohol liaison nurses (ALN)	Stoke community drug and alcohol service	Staffordshire services Drug and alcohol One Recovery
Ward pager: 07623676286	01782 283113	Edward Myers Unit: 01782 441715
A&E pager: 07623611822		Leek: 01538 384361
Office: 01782 672703		Newcastle: 01782 637658
Referrals on OrderComs		Stafford/south of county: 01785 270080
		Weekends: HALT 01782 637658

RECOGNITION AND ASSESSMENT

- Withdrawal syndromes are specific to:
  - type of drug involved
  - route of administration
  - frequency of use
  - quantity used
  - individual variation in sensitivity
  - psychological state
- Mild symptoms occurring after withdrawal of a drug do not require routine medical intervention. Explaining to patient likely course of withdrawal has been shown to reduce severity of withdrawal symptoms
- If treatment may be required suggest TAP – Test (investigations), Assess (as described below) and Phone (drug agency that will continue input following discharge acute hospital)

Investigations

- Obtain **witnessed** urine sample or mouth swab for drug screen (contact alcohol liaison team for screening tests)
- Check patient's prescribed medications with GP when surgery open
- if patient states they are taking opiate substitute, contact prescriber e.g. patient's own GP, Stoke community drug and alcohol service or One Recovery – see **Table 1** for contact numbers
- Pregnancy test, if indicated

Pregnancy is an indication for very detailed assessment and close management of withdrawal because of risks to fetus. Refer to appropriate drug service (patients living in Stoke-on-Trent to Stoke community drug and alcohol service, patients living in the rest of Staffordshire to One Recovery) and contact on-call obstetric team – *see* **Management of a pregnant woman with a non-obstetric problem** ***guideline***

OPIATE WITHDRAWAL

Symptoms and signs

- Nausea, vomiting
- Diarrhoea
- Restlessness, anxiety
- Irritability, insomnia
- Muscle and bone pains
- Running eyes and nose
- Sneezing, yawning
- Sweating, flushing
- Dilated pupils, pilo-erection
- In a hospital setting assess severity using **Table 2**
  - score **0** if not present
  - score **1** if mildly present
  - score **2** if strongly present

Table 2

Signs	0	1	2
Pupillary dilation			
Rhinorrhea			
Lacrimation			
Pilo-erection			
Nausea/vomiting			
Diarrhoea			
Yawning			
Cramps			
Restlessness			
Subjective evaluation			

- Score ≤5, no medical treatment indicated
- Score >5, treatment may be indicated

Immediate treatment

- Where withdrawal symptoms are of sufficient severity to warrant medical treatment, several options are available

Symptomatic treatment

- Nausea, vomiting and insomnia: promethazine hydrochloride 25 mg oral 12-hrly
- Somatic anxiety: propranolol 40 mg oral 8-hrly
- Diarrhoea: loperamide 4 mg single oral dose. Do not give loperamide if infective diarrhoea suspected
- Stomach cramps: hyoscine butylbromide 10–20 mg oral 6-hrly
- Pain: paracetamol 1 g oral 6-hrly or ibuprofen 400 mg oral 8-hrly if required

Opiate substitution

Discuss initiation of opiate substitution with drug agency (based on geography) that will continue input following discharge acute hospital. Do not give substitutes unless a screening test confirms presence of opiates. Drug of choice is methadone mixture (1 mg/1 mL) – do not use injectable or tablet forms of methadone. Do not give alternative forms of opiate unless discussed with relevant drug agency

Initial dose

- Measure withdrawal symptoms using **Table 2** at 6-hrly intervals for 24 hr. If score >5, give methadone 1 mg per point (i.e. score of 5 = no dose, score of 7 = 7 mg)
- Following first four 6-hrly assessments, add up doses administered at these assessments. Sum will be the daily dose on which patient should continue
- If significant withdrawal symptoms persist and patient remaining in hospital, give the new daily dose and perform a further 24 hr cycle of 6-hrly assessments
- in order to decide dose to be given on day 3, add any extra methadone given on day 2 to the sum obtained from day 1

Maintenance dose

- Once stable dose has been achieved, give methadone as single daily dose as described above

Maximum dose in 24 hr should not exceed 50 mg without specialist advice

Subsequent management

- Aim to allow patient to stabilise on the dose of methadone reached by titration with any reductions arranged by continuing care teams once discharged
- On discharge, continuing prescription should be via Staffordshire community drug service (One Recovery) or Stoke community drug service (Lifeline)

Monitoring treatment

- Complete withdrawal table 6-hrly (**Table 2**)

Discharge and follow-up

- Contact agency that has agreed to continue prescribing; allow as much warning as possible in order for necessary arrangements to be made
- relevant agency will confirm arrangements for prescription and appointment

Do not write methadone prescription as a TTO

- Notify GP

SEDATIVE WITHDRAWAL

- Benzodiazepines and other sedative hypnotic drugs
- Alcohol – see **Alcohol withdrawal** guideline

Symptoms and signs

- Confusion
- Nystagmus
- Tremor
- Agitation, irritability
- Insomnia
- Pyrexia
- Hyperreflexia
- Weakness
- Convulsions

Immediate treatment

- In initial stages, treatment of sedative withdrawal is similar to that for alcohol – see **Alcohol withdrawal** guideline. Once symptoms controlled, change to long-acting benzodiazepine (chlordiazepoxide, diazepam) in an equivalent dose (**Table 3**) to maintain clinical state and discuss a longer term strategy with either Edward Myers Centre or patient's GP

Table 3: Equivalent dosages

Drug	Dosage
Chlordiazepoxide	12.5 mg
Diazepam	5 mg
Loprazolam	500 microgram–1 mg
Lorazepam	500 microgram
Oxazepam	10 mg
Temazepam	10 mg
Nitrazepam	5 mg
Lormetazepam	500 microgram–1 mg

GAMMA-HYDROXYBUTYRATE (GHB)

- GHB is a 'party' drug used for its euphoric effects. It may interact with other illicit or prescribed drugs (e.g. anti-convulsants or anti-psychotics)

Serious side effects

- Headaches
- Hallucinations
- Dizziness
- Confusion
- Nausea
- Vomiting
- Drowsiness
- Agitation
- Diarrhoea
- Sexual arousal
- Numbing of legs

- Vision problems
- Tightness of chest
- Mental changes
- Combativeness
- Memory loss
- Serious breathing and heart problems
- Seizures
- Coma
- Death
- Long-term use may lead to withdrawal symptoms

Management

- Patients may present to A&E in an intoxicated or comatose state – most wake up within a few hours but some require ventilation
- Due to short half-life, withdrawal symptoms require active management – use diazepam as indicated in **Alcohol withdrawal** guideline using CIWA-Ar assessment chart, available from Trust intranet – Clinicians>clinical guidance>clinical guidelines>alcohol. Higher doses may be required
- Refer to Stoke community drug and alcohol service or One Recovery – see **Table 1** for contact numbers

STIMULANT WITHDRAWAL

- There are no acute symptoms of stimulant withdrawal that need medical treatment as a matter of urgency. Insomnia and anxiety can be treated symptomatically
- Advice and support are valuable
- Depressive symptoms sometimes occur as a later withdrawal effect and can be treated with an antidepressant
- Refer to Stoke community drug and alcohol service or One Recovery – see **Table 1** for contact numbers

VOLATILE SUBSTANCES

- Commonly misused are butane, toluene, glues, petrol. As there are no physical withdrawal syndromes, it is best to discontinue use abruptly. Treatment of intoxication involves general supportive measures:
- refer to Stoke community drug and alcohol service or One Recovery – see **Table 1** for contact numbers

CANNABIS

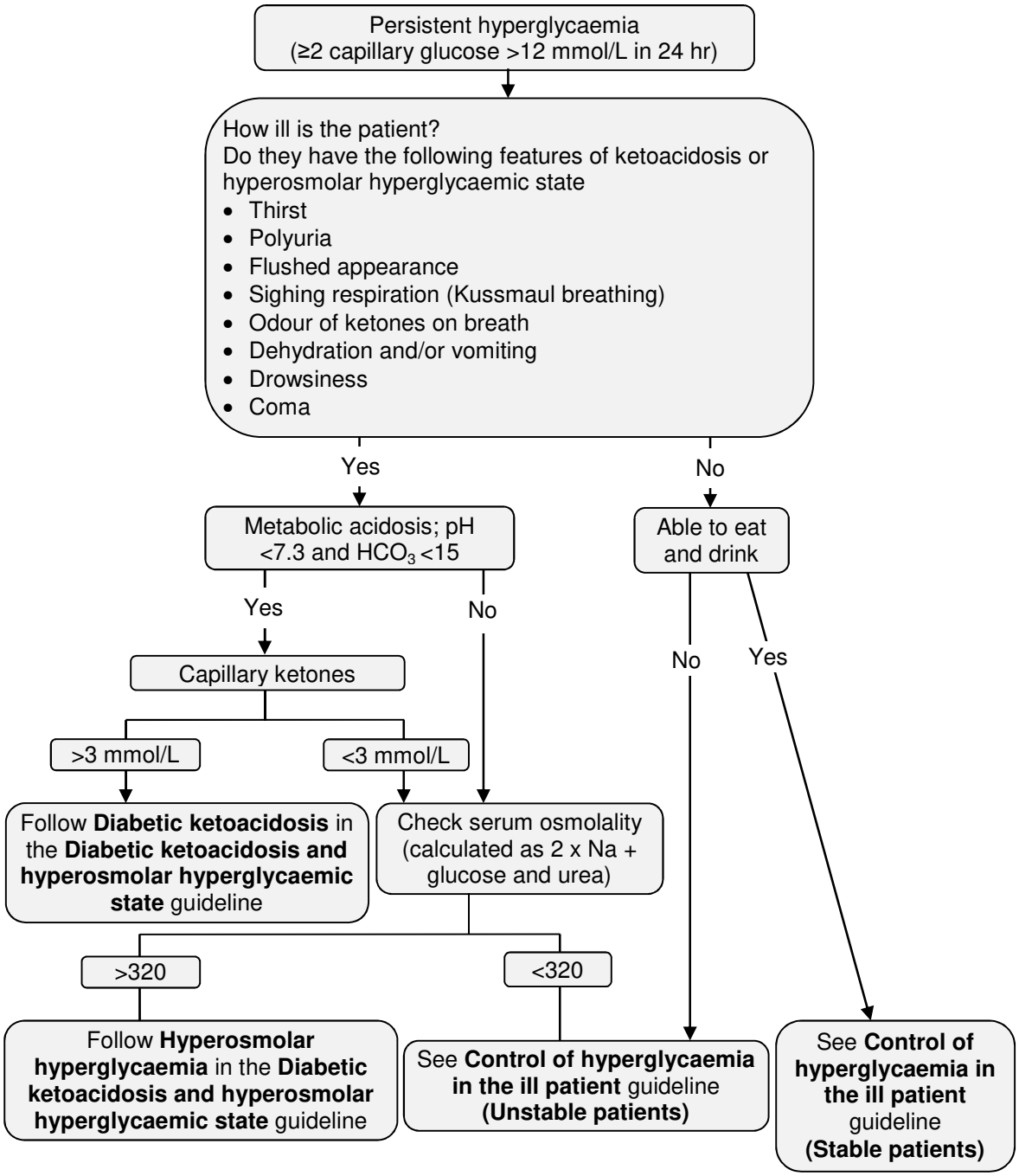
- Treat anxiety and insomnia symptomatically

THINK GLUCOSE • 1/1

CRITERIA FOR REFERRAL TO DIABETES TEAM

Referral not normally required	Referral may be required	Always refer
• Minor episodes of hypoglycaemia self-treated by patient • Simple educational need • Routine dietetic advice • Well-controlled diabetes • Good self-management skills • Routine diabetes care – dietary advice and life-style modification	• Acute coronary syndrome • Admission for urgent or major elective surgery • Significant educational need (poor self-management skills e.g. injection technique, hypoglycaemia management) • Newly diagnosed type 2 diabetes • Poor wound healing • Corticosteroid therapy • Patient prescribed insulin or oral hypoglycaemic medication but nil-by-mouth >24 hr • Patient request	• Diabetic ketoacidosis/ hyperosmolar/ hyperglycaemic state • Severe hypoglycaemia • Newly diagnosed type 1 diabetes • Started on insulin as inpatient • IV insulin infusion for >24 hr • Parenteral or enteral nutrition • Foot ulceration • Persistent hyperglycaemia (>12 mmol/L) • Recurrent hypoglycaemic episodes • Unstable/erratic blood glucose levels • Patients on GLP analogues (exenatide, liraglutide)
Rarely refer	**May refer**	**Refer**

TRIAGE OF PATIENTS WITH HYPERGLYCAEMIA ● 1/1



For referral to diabetic team of inpatients with hyperglycaemia or hypoglycaemic episodes on wards, see **Think glucose** guideline

CONTROL OF HYPERGLYCAEMIA IN THE ILL PATIENT ● 1/4

Check that this is the correct guideline – see **Triage of hyperglycaemia in the ill patient.**
The guideline below must not be used in patients with metabolic acidosis and/or severe dehydration – see **Diabetic ketoacidosis and hyperosmolar hyperglycaemic state** ***guideline***

RECOGNITION AND ASSESSMENT

- Patients with blood glucose persistently >12 mmol/L during monitoring
- in all ill diabetic patients, acute illness increases counter-regulatory ('stress') hormones that oppose the action of insulin and lead to a deterioration of glycaemic control
- patients who normally have acceptable glycaemic control will usually show deterioration in glucose control when they are given therapeutic doses of corticosteroids

Investigations

- Blood glucose (capillary)
- monitor at least 4-hrly in ill diabetic patients and/or when starting therapeutic doses of corticosteroids
- if persistently high, check venous blood glucose

MANAGEMENT

Never give single doses of insulin (e.g. Actrapid) – they lead to large swings in glucose concentration

- Withhold **metformin gliptins and GLP analogues** (exenatide and liraglutide) if there is significant renal impairment (creatinine >130 µmol/L and eGFR <45 mL/min), decompensated cardiac failure, liver failure or lactic acidosis
- Decide whether patient stable or unstable (see below); if in any doubt, discuss with diabetes nurse specialist or SpR/consultant in diabetes

STABLE PATIENTS

In patients with persistent hyperglycaemia (but no acidosis) who have mild or no dehydration and who are able to eat and drink:

- If using insulin, increase usual total daily insulin dose by 10–20%
- If taking oral agents, add low-dose insulin or insulin analogue, such as 10–12 units of isophane, glargine or detemir [if high risk of hypoglycaemia (e.g. elderly patient with variable oral intake) prefer glargine or detemir]
- at bedtime (if morning fasting glucose is >12 mmol/L) **or**
- at breakfast time (if pre-evening meal glucose is >12 mmol/L) **or**
- at bedtime and breakfast time (if **both** morning fasting and pre-evening meal glucose are >12 mmol/L)
- If taking pioglitazone**,** be alert for appearance of dyspnoea or peripheral oedema as introduction of insulin can precipitate heart failure
- If not on any treatment for diabetes
- start all diabetes patients on metformin as first line (irrespective of BMI)
- metformin contraindicated if eGFR <45 mL/min, when sulphonylurea can be used **or**
- in moderate degree of liver dysfunction (4-fold rise in liver enzymes) where the use of **all** oral hypoglycaemic agents are contraindicated until the cause of raised liver enzymes is ascertained
- monitor capillary blood glucose 4-hrly

UNSTABLE PATIENTS

When to use this guideline

- Patient nil-by-mouth
- Not eating or drinking and hyperglycaemia
- Blood glucose >12 mmol/L with blood ketones <3 mmol/L or urine ketones <3
- If long starvation period anticipated (e.g. ≥2 missed meals)
- Decompensated diabetes

NB: If capillary blood ketones >3 mmol/L or urinary ketones >3, follow **Diabetic ketoacidosis** ***in the*** **Diabetic ketoacidosis and hyperosmolar hyperglycaemic state** ***guideline***

CONTROL OF HYPERGLYCAEMIA IN THE ILL PATIENT ● 2/4

Important points to consider

- Patients with type 1 diabetes require insulin even if not eating
- omitting insulin is extremely dangerous and can rapidly lead to diabetic ketoacidosis, which can be fatal
- If patient eating and drinking and clinically well, consider SC insulin and repeat blood glucose to establish whether patient improving
- If in doubt, contact diabetes team (if out-of-hours, on-call medical SpR)

MANAGEMENT

Insulin delivery and infusion

- Use BD micro-fine insulin hypodermic syringe to draw up insulin dose accurately. **Do not use ordinary syringe**
- 50 units soluble insulin diluted to 50 mL with sodium chloride 0.9%, in a 50 mL syringe Luer-lock, through a spiral or long line delivered by syringe driver pump (each mL equates to 1 unit of insulin)

Insulin and sodium/glucose/potassium infusions must be administered via the same cannula using anti-siphon and anti-reflux valves (e.g. Vygon Protect-A-Line 2 extension set) to prevent inadvertent and dangerous administration of either insulin or sodium/glucose/potassium alone, and to prevent an overdose of insulin. This could occur as a result of a cannula restriction/occlusion, causing insulin to be pumped into the sodium/glucose/potassium giving set and then be administered as a bolus (if the restriction/occlusion resolves). See* Admin of insulin infusions and fluid infusions guideline *for appropriate set up of extension set

Never give single doses of insulin (e.g. Actrapid) as this can lead to large swings in glucose concentration

IV fluid giving sets

- Safest method of delivering insulin and IV fluids simultaneously to patients with diabetes is via a giving set incorporating anti-reflux valves through single cannula
- These valves allow flow in one direction only. **Do not use ordinary** 3-way taps
- Use IVAC pump to control IV fluid infusion rate and alert to when fluid bag requires replacing

Table 1: Variable rate insulin infusion (VRII)

Bedside capillary blood glucose (mmol/L)	Initial rate of insulin infusion (units/hr)
<4	0.5 (0.0 if long-acting background insulin had been continued)
4.1–7.0	1
7.1–9.0	2
9.1–11.0	3
11.1–14.0	4
14.1–17.0	5
17.1–20.0	6

- If bedside capillary blood glucose >20 mmol/L, seek advice from diabetes/medical team
- If patient taking long-acting insulin e.g. glargine (Lantus), detemir (Levemir) or deguldec (Tresiba), continue this and advise nurse to administer alongside IV insulin

Variable rate insulin infusion (VRII)

- Commence insulin infusion at a rate according to result of capillary blood glucose sample
- Measure capillary blood glucose **every hour** and adjust insulin infusion rate accordingly
- Insulin must be infused at a variable rate to maintain blood glucose 6–10 mmol/L (acceptable range 4–12 mmol/L)
- If blood glucose remains >12 mmol/L for 3 consecutive readings and is not dropping by ≥3 mmol/L/hr, increase rate of insulin infusion by 1 unit/hr until target achieved. When blood glucose falls below 12 mmol/L, follow VRII as in **Table 1**
- If blood glucose is <4 mmol/L, reduce insulin infusion rate to 0.5 units/hr, and treat low blood glucose as per **Acute hypoglycaemia** guideline irrespective of whether patient has symptoms. If patient has continued on their long-acting background insulin, switch off VRII, but continue regular capillary blood glucose measurements
- In patients with heart failure, exercise caution with fluid administration
- If patient on insulin pump subcutaneous (CSII), discontinue pump if on insulin infusion and contact diabetes team or consultant in charge of patient

CONTROL OF HYPERGLYCAEMIA IN THE ILL PATIENT ● 3/4

Fluid regimen for patient on VRII

Always use commercially produced pre-mixed bags of infusion fluid and potassium chloride. NEVER add potassium chloride to infusion bags

- Always consider clinical haemodynamic state and U&E before deciding on type and rate at which IV fluids are prescribed and given
- Set fluid replacement rate to deliver patient's hourly fluid requirement. This can vary between 83–125 mL/hr – see **Maintenance fluid therapy** guideline
- Ideal fluid of choice to be co-administered with VRII is pre-mixed bag (500 mL) of sodium chloride 0.45% with glucose 5% and potassium chloride (20 mmol of potassium in 500 mL or 10 mmol of potassium in 500 mL) given via an infusion pump
- If serum K^+ 3.6–5.5 mmol/L, use pre-mixed bag (500 mL) of sodium chloride 0.45% with glucose 5% and potassium chloride (10 mmol of potassium in 500 mL)
- If serum K^+ 3.0–3.5 mmol/L, use premixed bag (500 mL) of sodium chloride 0.45% with glucose 5% and potassium chloride (20 mmol of potassium in 500 mL)
- If serum K^+ >5.5 mmol/L, do not use potassium in the first bag of fluid
- If serum potassium <3.0 mmol/L, seek more senior help
- **If above fluid is not available the following can be used:**
- if blood glucose ≥14.0 mmol/L, use pre-mixed bag (500 mL) of sodium chloride 0.9% with potassium chloride (20 mmol of potassium in 500 mL or 10 mmol of potassium in 500 mL)
- if blood glucose <14.0 mmol/L, use pre-mixed bag (500 mL) of glucose 5% with potassium chloride (20 mmol of potassium in 500 mL or 10 mmol of potassium in 500 mL)
- If patient requires additional resuscitation fluid it should be given via other arm (see **Fluid resuscitation** guideline) preferably use compound sodium lactate (Hartman's) solution
- Check serum potassium after first bag of fluid has run through, which will be 4–6 hr after start of infusion depending on rate at which it was started
- If serum potassium remains 3.6–5.5 mmol/L, check U&E daily
- If serum potassium is <3.5 mmol/L or >5.5 mmol/L, adjust fluid as above accordingly and check potassium after second bag of fluid and continue to do so after each bag until serum potassium is 3.6–5.5 mmol/L, then check U&E daily

Conversion from IV insulin to oral agent and SC insulin

- Aim to convert to SC insulin regimen once patient biochemically stabilised and **able to eat and drink**
- Once patient ready to eat and drink, recommence oral hypoglycaemic agents
- If food intake likely to be reduced, be prepared to withhold or reduce sulphonylureas
- Recommence metformin **only if** eGFR is >50 mL/min/1.73 m^2
- Transition from IV to SC insulin should take place when the next meal-related SC insulin dose is due e.g. with breakfast or lunch
- If already on insulin, continue fixed-rate infusion for 30–60 min after SC insulin administration in conjunction with a meal
- If there is a delay in obtaining diabetes team support, the following is a suggested starting point for insulin therapy. In insulin naïve patients, daily insulin requirement ≈0.5–0.75 units/kg (see **Diabetic ketoacidosis and hyperosmolar hyperglycaemic state** guideline)
- In patient new to insulin, insulin requirements will fall initially as resistance falls, ensure close supervision during this period
- Caution in patients with low or high BMI as dosing requirement and insulin sensitivity may vary

Adjusting SC insulin regimen

- Once patient using SC insulin regimen, adjust doses to achieve target range of 6–11 mmol/L
- if using soluble insulin before breakfast, lunch and dinner, plus isophane at 2200 hr, use **Table 2** as guide to insulin adjustment, raising or lowering appropriate insulin by 2–4 units
- if patient usually using insulin analogue (e.g. lispro/aspart +/- glargine/detemir), additional isophane may be needed – discuss with diabetes team (Royal Stoke 07623 957536/07623 957535 or County Hospital: 01785 230223/bleep via switch)

Table 2

Time of capillary blood glucose	Glucose >11 mmol/L	Glucose <6 mmol/L
Pre-breakfast (0800 hr)	↑ bedtime isophane or glargine/detemir	↓ bedtime isophane or glargine/detemir
Pre-lunch (1200 hr)	↑ morning soluble	↓ morning soluble
Pre-dinner (1700 hr)	↑ lunchtime soluble	↓ lunchtime soluble
Pre-bed (2200 hr)	↑ evening soluble	↓ evening soluble

RECOVERY

- As patient recovers and/or corticosteroid dosage reduced, monitor glycaemic control and reduce insulin dosage appropriately
- if reintroduction of pre-admission anti-diabetic regimen proves difficult, refer to diabetes nurse specialist

DISCHARGE AND FOLLOW-UP

- If in any doubt about diabetic control on discharge, discuss with diabetes nurse specialist
- Royal Stoke: 07623 957536 or 07623 957535
- County Hospital: 01785 230223 or bleep via switch

DIABETIC KETOACIDOSIS AND HYPEROSMOLAR HYPERGLYCAEMIC STATE ● 1/5

Check you are using the correct guideline – see* Triage of patients with hyperglycaemia *guideline. The guideline below must be used in patients who have EITHER metabolic acidosis or severe dehydration

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Thirst
- Polyuria
- Flushed appearance
- Hyperventilation (Kussmaul breathing)
- Odour of ketones on breath – not always present or detectable
- Dehydration and/or vomiting
- Drowsiness
- Coma

Investigations

Initial

- Blood glucose (capillary)
- Test for ketones in urine
- U&E,
- Amylase
- Blood glucose (venous)
- Venous blood gases (if SpO_2 <94%, arterial blood gas)
- If metabolic acidosis present (pH <7.3), check capillary (blood) ketones (if available on ward. If not, assume acidosis with high glucose and ketonuria is DKA unless proved otherwise) [even in type 2 diabetes, severe hyperglycaemia can temporarily suppress insulin secretion leading to keto (metabolic) acidosis]. However, in any metabolic acidosis, causes other than diabetic ketoacidosis should be sought
- MSU
- If symptoms suggest sepsis, blood culture – see **Collection of blood culture specimens** guideline
- ECG
- Chest X-ray
- Calculate or measure serum osmolality (2 x Na + urea + glucose)

Search for precipitating causes of diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state, such as sepsis (signs of shock) or recent myocardial infarction

IMMEDIATE TREATMENT

General

- If patient febrile and septic and no obvious cause can be found – see **Sepsis, severe sepsis and septic shock** guideline
- If patient hypotensive or comatose, or fails to pass urine within 3 hr of starting IV fluids, introduce urethral catheter to monitor urine volume – see **Urethral catheterisation** guideline
- If hypotension persists beyond 6 hr, look again for evidence of sepsis, myocardial infarction or pancreatitis – discuss further management with medical SpR and consider transfer to critical care
- If GCS <8, request review by critical care team for endotracheal intubation and insertion of a nasogastric tube in order to aspirate stomach
- If not on critical care, admit patient to endocrinology ward
- If hyperglycaemia (blood glucose usually >12 mmol/L) accompanied by metabolic acidosis (pH <7.3, HCO_3 <15 mmol/L) and capillary ketones >3 mmol/L or urine ketones ≥3 and dehydration, manage as **Diabetic ketoacidosis**
- If hyperglycaemia severe (blood glucose usually >30 mmol/L), accompanied by severe dehydration (serum osmolality usually >320 mosmol/kg) without metabolic acidosis (pH >7.3, HCO_3 >15 mmol/L capillary ketones <3 mmol/L, urine ketones <2+ or less), manage as **Hyperosmolar hyperglycaemic state**
- Otherwise – see **Control of hyperglycaemia in the ill patient** guideline

Monitoring treatment

- Capillary glucose hourly for 6 hr, then 2-hrly if patient stable
- Capillary ketones hourly (if indicated) until normalises
- Lab glucose. U&E, VBG 2 hr and 4 hr, then judge by clinical need 2–4 hrly glucose and U&E
- Monitor patient for complications of over-rapid treatment:
- hypoglycaemia
- cerebral oedema (decreased conscious level +/- focal neurological deficit) in absence of hypoglycaemia
- Adult Respiratory Distress Syndrome (ARDS); hypoxia resistant to high FiO_2 – seek critical care opinion

DIABETIC KETOACIDOSIS

Definition

- Severe uncontrolled diabetes with:
- capillary ketones (≥3 mmol/L)
- metabolic acidosis (pH <7.3, HCO_3 <15)
- usually with hyperglycaemia (blood glucose >12 mmol/L)
- Beware of normoglycaemic DKA

High-risk patients

- **Severe DKA:**
- capillary ketones >6 mmol/L
- venous HCO_3 <5 mmol/L
- venous pH <7.1
- hypokalaemia <3.5 mmol/L on admission
- GCS <12
- SpO_2 <92% on air
- systolic BP <90 mmHg
- pulse rate >100 or <60/bpm
- Anion gap >16 [anion gap = $(Na^+ + K^+) – (Cl^- + HCO_3^-)$]
- Young patients (18–25 yr)/elderly
- Pregnant patient – manage in critical care area and involve obstetric team
- Heart/renal failure
- Other/serious co-morbidities

Insulin delivery and infusion

- Use BD micro-fine insulin hypodermic syringes to accurately dose and draw insulin. **Do not** use ordinary syringe
- 50 units soluble insulin (Actrapid or Humulin S) diluted to 50 mL with sodium chloride 0.9% in 50 mL, syringe, Luer-lok through a spiral or long line delivered by syringe driver pump (so each mL equates to 1 unit of insulin)
- See **Insulin delivery** and infusion section in **Control of hyperglycaemia in the ill patient** guideline

Intravenous fluid giving sets

- Safest way to deliver insulin and IV fluid simultaneously to patients with diabetes is via a set incorporating anti-reflux valves through single cannula. These valves allow flow in one direction only – see **Administration of IV insulin infusions and fluid infusions** guideline
- **Do not use** ordinary 3-way taps
- **Use** IVAC pump to control IV fluid infusion rate and to alert when fluid bag needs replacing

INITIAL MANAGEMENT

Step 1: Start fluid replacement before commencing insulin and then run concurrently

Fluid replacement	Insulin	Potassium (K^+)
• Commence sodium chloride 0.9% IV ◦ 1 L over 1 hr, then ◦ 1 L over 2 hrs, then ◦ 1 L over 2 hrs, then ◦ 1 L every 4 hrs and continue as indicated by volume status (slower infusion rate should be considered in young adults as increased risk of cerebral oedema) • If initial systolic BP <90 mmHg, give 500 mL sodium chloride 0.9% over 15 min ◦ if BP remains low, give repeat fluid challenge and seek senior/critical care support **early**	• Commence insulin infusion using standard concentration of 50 units soluble insulin diluted to 50 mL with sodium chloride 0.9% • Infuse at rate of 0.1 units/kg/hr (e.g. 60 kg – 6 units/hr). **Maximum 15 units/hr** • Use patient's **actual** weight (if not available, estimate weight)	• Take venous gas for K^+ (and pH) at 60 min • Consider the following potassium supplementation: using pre-mixed bags of sodium chloride 0.9% and potassium chloride – **always use commercially produced pre-mixed bags of infusion fluid and potassium chloride. NEVER add potassium chloride to infusion bags** ◦ serum K^+ ≥5.5 mmol/L = none ◦ serum K^+ 3.5–5.4 mmol/L = 40 mmol/L ◦ **serum K^+ <3.5 mmol/L** = see **Management** in **Hyperosmolar hyperglycaemic state** below • Monitor U&E • Do not prescribe any K supplement in fluid running ≤1 hr • If potassium infusion is >20 mmol/hr cardiac monitoring is needed • Do not give potassium if patient is anuric

- If patient taking long-acting insulin analogue e.g. lantus (glargine), levemir (detemir) or tresiba (degludec) continue this alongside infusion and ask nurse to administer
- Give SC prophylactic low molecular weight heparin (LMWH), adjusted according to renal function

Step 2

Fluid replacement	Insulin
• If blood glucose falls below 14 mmol/L, commence glucose 10% at 125 mL/hr alongside sodium chloride 0.9% **Caution in elderly, CCF, renal failure**	• If capillary ketones not falling by 0.5 mmol/L/hr, increase infusion rate by 1 unit/hr until this is achieved* (always check insulin infusion pump is working) • Continue infusion until capillary ketones <0.6, venous pH >7.3 and/or HCO_3^- >18 and follow **Step 3**

*If ketone measurement not possible, HCO_3^- to increase by 3 mmol/hr, blood glucose to reduce by 3 mmol/L/hr

6–12 hr following admission

- Maintain a strict fluid intake/output chart
- **Remember**: always assess patient clinically for fluid status and response to treatment
- Assess for resolution (pH >7.3, capillary ketones <0.3 mmol/L). **Do not rely on HCO_3^-** at this stage due to hyperchloraemia from large volume sodium chloride 0.9% infusion
- Treat any complications e.g. fluid overload
- Identify and treat any precipitating cause

FURTHER MANAGEMENT

Step 3: Conversion from IV insulin to SC insulin regimen

- Once patient biochemically stabilised (pH >7.3, capillary ketones <0.6 mmol/L) and able to eat and drink, aim to convert to SC insulin regimen. Continue fixed rate infusion for 30–60 min after SC insulin administration in conjunction with a meal and then stop IV fluids
- If there is a delay in obtaining diabetes team support, the following is a suggested starting point for insulin therapy
  - if patient previously using SC insulin, restart usual insulin, increasing previous dose by 10–20% for first 2–3 days
  - in insulin naïve patients, daily insulin requirement is calculated as 0.5–0.75 units/kg (e.g. in a 60 kg patient, total starting dose of insulin will be 30 units over 24 hr)

- give 50% of the total dose as long-acting analogue (glargine, detemir or degludec) SC before evening meal or before bedtime and divide the remaining 50% into 3 equal doses of quick-acting insulin (Novorapid, Humalog or Apidra) SC to be given before breakfast, lunch and evening meal. If twice daily pre-mixed insulin regime to be used – $^{2}/_{3}$ of total dose can be given before breakfast and $^{1}/_{3}$ before evening meal
- If **not** eating and drinking but ketones normal and acidosis resolved, convert to variable rate insulin infusion as in **Control of hyperglycaemia in the ill patient** guideline (**Unstable patients**)
- Assess fluid requirement clinically and involve diabetes team
- If patient new to insulin, insulin requirement will fall initially as resistance falls, close supervision is needed during this period. **Caution** in insulin dosing in individuals with low or high BMI as requirement and insulin sensitivity may vary

HYPEROSMOLAR HYPERGLYCAEMIC STATE

Administer insulin and glucose infusions via same cannula using anti-siphon and anti-reflux valves (e.g. Vygon Protect-A-Line 2 extension set) through a large peripheral vein or central line – see* Administration of IV insulin infusions and fluid infusions *guideline

DEFINITION

- Severe hypovolaemia
- Marked hyperglycaemia (>30 mmol/L) without significant hyperketonaemia (capillary ketones <3 mmol/L), ketonuria (≤2+) or acidosis (pH >7.3, HCO_3 >15 mmol/L)
- Serum osmolality usually >320 mosmol/kg or more (calculated as 2 x Na + urea + glucose)

MANAGEMENT

Insulin

- 50 units soluble insulin diluted to 50 mL with sodium chloride 0.9% via IV syringe pump at 3 units/hr
- If decline in capillary glucose <5 mmol/hr, increase insulin infusion by 1 unit/hr until this rate of decline is achieved

IV fluid and potassium

Always use commercially produced pre-mixed bags of infusion fluid and potassium chloride. NEVER add potassium chloride to infusion bags

- Measure serum K^+ and phosphate together with venous glucose on admission and serum K+ whenever a bag of fluid is replaced. Use last serum K^+ to determine which bag should be used in the following regimen (**Table 3**)

Table 3

Time (hr)	K^+ >5.5	K^+ 3.5–5.5	K^+ <3.5
First 8 hr	Sodium chloride 0.9% 1 L	Sodium chloride 0.9% 1 L with potassium chloride 40 mmol	Sodium chloride 0.9% 2 × 500 mL, each with potassium chloride 40 mmol/500 mL. First over 4 hr, next over following 4 hr
Next 8 hr	Sodium chloride 0.9% 1 L	Sodium chloride 0.9% 1 L with potassium chloride 40 mmol	Sodium chloride 0.9% 2 × 500 mL, each with potassium chloride 40 mmol/500 mL. First over 4 hr, next over following 4 hr
Next 8 hr	Sodium chloride 0.9% 1 L	Sodium chloride 0.9% 1 L with potassium chloride 40 mmol	Sodium chloride 0.9% 2 × 500 mL, each with potassium chloride 40 mmol/500 mL. First over 4 hr, next over following 4 hr

While potassium is being infused, attach cardiac monitor to patient

- Repeat **Table 3** until glucose fallen to 14 mmol/L, then move to **Subsequent management**
- If plasma osmolality is not declining despite achieving adequate positive fluid balance, use only sodium chloride 0.45% very carefully **after seeking senior help**

SUBSEQUENT MANAGEMENT

- Once blood glucose has fallen below 14 mmol/L, use glucose 5% in fluid and K^+ regimen (**Table 4**) to avoid cerebral oedema caused by inappropriate rapid fall in blood glucose

Table 4

Time (hr)	K^+ >5.5	K^+ 3.5–5.5	K^+ <3.5
First and subsequent 8 hr	Glucose 5% 1 L	Glucose 5% 2 × 500 mL, each with potassium chloride 20 mmol/500 mL. Each over 4 hr	Glucose 5% 2 × 500 mL, each with potassium chloride 40 mmol/500 mL. First over 4 hr, next over following 4 hr

Blood glucose may rise as a result. Do not revert to sodium chloride 0.9%

- If blood glucose between 10–14 mmol/L, maintain same insulin infusion rate
- If blood glucose <10 mmol/L, reduce insulin infusion rate by 1 unit/hr until >10 mmol/L
- If glucose falls below 6 mmol/L, change fluid regimen to glucose 10% (**Table 5**)
- check capillary glucose in 1 hr

Table 5

Time (hr)	K^+ >5.5	K^+ ≤5.5
First and subsequent 8 hr	Glucose 10% 1 L	Glucose 10% 2 × 500 mL, each with potassium chloride 20 mmol/500 mL. First over 4 hr, next over following 4 hr

- Ensure continuing improvement of clinical and biochemical parameters
- Continue treatment of any underlying precipitant
- Do not expect biochemistry to have normalised by 24 hr
- Continue IV fluids until eating and drinking normally
- When biochemically stable (see **Diabetic ketoacidosis** section, **Subsequent management** above), convert to appropriate SC insulin regimen
- Encourage early mobilisation
- Continue prophylactic LMWH until day of discharge (unless contraindicated)

DISCHARGE AND FOLLOW-UP

- Check diabetes team (07623 957536 or 07623 957535) have made appropriate follow-up arrangements or refer to diabetes team for out-patient review
- If patient new to insulin, do not forget to prescribe needles for insulin pens, lancets and sharps guard

ACUTE HYPOGLYCAEMIA ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Skin cold, clammy
- Tachycardia
- Restlessness
- Confusion
- Coma
- Focal neurological deficit (e.g. hemiparesis)

Consider hypoglycaemia in any patient with acute agitation, abnormal behaviour or impaired consciousness. These signs do not usually occur unless blood glucose falls below 2.5 mmol/L; but can occur at higher concentrations in patients with insulin-dependent diabetes whose day-to-day blood glucose is above normal

Investigations

- Finger-prick blood glucose strip (if not available, treat after taking venous sample)
- Venous sample for blood glucose (if venous access not possible, give glucose immediately)
- If hypoglycaemia recurrent, consider:
- LFT
- U&E
- short tetracosactide (Synacthen®) test
- TSH/FT4
- anti-tissue transglutaminase

IMMEDIATE TREATMENT

If conscious, oriented and able to swallow

- Glucose tablets 4–5 tablets or 59 mL (a bottle) of glucose juice – repeat capillary glucose after 15 min if still <4 mmol/L then repeat this step
- If blood glucose remains <4 mmol/L after 45 min or 3 cycles consider IV access and start glucose 10% infusion at the rate of 100 mL/hr

If semi-conscious (gag reflex present and swallowing deemed to be safe)

- Glucose oral gel (e.g. GlucoGel®) 1 or 2 tubes (each 25 g contains 10 g glucose) oral – repeat as necessary after 10–15 min
- If blood glucose remains <4 mmol/L after 45 min or 3 cycles consider IV access and start glucose 10% infusion at the rate of 100 mL/hr

If unconscious (gag reflex absent or swallowing deemed to be unsafe)

- Glucose 20% 75 mL or glucose 10% 150 mL IV into large vein through Venflon (largest gauge you can insert) over 15 min and flush with sodium chloride 0.9% 10 mL – if still unconscious after 15 min, repeat
- Once conscious, give oral glucose or further carbohydrate intake
- If hypoglycaemia induced by excess oral agents or overdose of insulin, consider maintenance IV infusion of glucose 10% 100 mL/hr
- Admit all patients with severe hypoglycaemia for observation and monitoring, especially if caused by oral agents
- Glucagon 1 mg IM can be used in exceptional circumstances where securing IV access is difficult or delayed. Glucagon will be less effective in patients who are chronically malnourished (e.g. alcohol dependency or in patients with prolonged starvation)

Do not use glucagon, especially in sulphonylurea-induced hypoglycaemia as any response will be short-lived and followed by further hypoglycaemia

Adults requiring enteral feeding: treatment to be administered via feed tube, do not administer these treatments via IV line or TPN line

1. Give 15–20 g quick acting carbohydrate e.g. 50–70 mL of Ensure® Plus Juice or Fortijuice® (not Fortisip®)
2. All treatment should be followed by water flush of the feeding tube to prevent blockage
3. If repeated blood glucose after 15 min remains <4 mmol/L then repeat this step
4. If blood glucose remains <4 mmol/L after 45 min or 3 cycles then consider glucose 10% IV infusion at rate of 100 mL/hr
5. Restart feed when blood glucose >4 mmol/L and patient has recovered

ACUTE HYPOGLYCAEMIA ● 2/2

SUBSEQUENT MANAGEMENT

- If patient has diabetes, review maintenance treatment
- Seek cause of hypoglycaemia (e.g. poor control, too much insulin, alcohol excess)
- If hypoglycaemia prolonged, continue IV glucose infusion (hypoglycaemia can persist for several days in patients taking chlorpropamide/glibenclamide)
- Do not start IV insulin unless recommended by diabetes team
- If admission necessary due to severity of hypoglycaemia, discuss with diabetes nurse specialist (07623 957536 or 07623 957535)

MONITORING TREATMENT

- Blood glucose (finger-prick) 4 times daily before meals

DISCHARGE AND FOLLOW-UP

- Ensure diabetes control stable
- Follow-up severe cases in diabetic clinic within 4 weeks; in case of difficulty, contact diabetes nurse specialist
- Royal Stoke: 07623 957536 or 07623 957535
- County Hospital: 01785 230223 or bleep via switch

ACUTE ADRENAL INSUFFICIENCY • 1/2

RECOGNITION AND ASSESSMENT

Most common cause is secondary adrenal failure, where mineralocorticoid production is generally preserved

Symptoms and signs

- Lethargy
- Nausea
- Weight loss
- Hypoglycaemia

Indicators of severe adrenal insufficiency

- Hyponatraemia
- Hypoglycaemia
- Hypotension – systolic BP <90 mmHg, diastolic BP <50 mmHg
- Tachycardia – with no other reason to explain it

Primary adrenal failure

- Hypotension (postural/sustained)
- Pigmentation (palmar/buccal/scars/pressure areas)
- Vitiligo

Secondary adrenal failure

- Pallor
- Loss of pubic/axillary hair (because of co-existing secondary hypogonadism)

Risk factors

Primary adrenal failure

- Auto-immune disease (diabetes/hypothyroidism/pernicious anaemia)
- TB
- Metastases, especially from carcinoma of lung

Secondary adrenal failure

- Withdrawal of oral (or potent topical or inhaled) corticosteroids
- Pituitary surgery/radiotherapy

INVESTIGATIONS

- FBC
- U&E
- Blood glucose
- Unless severely ill (see above), perform short tetracosactide (Synacthen®) test (SST) (serum cortisol before, then 30 min after tetracosactide 250 microgram IV/IM)
  - adrenal failure excluded by basal or peak (30 min) serum cortisol >550 nmol/L during SST
- If Synacthen® test not available, 0900 hr serum cortisol preferred but random cortisol can be taken to prevent delay in treatment
  - adrenal failure confirmed by 0900 hr serum cortisol <150 nmol/L
  - random cortisol criteria of adrenal insufficiency during sepsis (or during any stress-like injury, myocardial infarction) with basal cortisol (any time of day) <500 nmol/L
- If adrenal failure suspected, send yellow top and EDTA blood bottles for markers of pituitary function:
  - FSH/LH
  - testosterone (males)
  - TSH/FT4
  - growth hormone (GH)
  - insulin-like growth factor 1 (IGF-1)
  - prolactin
  - if adrenal insufficiency strongly suspected, adrenocorticotropic hormone (ACTH)

In primary adrenal failure only

- Hyperkalaemia
- Raised urea

ACUTE ADRENAL INSUFFICIENCY ● 2/2

IMMEDIATE TREATMENT

Obtain blood sample for serum cortisol (gold top) and plasma ACTH (purple top bottle on ice) before hydrocortisone is given but treatment must not await result. If urgent cortisol required, inform biochemistry laboratory (bleep 143)

- If severely ill:
- hydrocortisone 100 mg as slow IV bolus, followed by 100 mg by slow IV bolus 6-hrly
- sodium chloride 0.9% 1 L by IV infusion over 30–60 min, followed by 3–4 L IV over next 24 hr
- If hypoglycaemic, give simultaneous infusion of:
- glucose 20% 100 mL by IV infusion over 30 min, followed by glucose 10% 1 L by IV infusion over 12 hr. Monitor blood glucose and change to glucose 20% if 10% inadequate
- glucagon is **unhelpful** in this situation

SUBSEQUENT MANAGEMENT

- Admit to endocrinology ward
- When improving and tolerating oral fluid:
- hydrocortisone 20 mg oral 8-hrly
- refer to endocrinology team for advice on maintenance dosage (usually 20 mg in morning and 10 mg in afternoon – no later than 1800 hr)
- if diagnosis in doubt, seek advice from endocrinology team about substituting dexamethasone 1 mg oral 8-hrly for hydrocortisone and perform SST within three days. If on oral hydrocortisone (maintenance dose 20 mg in morning and 10 mg in afternoon), afternoon dose can be omitted and SST carried out between 0800–0900 next day
- after the test and while awaiting result, revert to maintenance dose
- In primary adrenal failure:
- add fludrocortisone 50–100 microgram oral daily
- request adrenal autoantibodies
- arrange chest and abdominal X-rays
- if TB suspected, request CT scan of adrenals
- If secondary adrenal failure suspected, refer to endocrinology team

MONITORING

- U&E daily
- Lying and standing BP twice daily, looking for orthostatic hypotension

DISCHARGE AND FOLLOW-UP

- Patients must carry ‘Steroid card’ and wear ‘Medic Alert bracelet’
- Patients must understand need for:
- lifelong hydrocortisone
- doubling the daily dose for the duration of any intercurrent illness
- parenteral hydrocortisone if vomiting (supply with ampoule of hydrocortisone 100 mg to keep in fridge for use by paramedics in emergency)
- Refer to endocrinology for follow-up

ELECTROLYTE DISTURBANCES ● 1/4

HYPONATRAEMIA (serum Na^+ <135 mmol/L)

Further information available from clinical biochemistry or from renal or endocrine teams

Symptoms and signs

Nausea, cramps, confusion, seizures, varied CNS manifestations. Unless serum sodium (Na^+) falling rapidly, concentrations in range 125–135 mmol/L are usually asymptomatic

Investigations

Ensure not artefact, FBC and U&E (eosinophilia, hyperkalaemia, or hypercalcaemia suggest hypoadrenalism), glucose, osmolality (urine plus serum), urine Na^+, TFT

Clinical assessment

Assess state of hydration: BP, pulse, skin turgor, monitor urine output

- Dehydration
- No dehydration or oedema
  - Commonly
  - Rarely
- Oedema

Mechanism

- Dehydration: Relative depletion of salt to water
- Commonly: 1. Blood sample taken from drip arm; 2. Excess of water to salt
- Rarely: High concentration of lipid or protein in blood may give false Na^+ result
- Oedema: Retention of water greater than salt

Expected results

- Dehydration: Urine osm >280 and Serum urea >7 mmol/L
- Commonly: Urine Na^+ >20 and Serum urea <7 mmol/L
- Rarely: Serum osm >275 mmol/L

Cause

- Urine Na^+ >20: Consider: Addison's, diuretics, renal tubular disease, osmotic diuresis
- Urine Na^+ <20: Fluid loss (e.g. GI loss, sweat, poor intake)
- Urine osm <Serum osm: Acute onset: excess intake IV post-op, polydipsia
- Urine osm >Serum osm: Chronic onset: Hypoadrenalism or if excluded SIADH? cause (e.g. lung, CNS disorders, tumours), drugs – commonly diuretics, antidepressants, carbamazepine
- Serum osm >275 mmol/L: 'Pseudo-hyponatraemia' Laboratory will usually comment that sample is lipaemic or viscous and difficult to analyse
- Oedema: Cardiac, hepatic failure, nephrotic syndrome, renal failure

Treatment

PLEASE NOTE:

RAPID CHANGES IN SODIUM ARE MORE DANGEROUS THAN LOW Na^+ ITSELF, even when the change is corrective

Treat the underlying cause

- Dehydration: Restore normovolaemia and continue fluid replacement with sodium chloride 0.9% 1–2 L in 12 hr – see **Maintenance fluid therapy** guideline for more detailed guidance on fluid volume requirement. Check U&E 12-hrly initially **If sodium rises by >5 mmol/L in 12 hr, reduce rate of infusion by 30%**
- Acute onset: Acute (<48 hr) hyponatraemia is usually the result of inappropriate IV fluid administration and usually self-corrects when infusion is discontinued or prescribed appropriately – see **Maintenance fluid therapy** guideline
- Chronic onset: 1. Stop diuretics; review other drugs 2. Restrict fluid intake 1.5 L/day initially and further to 1 L/day depending on response 3. If poor response, give Slow Sodium® 1 tab (10 mmol) 8-hrly plus furosemide 20 mg daily (double dosage if response still poor) 4. If symptomatic, consider demeclocycline 300 mg oral 8-hrly ***Serum Na^+ should not rise by >10 mmol/L/day***
- Rarely: No treatment for hyponatraemia Check serum triglycerides and protein electrophoresis
- Oedema: Restrict Na^+ intake <100 mmol/day and fluid <1.5 L/day. For renal and cardiac failure: furosemide 80 mg oral or 40 mg IV. For hepatic failure, stop all diuretics. See respective guidelines. If hypokalaemic or HCO_3^- >32 mmol/L correct K^+ deficit – see **Hypokalaemia**

Hypertonic saline is almost never justified, carries a significant risk, should be given only with consultant approval and requires monitoring in a high dependency area

It is important to note that if a patient has a high urine output and/or very low Na <115 mmol/L, 4-hrly monitoring of electrolytes is initially required to avoid sudden rises in serum Na

Failure to correct, or recurrence of hyponatraemia merits referral to the team appropriate to the underlying cause (e.g. renal, endocrine, psychiatric). Review drug treatment before discharge

HYPERNATRAEMIA (serum Na^+ >150 mmol/L)

Symptoms and signs

Various CNS symptoms e.g. lethargy to coma and seizures
Dehydration – hypovolaemia

Mechanism

Loss of water in excess of salt or intake of salt in excess of water

Investigations

Serum: U&E, glucose, osmolality **Urine:** U&E, osmolality

Clinical assessment

Assess volaemic status

- Hypovolaemic
  - **Expected results:** Urine osm >300 mmol/L
    - **Cause:** 1. Osmotic diuresis, (e.g. hyperglycaemia) 2. Excess water loss (e.g. sweat) 3. Inability to drink, failure of thirst
  - **Expected results:** Urine osm <300 mmol/L, Serum osm >295 mmol/L
    - **Cause:** Diabetes insipidus: a. pituitary b. nephrogenic
- Normovolaemic
  - **Expected results:** Urine osm >300 mmol/L, Urine Na^+ >5 mmol/L
    - **Cause:** Excess salt administration

Immediate treatment

Encourage oral fluids in conscious patient – the safest route

- Asymptomatic
  - Free oral fluids or increase/add 500 mL enteral water if NGT fed
  - Monitor serum Na^+ daily
- **Hypovolaemic** + symptomatic
  - Balanced crystalloid e.g. compound sodium lactate (Hartmann's) solution sufficient to achieve haemodynamic stability – see **Fluid resuscitation** guideline **Table 3.**
  - Then correct hypernatraemia with glucose 5% using formula in adjacent box
- Discontinue Na^+ excess
  - Symptomatic and normovolaemic
  - Estimate the water deficit from: 0.4 × **Ideal body weight*** × (serum Na^+ − 140)/140 = L. Aim to replace 50% of this in 24 hr as glucose 5% IV as an addition to normal maintenance fluid requirements
  - Monitor serum Na^+ 12-hrly **Serum Na^+ must not decrease by >10 mmol/L in 24 hr**

Further investigations

If cause not apparent at this stage, consider diabetes insipidus and refer patient to endocrine team

* see **Ideal body weight** guideline

HYPOKALAEMIA (serum K^+ <3.5 mmol/L)

Symptoms and signs

Often none, or neuromuscular symptoms (e.g. muscle weakness, absent reflexes, ileus)
ECG changes – depressed ST, flat T, U waves, arrhythmias (arrhythmias may cause cardiorespiratory symptoms), metabolic alkalosis – increased HCO_3^-

Investigations

Immediate

1 ECG – see **Symptoms and signs**
2 FBC, glucose

Helpful

1 Venous HCO_3^- – when raised indicates chronic depletion; if <22 mmol/L in absence of GI loss, suspect renal tubular acidosis – refer to renal team
2 Urine K^+ if cause not obvious
3 Serum magnesium (Mg^{2+}) for persistent urine K^+ loss especially patients with diarrhoea or on diuretics

Common causes

1 Blood taken from drip arm (artefact)
2 Any excessive gastrointestinal fluid loss
3 Renal loss: urine K^+ >20 mmol/L – diuretics, mineralocorticoid excess (hyperaldosteronism and excess cortisol), Mg^{2+} deficiency see **Hypomagnesaemia** guideline, and renal tubular disease
4 Intracellular shift (redistribution): insulin or bicarbonate treatment, theophylline, $beta_2$ agonists, periodic paralysis, rapid blood cell proliferation
5 Intravenous fluid therapy, with inadequate electrolyte replacement

Treatment

Always use commercially produced pre-mixed bags of infusion fluid. NEVER add potassium chloride to infusion bags

Monitor serum K^+ concentration at least daily if K^+ given IV

Serum K^+ 3.0–3.5 mmol/L

No immediate treatment. If taking digoxin or symptoms present, give potassium chloride effervescent 72 mmol/day – Sando-K 2 tabs (12 mmol/tab) 8-hrly **Only** if unable to swallow, follow **Maintenance fluid** guideline and, if no contraindications, use fluid advised for **3.0 ≤K^+ ≤3.6 mmol/L** in **Table 2**

Serum K^+ <3.0 mmol/L with symptoms but no pre-existing cardiac disease

Monitor plasma K^+ daily for change, identify and correct underlying cause; if cause non-remediable, give potassium chloride effervescent 72 mmol/day – Sando-K 2 tabs(12 mmol/tab) 8-hrly – if poor response, increase dose to max 192 mmol/day **Only** if unable to swallow, follow **Maintenance fluid** guideline and, if no contraindications, use fluid advised for **3.0 ≤K^+ ≤3.6 mmol/L** in **Table 2,** even though K^+ <3 mmol/L

Serum K^+ <3.0 mmol/L with pre-existing cardiac disease, but no new symptoms

Give sodium chloride 0.9% 500 mL with potassium chloride 20 mmol IV (**as pre-mixed bag),** over 2 hr, with continuous ECG monitoring. If potassium not restored to at least 3.0 mmol/L and new tachyarrhythmia or muscle weakness occur, follow advice in box on right;
if potassium not restored to at least 3.0 mmol/L but no new symptoms, follow advice in box on left

Serum K^+ <2.5 mmol/L with persistent losses or poor absorption OR Serum K^+ <3.0 mmol/L plus new tachyarrhythmia or muscle weakness

Use central intravenous route, **in a high dependency area** with continuous ECG monitoring. Give 40 mmol potassium chloride in 100 mL sodium chloride 0.9% (**as pre-mixed bag)** over 2 hr. In intractable cardiac arrhythmia, contact cardiology team **urgently**

If cause not obvious, refer to renal or endocrine team for further evaluation

HYPERKALAEMIA (plasma K^+ >5.5 mmol/L)

Contact renal team urgently for hyperkalaemia in a dialysis patient

Symptoms and signs

Frequently none, or non-specific neuromuscular symptoms
Muscular weakness may occur if blood K^+ >7.0 mmol/L
Cardiac arrest without warning
ECG changes (see **Treatment**)

Common causes

1. Artefact: release from blood cells (e.g. during clotting, blood dyscrasias, haemolysis, delayed centrifugation of sample for >2 hr)
2. Failure of excretion: renal failure, mineralocorticoid deficiency, drugs e.g. low molecular weight heparin, spironolactone, amiloride (potassium sparing diuretics), ACE inhibitors (~prils), angiotensin II blockers (~sartans), aliskiren, NSAIDs, ciclosporin, tacrolimus
3. Release from cell: severe tissue damage, acidosis (consider DKA, lactic acidosis)
4. Excess ingestion or supplementation

Investigations

1. In emergencies, K^+ is measured from an arterial or venous blood sample using a point-of-care blood gas analyser and treatment initiated whilst awaiting the results from a formal laboratory measurement on **plasma sample** (green top; lithium heparin)
2. ABCDE approach and NEWS2 system
3. Comprehensive medical and drug history and clinical examination to determine the cause of hyperkalaemia
4. HCO_3^- in venous blood (or from blood gases, if indicated for other reasons) and lactate
5. **Urgent 12-lead ECG if serum K ≥6.0,** with continuous 3 lead cardiac monitoring if ECG changes, or rapid rise in K levels and in patients with plasma K^+ ≥6.5 mmol/L); ideally in a high-dependency setting

Treatment

Plasma K^+ (mild)
5.5–5.9 mmol/L
Consider cause and if treatment indicated

Plasma K^+ (moderate)
6.0–6.4 mmol/L
Treatment guided by clinical scenario, ECG and rate of rise

Plasma K^+ (severe)
≥6.5 mmol/L
Emergency treatment indicated

Acute ECG changes present: Peaked T waves, broad QRS, bradycardia, absent or flattened P waves, Sine wave, VT

No

Yes

Protect the heart

Calcium gluconate 10% 30 mL over 10 min (if patient on digoxin give over 30 min*). Use central access; **or** large peripheral cannula. Continuous cardiac monitoring

*Watch continuously for extravasation which is very damaging to tissues. If this occurs, stop infusion **immediately** and re-site access elsewhere*

Repeat ECG, if changes present consider further dose after 5–10 min

Shift K^+ into cells

Moderate and severe hyperkalaemia consider:

1 Soluble insulin (Actrapid) **10 units** IV in glucose 50% **50 mL** over 30 min – see **Administration of fluid and insulin infusions** guideline – to be given through a large peripheral cannula: ensure patency of cannula before administering. If access poor, arrange insertion of, and give through, a central line. (Consider giving glucose 10%; at a rate of 50 mL/hr for 5 hr, if pre-treatment glucose was <7 mmol/L in appropriate patients, after insulin-glucose infusion)*

2 Nebulised salbutamol 10–20 mg can be given (**do not use** salbutamol as monotherapy in severe hyperkalaemia; limit dose to 10 mg in patients with IHD)

3 **Alongside** above treatment: Consider sodium zirconium cyclosilicate (Lokelma™) 8-hrly oral for 24–48 hr until normokalaemia achieved. This should be explicitly approved by renal physicians with AKI stage 3†

Remove K^+ from body

Consider calcium resonium 15 g oral 6-hrly ‡

Consider dialysis – seek **urgent** advice from renal or ITU team; if K^+ >6.5 mmol/L despite 2 glucose/insulin treatments and/or rising potassium levels (earlier ITU referral if refractory shock/other organ failure)

Monitor K^+ and blood glucose

- Monitor plasma K^+: at 1, 2, 4, 6 and 24 hr after identification and treatment of hyperkalaemia. If K+ >6.5 mmol/L despite medical therapy – seeking advice from renal or ITU team
- Blood glucose: monitor at regular intervals (0, 15, 30, 60, 90, 120, 180, 240, 300, 360 min) for a minimum of 6 hr after administration of insulin-glucose infusion in all patients

Prevention

- **Consider cause of hyperkalaemia, prevent further rise and recurrence as an inpatient**
- Stop all medications that can increase potassium levels including ace-inhibitors, angiotensin II receptor blockers, potassium sparing diuretics, NSAIDs and assess diet whilst an inpatient
- Discuss long-term management plan (e.g. restarting ACEi/ARBs) with parent team **before** discharge

*In patients with DKA, follow DKA treatment protocol, 50% Glucose is contraindicated
†Maintenance dosing and drug interactions (e.g. anti-HIV therapy) need specialist input – seek help from pharmacy and consultant physician
‡Slow course of action, rescue therapies may be needed in interim

HYPERCALCAEMIA (SERUM CALCIUM >2.6 mmol/L) ● 1/2

Symptoms and signs

Unusual unless calcium (Ca^{2+}) >3.0 mmol/L
GI: nausea, vomiting, constipation, abdominal pain
Renal: polyuria, polydipsia
CVS: hypertension, on ECG: altered QT interval, long PR, wide QRS, arrhythmias
CNS: various including depression, cognitive difficulties, headache, altered consciousness, acute psychosis

Investigations

U&Es, creatinine, adjusted Ca^{2+} [aCa^{2+}], albumin, PTH (EDTA), FBC, ESR, alkaline phosphatase, phosphate, glucose, myeloma screen, chest x-ray and ECG

A **broad estimate** of adjusted calcium is given by:
serum unadjusted Ca^{2+} + 0.02 (40 – albumin g/L) mmol/L
Chase lab for urgent PTH result

Treatment

MILD aCa^{2+} 2.6–2.9 mmol/L

Immediate treatment not usually necessary but ensure adequate fluid intake, and stop thiazides and any vitamin A, D or Ca^{2+} supplements

See **Further management**

MODERATE aCa^{2+} 3.0–3.4 mmol/L

Symptoms absent

Oral rehydration if possible: water 2–3 L/day. If oral route inappropriate give sodium chloride 0.9% 2–3 L by IV infusion/day. Ca^{2+} should decrease by 0.5 mmol/L within 48 hr

Check U&Es, creatinine,aCa^{2+} at 24 hr

Symptoms present

SEVERE aCa^{2+} >3.4 mmol/L

Rehydrate with sodium chloride 0.9% 3–4 L/24 hr depending on severity of symptoms and Ca^{2+}. If fluid overload, give furosemide 20–40 mg 12-hrly. Large doses of furosemide (160 mg) may lower Ca^{2+} more quickly, but are not recommended as electrolytes must be accurately replaced, based on urinary loss. If symptoms life-threatening, consider calcitonin (see **Other treatments**)

Check U&Es, creatinine, aCa^{2+} at 24 hr

Check Ca^{2+} response to initial treatment

aCa^{2+} <3.0 mmol/L

See **Further management**

aCa^{2+} 3.0–3.4 mmol/L no symptoms

Continue rehydration

aCa^{2+} >3.4 mmol/L, or >3.0 mmol/L with symptoms

Disodium pamidronate 60 mg (90 mg if Ca^{2+} >3.5 mmol/L, 30 mg if AKI or CKD) IV in sodium chloride 0.9% 500 mL over 2 hr, and continue sodium chloride 0.9%. Ca^{2+} usually returns to normal within 7 days. If 30 or 60 mg given first, this can be followed with a further 30 mg dose at 24 +/- 48 hr up to maximum of 90 mg per treatment course. (This will only work if increased bone turnover is the cause of hypercalcaemia)

Recheck U&E, aCa^{2+}, phosphate daily.
If no response within 48 hr, see **Further management**

HYPERCALCAEMIA (SERUM CALCIUM >2.6 mmol/L) ● 2/2

Other treatments

Calcitonin: Used only during first 24 hr for severe hypercalcaemia when symptoms are life-threatening. Effective rapidly but response lasts only for a few hours – 4 unit/kg over 6 hr IV 12-hrly lowers Ca^{2+} by 0.5 mmol/L

Corticosteroids: If cause known to be granulomatous disease or calcitriol excess: hydrocortisone 100 mg by slow IV injection 8-hrly (or prednisolone 40 mg oral daily). Calcitriol excess usually responds poorly to disodium pamidronate

Haemodialysis: Consider if renal function poor – contact renal team

Mithramycin, gallium nitrate, phosphate: toxic and should **not** be used

Further management

Find and treat cause: Check PTH and assess if PTH-driven hypercalcaemia or PTH suppressed hypercalcaemia. (Most obviously hyperparathyroidism if PTH above upper limit of reference range but insufficiently suppressed PTH is sometimes seen)

PTH detectable >1.5 pmol/L

Primary hyperparathyroidism
Familial hypocalciuric hypercalcaemia
Consider endocrine opinion for further evaluation with possible referral for parathyroidectomy
CKD patients may have tertiary hyperparathyroidism

PTH absent ≤1.5 pmol/L

Consider: malignancy (lung, breast, haematological rarely); granulomatous disease; AKI or adrenal insufficiency; excess Vitamin D/Ca^{2+} intake; drug therapy (e.g. lithium, oestrogens, progestogens, tamoxifen).
Essential to treat underlying cause as soon as possible

Further treatment to maintain normal calcium if cause not treatable

Ensure hydration maintained because this will work, whatever the cause, even if only by dilution

Contact endocrinology team for advice if hyperparathyroidism, contact renal team for advice if AKI or CKD, contact oncologists if evidence of malignancy, unless haematological, in which case contact haematologists

HYPOMAGNESAEMIA ● 1/2

DEFINITION

Severe deficit

- Serum Mg^{2+} <0.5 mmol/L

Moderate deficit

- Serum Mg^{2+} 0.5–0.7 mmol/L

Mild deficit

- Magnesium is largely intracellular so mild deficiency can occur with a normal serum concentration, but urine excretion will be reduced:
- urine Mg^{2+}/urine creatinine <0.1 = deficiency; <0.05 = severe deficiency, except if secondary to renal loss – see **Investigations**

COMMON CAUSES

Gastrointestinal loss

- Diarrhoea
- Stoma
- Fistula
- Malabsorption states
- Proton pump inhibitors (PPIs)

Renal loss

- Tubular damage
- Genetic syndromes (e.g. Gitelman's syndrome)
- Chronic acidosis
- Phosphate or potassium depletion
- Hypoparathyroidism
- Drug-induced (e.g. loop and thiazide diuretics, aminoglycosides, ciclosporin, cisplatin)

Other

- Alcoholism
- Insulin administration
- Critical illness

SYMPTOMS AND SIGNS

- Non-specific and often attributed to hypocalcaemia or hypokalaemia

Musculoskeletal

- Muscle twitching
- Tremor
- Tetany
- Cramps

CNS

- Apathy
- Depression
- Hallucinations
- Agitation
- Confusion
- Fits

Cardiovascular

- Tachycardia
- Hypertension
- Arrhythmias (e.g. torsade de pointes)
- Digoxin toxicity

INVESTIGATIONS

- Cause usually apparent from clinical picture – investigation necessary only if not obvious
- Check U&E, bone profile and PTH as Mg^{2+} deficiency associated with hypocalcaemia and hypokalaemia
- Calculate fractional excretion of Mg^{2+} in a random urine sample from:

$$\frac{\text{Urine } Mg^{2+} \times \text{serum creatinine} \times 100}{\text{Serum } Mg^{2+} \times \text{urine creatinine} \times 0.7}$$ (units for each of urine and serum must be the same)

- fractional excretion of Mg^{2+} >3% indicates renal loss. See above for causes
- If hypocalcaemia or hyperphosphataemia present, check plasma parathyroid hormone

IMMEDIATE TREATMENT

- For severe deficiency, intractable loss or symptoms of hypocalcaemia or hypokalaemia, use IV route
- Magnesium sulphate 5 g (20 mmol in 10 mL) into 250 mL glucose 5% over 4 hr (may also be given with sodium chloride 0.9%) if given peripherally, monitor insertion site closely for phlebitis using a recognised infusion phlebitis scoring tool. Minimum dilution is 100 mL but more concentrated infusions should ideally be given centrally

In presence of life-threatening features, a bolus of 2–4 g over 20 min is appropriate but risk of dysrhythmias so cardiac monitoring and resuscitation facilities need to be readily available

- For moderate asymptomatic deficiency (serum Mg^{2+} >0.5 mmol/L), consider oral route – see **Moderate deficiency**

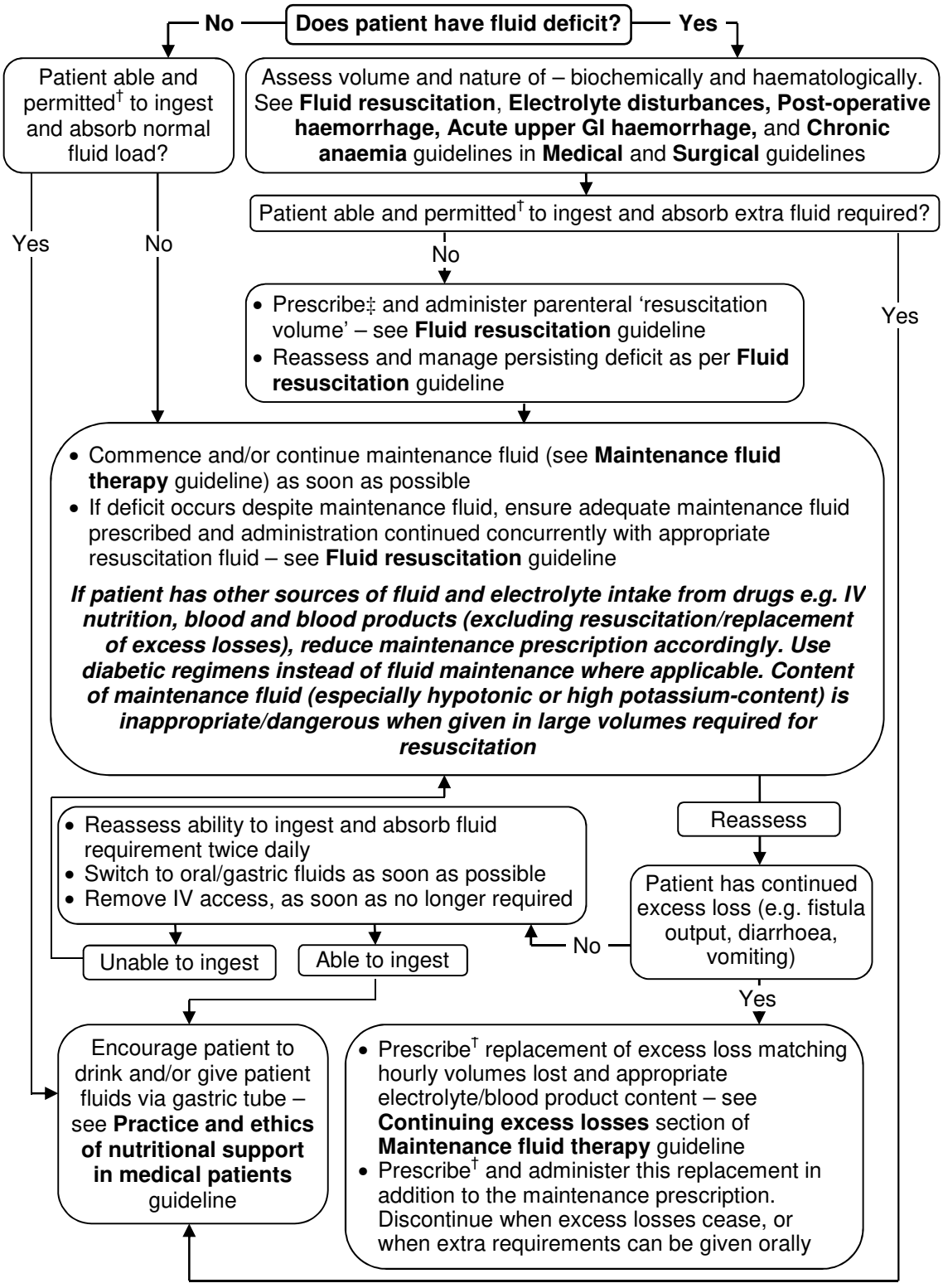
MONITORING

- Leave at least 2 hr after end of infusion before checking serum Mg^{2+}
- if still <0.5 mmol/L, repeat dose
- otherwise, check again after 24 hr
- Toxicity rare if renal function normal
- Clinical signs of overdose:
- loss of tendon reflexes (>5 mmol/L)
- hypotension
- bradycardia
- respiratory depression (>7.5 mmol/L)

MODERATE DEFICIENCY

- Oral magnesium aspartate 243 mg powder for oral solution. Dose: 1–2 sachets (equivalent to 243–486 mg or 10–20 mmol magnesium) dissolved in 50–200 mL water, tea or orange juice, daily
- if tolerance to oral intake limited by diarrhoea, reduce dose to maximum tolerated
- Stop PPIs if possible, substituting H_2 antagonists if necessary

FLUID DEFICIT/MAINTENANCE MANAGEMENT FLOWCHART ● 1/3



†Permitted = not nil-by-mouth in preparation for intervention such as anaesthesia or due to aspiration risk from impaired swallow/gag/conscious level
‡Use inpatient medication prescription chart to prescribe fluids

FLUID DEFICIT/MAINTENANCE MANAGEMENT FLOWCHART ● 2/3

NOTES

Blood products

Haemodynamically stable patient

- If required, blood products replace some or all the calculated maintenance volume requirement

Haemodynamically unstable patient

- Blood products replace some or all the calculated resuscitation volume

Content

- It is important to administer intravenous fluid with an appropriate concentration of electrolytes – see **Electrolyte disturbances** guidelines
- **note:** glucose 5% behaves as a hypotonic solution, as glucose is metabolised to water and carbon dioxide. Excessive use can cause dangerous dilution of electrolytes (e.g. hyponatraemia)
- Use blood products only where they are specifically indicated
- Normal adult sodium and potassium requirements (in the absence of excess losses or abnormalities of homeostasis, e.g. due to endocrine disease) are:
- sodium: **1–2 mmol/kg/day**
- potassium: **0.5–1 mmol/kg/day**

Recommended reading

NICE Guideline 174 – https://www.nice.org.uk/guidance/CG174

FLUID DEFICIT/MAINTENANCE MANAGEMENT FLOWCHART ● 3/3

Table: Comparison between serum electrolyte content and content of most commonly used IV fluids

								Only to be used intra-operatively				
Serum normal values	**Content**	**Compound sodium lactate (Hartmann's) solution**	**Plasmalyte 148**	**Sodium chloride 0.9%**	**Sodium chloride 0.45%/ glucose 5%**	**Sodium chloride 0.18%/ glucose 4%**	**Glucose 5%**	**Succinylated gelatin**	**'Balanced gelatin' e.g. Isoplex**	**4.5% Human albumin**	**20% albumin**	**Voluven**
133–146	Na^+	131	140	154	77	30	0	154	145	154	122	**Banned -excess risk of kidney injury requiring dialysis and mortality in critically ill patients**
95–108	Cl^-	111	98	154	77	30	0	125	105	154	110	
3.8–5.3	K^+	5	5	No potassium chloride 0 0.15% potassium chloride (not available in 0.18%/4% bag) 20 mmol/L 0.3% potassium chloride 40 mmol/L				0	4	0	0	
2.2–2.6	Ca^{++}	2		0	0	0	0	0	0	0	0	
0.7–1.0	Mg^{++}	0	1.5	0	0	0	0	0	0.9	0	0	
	Other significant content	Lactate 29	Acetate 27 Gluconate 23		Glucose 5%	Glucose 4%	Glucose 5%	Succinylated gelatin 4%	Succinylated gelatin 4%	Human albumin 4,5%	Human albumin 20%	
	Metabolised to	H_2CO_3	CO_2 and H_20		H_2O	H_2O	H_2O	99% excreted unchanged in urine and faeces. No evidence of accumulation of the remaining 1%		**NB:** pasteurised product derived from blood. May be unacceptable to Jehovah's Witnesses		
7.35–7.45	pH	5.0–7.0	4–6.5	5.5 (with no potassium chloride)	4–6	3.5–6.5 (with no potassium chloride)	4–4.2	7.4	7.4 +/- 0.5			
Risk		Hypersensitivity reactions Lactate in liver patients		HCMA*		Free water overload	Free water overload	HCMA* Anaphylaxis AKI** Coagulopathy	Anaphylaxis AKI** Coagulopathy	Avoid in head injury		
Benefit			Preferable in liver patients if available as no lactate, but limited availability therefore use only in selected patients		Not for acute resuscitation of hypovolaemia, unless due to dehydration when acceptable to use cautiously – avoid hyponatraemia, overload and rapid infusion of potassium			More rapid and sustained restoration of circulating volume when endothelial glycocalyx is not systemically damaged		Severe sepsis when crystalloid inadequate		

*HCMA = Hyperchloraemic metabolic acidosis
**AKI = Acute kidney injury

MAINTENANCE FLUID THERAPY ● 1/3

HOW TO USE THIS GUIDELINE

In all patients at risk of hypovolaemia, make a clinical assessment of degree and type of fluid deficit. See* Fluid resuscitation *guideline

Specific conditions

If patient has any of the following conditions, follow appropriate condition-specific guideline in **Medical** or **Surgical** guidelines:

- Diabetic ketoacidosis
- Hyperosmolar hyperglycaemic state
- Acute adrenal insufficiency
- Acute upper gastrointestinal haemorrhage
- Hypo/hypernatraemia
- Acute cardiac failure
- Acute liver failure
- Acute kidney injury (acute renal failure)
- Diabetes mellitus and requirement for fluids to cover surgery
- Post-operative haemorrhage
- Hypercalcaemia
- Recent retention of urine

Clinical application of guidance

- Undertake a careful initial assessment of each patient's fluid and electrolyte needs. Take into account:
  - history of limited intake/absorption, thirst, abnormal losses, comorbidities
  - examination of pulse, capillary refill, JVP, peripheral or pulmonary oedema, postural hypotension (see **Fluid resuscitation** guideline – **Table 1**)
  - clinical monitoring NEWS, fluid balance charts, weight
  - investigations: FBC, U&E
- Ensure regular reassessment to monitor clinical response to treatment
- In all patients requiring IV fluid (unless stable on long-term IV fluid therapy), ensure daily senior review of fluid and electrolyte status and management plan
- If patient has complex fluid or electrolyte replacement or abnormal distribution issues, seek senior help and see **Continuing excess losses** section of this guideline
- In particular, in the following conditions seek senior advice as guidance may need to be modified:
  - chronic cardiac failure
  - chronic renal failure
  - chronic liver failure – seek advice of liver specialist
  - hyperkalaemia (K^+ >6.0 mmol/L) – see **Hyperkalaemia** guideline
  - neurosurgical/neurological pathology. Avoid free water (fluids with inadequate sodium) and control blood sugar level. Seek expert help
  - frail elderly/malnourished – see **Refeeding syndrome** in **Artificial nutritional support** guideline in the **Surgical** guidelines
- Prescribe intravenous fluid therapy in the patient prescription chart

Indication for use of parenteral fluid therapy

If possible, use enteral replacement. Re-evaluate need for parenteral fluids at least twice daily

- Patient unable to ingest or absorb fluid and electrolyte requirements via enteral route

MAINTENANCE

If patient requires additional resuscitation fluid after commencing maintenance regimen, see guidance in* Fluid resuscitation *guideline

- If patient has continuing excess losses, replace them, in addition to the maintenance fluid, by following the **Continuing excess losses** section at the end of this guideline
- If patient has other sources of fluid and electrolyte intake from drugs e.g. IV nutrition, blood and blood products (excluding resuscitation/replacement of excess losses), reduce the maintenance prescription accordingly. Use diabetic regimes instead of fluid maintenance where applicable

MAINTENANCE FLUID THERAPY ● 2/3

Total volume of maintenance fluid required (oral and parenteral) in 24 hr is 25–30 mL/kg
Table 1: Volume of fluid over 24 hr and in mL/hr

Approx. male height		Approx. female height		Ideal body weight (kg)*	No fever present (25 mL/kg/24 hr)			Fever present (30 mL/kg/24 hr)		
Feet	cm	Feet	cm		L/24 hr	1 L over approx.	mL/hr	L/24 hr	1 L over approx.	mL/hr
4'8"	142	4'10"	147	40	1	24 hr	42	1.2	20 hr	50
4'10"	147	5'0"	152	45	1.125	21 hr	47	1.35	18 hr	56
5'0"	152	5'2"	157	50	1.25	19 hr	52	1.5	16 hr	63
5'2"	157	5'4"	162	55	1.375	17 hr	57	1.65	15 hr	69
5'4"	162	5'6"	167	60	1.5	16 hr	63	1.8	13 hr	75
5'6"	167	5'9"	175	65	1.625	15 hr	68	1.95	12 hr	81
5'9"	175	5'11"	180	70	1.75	14 hr	73	2.1	11 hr	88
5'11"	180	6'1"	185	75	1.875	13 hr	78	2.25	11 hr	94
6'1"	185	6'3"	190	80	2 L	12 hr	83	2.4	10 hr	100
6'3"	190	6'5"	198	85	2.125	11 hr	89	2.55	9 hr	106
6'5"	198	6'7"	195	90	2.25	11 hr	94	2.7	9 hr	113

* Use ideal body weight or actual body weight, whichever is lower. See **Ideal body weight** guideline

- Note that 1000 mL over 8 hr is not indicated simply for maintenance, even for the largest pyrexial patients
- It is beneficial to deliver daily maintenance requirement over day-time hours, this is more physiological and will promote sleep and wellbeing. Increase rate and limit time that infusion should run accordingly
- Give as much fluid volume as possible orally or (if inserted) via nasogastric or other enteric tube. Give remainder IV or, in selected medical patients, SC
- **If signs of fluid overload in any patient,** review need for IV fluids. If essential, restrict fluid input to maximum 1 L/24 hr or reduce input by 50%

Choice of fluid – principles

- Choice depends on patient, and on sodium and potassium levels

Patient

- Stressed patients (e.g. post-operative, septic) are at risk of complication from excessive:
  - chloride (hyperchloraemic acidosis caused by sodium chloride 0.9%)
  - free water (acute hyponatraemia, seizures, brain damage and death, if glucose solutions with inadequate sodium content are used)
- Co-morbidities – see specific conditions in **How to use this guideline** above
- Many unstable patients may need maintenance fluids and require repeated fluid boluses for resuscitation

Content of maintenance fluid (especially hypotonic or high potassium-content) is inappropriate/dangerous when given in large volumes required for resuscitation. Do not increase rate of maintenance fluids to resuscitate. Prescribe and administer resuscitation fluid separately

Adult fluid, electrolyte and glucose requirements

Water

- 25–30 mL/kg/day

Sodium

- 50–170 mmol/day (1–2 mmol/kg/day)

Potassium

- 25–85 mmol/day (1 mmol/kg/day)
- Patients with excessive lower GI losses or enteric fistula may have losses requiring more significant replacement. See **Continuing excess losses** below

Chloride

- 80–120 mmol/day (1–1.5 mmol/kg/day)

Glucose

- 50–100 g/day to limit starvation ketosis, but this does not address nutritional needs (see **Artificial nutritional support** guideline in the **Surgical** guidelines)

Choice of maintenance fluid when no hypovolaemia and near normal renal function

- If any of the following biochemical disorders is present, follow appropriate **Hyponatraemia**/**Hypernatraemia** and/or **Hypokalaemia**/**Hyperkalaemia** guideline:
- **hyponatraemia** – Na^+ <135 mmol/L
- **hypernatraemia** – Na^+ >150 mmol/L
- **hypokalaemia** – plasma K^+ <2.5 mmol/L with persistent losses/poor absorption or plasma K^+ either persistently <3.0 mmol/L or <3.0 mmol/L and combined with new tachyarrhythmia or muscle weakness
- **hyperkalaemia** – K^+ >6.0 mmol/L
- Otherwise, for the 'general' patient, on day 1 prescribe sodium chloride 0.18% with glucose 4% with potassium chloride 20 mmol/L in the volumes listed in **Table 1** (refer to NICE Guideline CG174 for further details)
- monitor electrolytes regularly and adjust quantity and content of maintenance fluid used as indicated by most recent biochemical results

CONTINUING EXCESS LOSSES

- If patient has continuing excess losses from any source (e.g. vomiting, nasogastric tube losses, diarrhoea, fistulae, stoma, drains, continuing blood loss – melaena, polyuria, sweating, lactation), measure volume of losses and replace volume using an appropriate fluid (see below) in addition to maintenance regimen

Choice of fluid

- Depends on type of fluid lost (biochemical analysis of fluid may be helpful), and impact upon haematocrit, biochemistry and serum protein
- replace vomiting or gastric tube losses. If GI losses >1500 mL, check chloride level. If patient hypochloraemic, use sodium chloride 0.9% +/- potassium chloride
- replace diarrhoea/small bowel/bowel preparation losses with compound sodium lactate (Hartmann's) solution

Always use commercially produced pre-mixed bags of any fluid with potassium chloride.
NEVER add potassium chloride to infusion bags.
Rapid infusion of bags containing potassium 40 mmol/L causes dangerous arrhythmias.
Suggestion – place a handwritten label on any bag containing potassium, warning staff NOT TO INCREASE INFUSION RATE

MONITORING

Chart

Hourly

- Urine output if continuing excess losses or patient haemodynamically unstable

6-hrly

- BP – if patient haemodynamically unstable, increase frequency

Daily

- Fluid balance chart
- Serum U&E
- Body weight

Examine daily

- Check for peripheral oedema
- Auscultate lung fields

FLUID OVERLOAD

If signs of fluid overload appear and parenteral fluid remains necessary, restrict fluid input to maximum 1 L/24 hr or reduce input by 50%

As soon as possible, re-establish oral fluids and remove indwelling intravenous lines

FLUID RESUSCITATION ● 1/3

RECOGNITION AND ASSESSMENT

- In all patients at risk of hypovolaemia, make a clinical assessment of degree and type of fluid deficit taking account of clinical trends and context (history and examination)
- Use ABCDE (Airway, Breathing, Circulation, Disability, Exposure) approach – see also NICE **Algorithms for IV fluid therapy, Assessment & Management** http://bit.ly/1Bzp6lj (pathways.nice.org.uk)

Oliguria in an otherwise well patient during early post-operative period in the absence of other signs of volume depletion does not indicate need for IV fluid therapy. It can be a normal physiological response to surgery

Table 1: Assessment of fluid deficit (patients are unlikely to exhibit all of the clinical signs)

	FLUID DEFICIT			
Signs	**None**	**Moderate**	**Severe**	**Critical**
Mental status	Normal (GCS 15*)	Mildly anxious (GCS 15*)	Anxious/confused (GCS 12–14*)	Confused/lethargic/ comatose (GCS <12*)
Dry mouth	No	Yes	Yes	Yes
Reduced skin turgor	No	Yes	Yes	Yes
Sunken eyes	No	No	Yes	Yes
Capillary refill time	<2 sec	<2 sec	2–4 sec	>4 sec
Heart rate	<100	>100	>120	>140
Respiratory rate	14–20	20–30	30–35	>35
Blood pressure	Normal	Normal	Decreased	Decreased
JVP when supine	Visible	May not be visible	Not visible	Not visible
Urine output	>30 mL/hr	20–30 mL/hr	5–20 mL/hr	<5 mL/hr

* See **Glasgow coma scale** guideline

Clinical notes

- Heart rate may be raised for reasons other than hypovolaemia
- increases due to hypovolaemia will be less pronounced in the super-fit, the elderly and by beta-blocker drugs
- Interpret BP in light of any history of hypertension and patient's age. If patient in pain, reductions will be masked
- Review all diuretics. Oliguria may be prevented by diuretics
- Capillary refill time is also increased by other factors (e.g. anxiety, pain, hypothermia, or cold environment). Cool peripheries may indicate a requirement for fluid resuscitation, but peripheries may be warm when fluid resuscitation is required e.g. sepsis

Investigations

- U&E
- Glucose
- FBC
- ESR
- If blood loss suspected, group and save or crossmatch
- If peripheral perfusion is poor, measure:
- arterial/venous blood gases or lactate to detect metabolic acidosis
- CRP
- coagulation studies

INITIAL MANAGEMENT

- Ensure airway patent, breathing adequate and appropriate care of cervical spine
- Give high-flow oxygen via reservoir mask to all patients with shock, major trauma, sepsis, or other critical illness. Aim for SpO_2 94–98% – see **Oxygen therapy in acutely hypoxaemic patients** guideline. In patients with chronic respiratory failure at risk of hypoventilation, ensure early titration of oxygen dose to an SpO_2 of 88–92%, with blood gas measurement to assess for elevated PCO_2
- Manage specific conditions as soon as possible by following appropriate condition-specific guideline in **Medical** or **Surgical** guidelines (see **Specific conditions** following **Table 3: Choice of fluid for resuscitation**)

FLUID RESUSCITATION ● 2/3

Treatment

- Use ABCDE approach and address cause of fluid deficit
- Manage fluid deficit as follows:

All treatment is given as boluses of fluid in addition to, or before starting, maintenance therapy

- See **Tables 2** and **3** for rate and type of resuscitation fluid therapy to be given

Table 2: Initial treatment of fluid deficit

Fluid deficit	Fluid bolus and other management	Other management in addition to addressing cause of fluid deficit
None/mild	Give oral maintenance if possible. Otherwise move to **Maintenance fluid therapy** guideline	
Moderate	500 mL over 15 min, then reassess	• Give oxygen • See **Clinical notes** below • Investigations as above
Severe	500 mL over 10 min, then reassess	
Critical	1000 mL over 5 min, then reassess	• Ensure airway patency • Give oxygen • See **Clinical notes** below • Investigations as above

Clinical notes

- In patients at risk of pulmonary oedema because of heart failure, reduce fluid bolus volume by half, these are complex patients and senior review is necessary

Regular reassessment is required to assess magnitude and duration of response to initial treatment, and to avoid iatrogenic fluid overload
Note: Septic and spinal cord injured patients may be hypotensive despite adequate filling

Choice of initial fluid

Resuscitate using initial fluid therapy recommended in Table 3, use blood products if indicated by major haemorrhage/coagulopathy. Continue prescribed maintenance fluid therapy concurrently with resuscitation therapy. Use clinical assessment rather than cumulative maintenance volumes administered when predicting required resuscitation volume. Hypotonic or potassium-rich maintenance fluid is inappropriate/dangerous when given in large volumes required for resuscitation

Table 3: Choice of fluid for resuscitation

Fluid deficit	Initial fluid
• Severe vomiting • Brain injury	Sodium chloride 0.9%
• Severe diarrhoea • Gastrointestinal fistula • Poor intake (many medical patients) • Serum potassium ≥5.5 mmol • Loss of fluid of plasma constituency or severe patient stress (majority of surgical patients) resulting from: ◦ blood loss ◦ surgery ◦ injury ◦ systemic inflammatory response ◦ burns ◦ increased insensible losses due to fever or environmental factors ◦ increased losses from respiratory tract in acute respiratory failure (includes acute severe asthma) ◦ epidural anaesthesia	Balanced crystalloid e.g. compound sodium lactate (Hartmann's) solution

Specific conditions

- If patient has massive haemorrhage from any cause, follow **Massive haemorrhage protocol** on Trust intranet>Clinicians>clinical guidance>blood and blood products>general documents>procedures
- If renal failure suspected, discuss with critical care or renal physicians
- If coagulopathy suspected, involve haematologist

If patient has any of the following conditions, follow appropriate condition-specific guideline in **Medical** and **Surgical guidelines**

- Diabetic ketoacidosis and hyperosmolar hyperglycaemic state
- Acute adrenal insufficiency
- Acute upper gastrointestinal haemorrhage
- Hypo/hypernatraemia
- Acute cardiac failure
- Acute liver failure
- Established acute kidney injury (acute renal failure)
- Diabetes mellitus and requirement for fluids to cover surgery
- Post-operative haemorrhage. For intra-operative patients only, **Choice of intravenous fluid for intra-operative resuscitation of acute hypovolaemia flowchart** is available on Trust intranet Clinicians>Clinical services>Anaesthesia and theatres
- Hypercalcaemia
- Recent retention of urine

Monitoring

- Reassess using **Recognition and assessment** above. See **Table 1**
- Manage continuing persistent fluid deficit with further fluid boluses as per **Initial management** above
- Hourly urine output (renal failure likely if <0.5 mL/kg/hr)
- If >2000 mL required in 1 hr, patient has signs of shock or there is doubt about requirement for continuing fluid resuscitation, seek expert help
- If >4 L of fluid required in 24 hr or blood loss suspected, send repeat FBC, clotting screen and ensure group and save sample is in date or crossmatched blood is available

MANAGEMENT OF POTASSIUM

Never infuse fluids containing >5 mmol/L potassium rapidly (compound sodium lactate contains 5 mmol/L and can, therefore, be infused rapidly). Consideration should be given to using isotonic sodium bicarbonate in hyperkalaemia to encourage intracellular shift of potassium). If a patient requiring rapid fluid boluses for resuscitation is also hypokalaemic, prescribe potassium separately in their maintenance fluid regimen or, if hypokalaemia severe (serum potassium <3 mmol/L), follow* Hypokalaemia *guideline

OUTCOME

- Reassess as indicated in **Table 1** and give further fluid boluses as required

Signs of hypovolaemia do not resolve

- If patient shows only transient recovery despite fluid boluses totalling 2000 mL in 1 hr, (or 1000 mL in elderly patients), perform arterial blood gas analysis to detect metabolic acidosis secondary to inadequate tissue perfusion and/or endogenous catecholamines
- request senior review to consider referral to critical care, advice on specific treatment including possible insertion of central venous catheter

Signs of hypovolaemia resolve

- Commence or continue maintenance fluid regimen. See **Maintenance fluid therapy** guideline
- Reassess for clinical signs of hypovolaemia at 30 min intervals until signs of hypovolaemia have resolved for at least 2 hr and there are no signs of continuing losses
- a significant proportion of patients will have only a transient response to fluid bolus

ADDITIONAL INFORMATION

Further reading on balanced physiological solutions in the presence of hyperkalaemia can be found at:

- http://www.pulmcrit.org/2014/09/myth-busting-lactated-ringers-is-safe.html
- http://www.derangedphysiology.com/main/core-topics-intensive-care/manipulation-fluids-and-electrolytes/Chapter%202.3.4/response-1l-hartmanns-compound-sodium-lactate

UPPER GASTROINTESTINAL HAEMORRHAGE ●1/5

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Coffee-ground vomit (dark brown, denatured blood in vomit)
- Haematemesis (bright red or clotted blood in vomit)
- Melaena (black, tarry, smelly stool containing digested blood)
- Postural dizziness or fainting
- Evidence of severe bleeding – defined as presence of shock with tachycardia (heart rate >100 beats/min), hypotension (systolic BP <100 mmHg) and clammy skin, or of postural hypotension in patient who is not clinically shocked
- Evidence of anaemia
- Features of precipitating disease, jaundice, stigmata of liver disease
- Features of bleeding disorder (petechiae)
- Buccal or facial telangiectasia

Bright red rectal bleeding in the absence of hypotension is likely to arise from lower gastrointestinal tract

Previous history

- Enquire about:
- peptic ulceration
- previous bleeds
- liver disease
- family history of bleeding
- ulcerogenic medication/anticoagulants
- alcohol
- weight loss

ASSESSMENT OF RISK

It is essential to categorise patients according to their risk of death/rebleeding – use Glasgow Blatchford score (GBS) (see Figure 1): ≥1 high-risk; 0 low-risk

If more than one of the following are present, patient is at high risk

- Heart rate >100 beats/min and systolic BP <100 mmHg, or postural hypotension (fall ≥20 mmHg 3 min after standing)
- Recent syncope
- Melaena
- Heart failure or liver disease
- Haemoglobin (Hb) <130 g/L (male), or <120 g/L (female)
- Urea >6.5 mmol/L

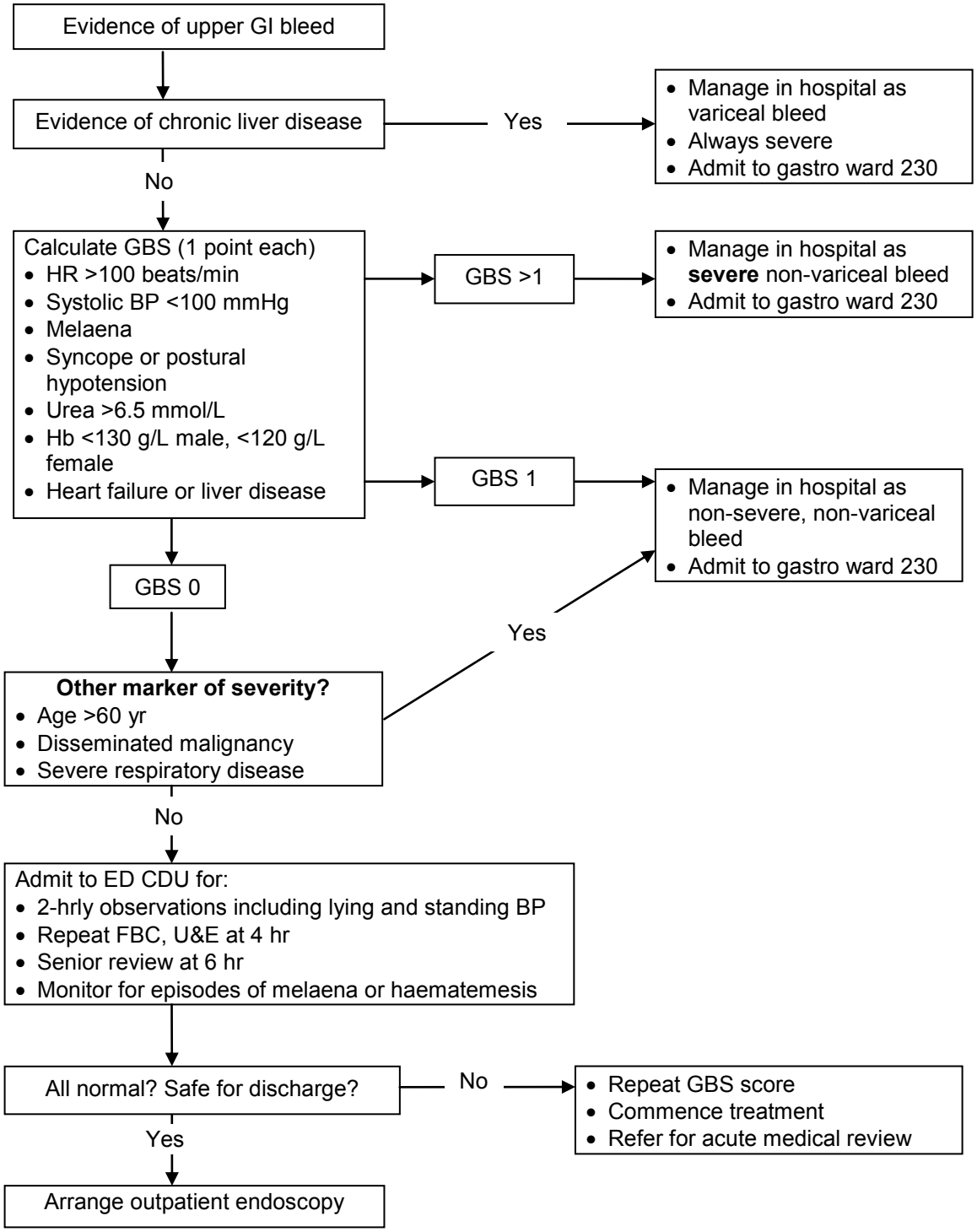
Additional markers of severity

- Rebleeding after admission
- GI bleeding arising after admission with another condition
- Actively bleeding ulcer or visible non-bleeding vessel at endoscopy
- Disseminated malignancy
- Severe respiratory disease

Investigations

- **All**
- FBC
- U&E
- **Non-severe bleeding**
- group and save (non-urgent)
- **Severe bleeding:**
- INR
- LFTs
- crossmatch (4 units), notify blood transfusion laboratory of clinical problem and degree of urgency

Figure 1 is an aid to clinical judgement



PATIENTS FOR POSSIBLE DISCHARGE

Management – clinical decision unit (CDU)

Observations – 2-hrly

- Heart rate
- BP: lying and standing at 3 min

Investigations

- See above
- Repeat FBC and U&E 4 hr after admission to CDU

Treatment

- None, unless specific cause or increase in severity identified

Review

- After 6 hr

Admission criteria

- Glasgow Blatchford score ≥1
- Further episode of GI bleed
- Haemodynamic instability
- Abnormal blood results

Criteria for CDU discharge and outpatient endoscopy

- Glasgow Blatchford score 0
- No co-morbidities requiring acute admission
- Patient information pack provided to patient
- Request OGD on Order Comms (as urgent outpatient)
- Give patient copy of discharge letter

PATIENTS REQUIRING ADMISSION

Non-severe non-variceal bleeding

- Baseline observations with a view to upper GI endoscopy within 24 hr/next available endoscopy list
- Wide bore IV access
- Allow food and drink until 4 hr before endoscopy
- No treatment necessary before endoscopy
- Send patient to GI bleeding reception area on ward 230

Severe non-variceal bleeding

The first priority is to replace fluid loss and restore BP

- Insert 2 large bore (14–16 G) venous cannulae
- Infuse compound sodium lactate (Hartmann's) solution (or, alternatively, sodium chloride 0.9%) 1–2 L over 30–120 min to achieve systolic BP >100 mmHg
- In patients with significant cardiac disease, consider inserting central venous pressure (CVP) line to guide IV fluid replacement
- Stop antihypertensives, diuretics, NSAIDs, anticoagulants
- Measure urine output. Adequately resuscitated patients have urine output of 0.5 mL/kg/hr
- Keep patient nil-by-mouth
- If not already an inpatient **admit**, preferably to GI bleeding reception area on Ward 230
- Transfuse as soon as blood available – see **Blood and blood products** guidelines
- prefer packed cells
- if 50% of total blood volume loss in 3 hr, follow **Massive haemorrhage protocol** with blood bank to obtain blood products rapidly – see **Massive haemorrhage protocol** on Trust intranet>Clinicians>Clinical guidance>Blood and blood products>
- Once resuscitation has begun, give omeprazole 80 mg by IV infusion over 40–60 min, then by continuous IV infusion of 40 mg in 100 mL sodium chloride 0.9% at 20 mL/hr (8 mg/hr) for 72 hr. Arrange upper GI endoscopy by contacting gastroenterology unit 0830–1700 hr weekdays and 0830–1200 hr Saturday and insert request on Order Comms 'Gastroscopy – UGI bleed'
- After preliminary resuscitation, discuss all patients with severe non-variceal bleeding with on-call surgical team. If appropriate, transfer patient to general surgical care for further management:
- if doubt about realistic possibility of surgery, duty surgeon and duty physician to review patient in consultation
- if any difficulties are encountered with this policy, inform on-call consultant physician. Contact a senior gastroenterologist via call centre only if on-call team unable to resolve the clinical management problem satisfactorily with duty surgical team
- Indications for surgical intervention (or interventional radiology under surgical care) are:
- exsanguinating haemorrhage (too fast to replace or requiring >4 units of blood to restore blood pressure)
- failed medical therapy
- special situation (e.g. patients with rare blood group or refusing blood transfusions)

Oesophageal variceal bleeding

Haemorrhage from oesophageal varices is always life-threatening

- Identify patients from clinical history, previous hospital notes or by clinical signs (e.g. jaundice, ascites, spider naevi)
- Insert 2 large bore (14–16 G) IV cannulae, 1 in each antecubital fossa. In patients with significant cardiovascular disease, a CVP line is advisable
- Initially infuse sodium chloride 0.9% 1 L over 2–4 hr:
- if Hb <100 g/L, transfuse 1 unit of blood for every 10 g/L <100 g/L – see **Blood and blood products** guidelines
- Correct raised INR with fresh frozen plasma but prothrombin complex concentrate recommended for major bleeding associated with warfarin (see **Warfarin** guidelines)
- Continue fluid replacement, aiming to restore heart rate <100 beats/min, systolic BP >80 mmHg and Hb ≥100 g/L, but avoid rapid fluid replacement as it increases risk of rebleeding
- Whilst awaiting endoscopy, give terlipressin 2 mg IV bolus then 1 mg 6-hrly, duration directed by endoscopist
- If haemorrhage still not controlled, discuss with gastroenterology team
- Give co-amoxiclav 625 mg oral or if nil-by-mouth, 1.2 g IV 8-hrly for 3 days
- in penicillin allergic patients give aztreonam 1 g IV 8-hrly and metronidazole oral 400 mg 8-hrly or if nil-by-mouth, 500 mg IV by infusion 8-hrly for 3 days. If previously MRSA colonised, add vancomycin IV by infusion – see **Vancomycin** guideline
- penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction. True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases
- always obtain blood culture before giving an antimicrobial – see **Collection of blood culture specimens** guideline
- If septic – see **Sepsis, severe sepsis and septic shock** guideline
- In patients with grade 4 encephalopathy – see **Acute liver failure with encephalopathy** guideline, discuss endotracheal intubation with gastroenterology team and, if decided appropriate to intubate, contact critical care team
- If not already inpatient, admit to ward 230
- Contact gastroenterology team for advice on further management

Do not refer to surgical team

SUBSEQUENT MANAGEMENT

Non-variceal bleeding

- Continue observations until outcome of upper GI endoscopy known
- Follow advice appearing on endoscopy report

Preferred eradication regimen for *Helicobacter pylori* is:
omeprazole 20 mg oral 12-hrly
amoxicillin 1 g oral 12-hrly
metronidazole 400 mg oral 12-hrly
for 7 days*

In patients allergic to penicillin:
omeprazole 20 mg oral 12-hrly
clarithromycin 250 mg oral 12-hrly
metronidazole 400 mg oral 12-hrly
for 7 days*

Absolute compliance with regimen essential in order to achieve an eradication rate of 90%

***If ulcer large, or complicated by haemorrhage or perforation, then omeprazole treatment continued for a further 21 days**

Simvastatin contraindicated in combination with clarithromycin see current BNF for other interactions)

- After successful eradication of *Helicobacter pylori* and course of PPI for ulcer healing, if NSAID therapy must be reintroduced, continue omeprazole 20 mg oral daily for as long as NSAID required
- If neoplasm identified, refer to upper GI cancer nurse specialist
- **Patients who rebleed:**
- if an otherwise stable patient who is potentially referable for surgery rebleeds, request **urgent** endoscopy and discuss with on-call surgical team
- **Indications for surgical intervention:**
- exsanguinating haemorrhage (too fast to replace)
- failed endoscopic therapy
- major rebleed after successful endoscopic therapy
- special situation (e.g. patients with rare blood group or patients refusing blood transfusion) – a major bleed may warrant early surgery
- **Once agreed with s**urgical team, transfer high-risk patients to SAU

Variceal bleeding

- Contact gastroenterology team for advice on management:
- if not admitted directly, transfer patient to GI ward 230

MONITORING TREATMENT

All patients

- 4-hrly heart rate and BP
- Observe vomit for blood content and stool chart for melaena
- Daily Hb until it is stable (not falling)
- In patients with severe bleeding, urine output – aim for >30 mL/hr

DISCHARGE AND FOLLOW-UP

- Discharge when stable

Non-variceal bleeding

- If *H.pylori* positive **duodenal** ulcer*,* ask GP to arrange faecal antigen testing for *H pylori* >4 weeks after completion of eradication therapy
- If *H.pylori* positive **gastric** ulcer, ask GP to arrange faecal antigen testing for *H pylori* >4 weeks after completion of eradication therapy and repeat upper GI endoscopy to check healing 6–8 weeks following discharge
- If Hb still <100 g/L, start ferrous sulphate 200 mg oral 8-hrly
- **Non-severe bleeding with transient pathology (e.g. Mallory–Weiss tear, acute erosion):**
- discharge promptly after endoscopy with no follow-up
- **Non-severe bleeding and ulcer-related disease:**
- discharge young stable patients (aged <45 yr) promptly after endoscopy
- discharge older patients (aged >45 yr) when their condition is stable
- **Severe bleeding and ulcer-related disease:**
- discharge when condition and Hb stable

Variceal bleeding

- Start propranolol 40 mg oral 12-hrly, unless contraindicated, as prophylaxis for further variceal bleeding
- Refer to Dr Brind or Dr Bohan for follow-up

Neoplasia

- Discuss further investigation and treatment with upper GI cancer team – contact cancer nurse specialist

ACUTE LIVER FAILURE WITH ENCEPHALOPATHY ● 1/5

RECOGNITION AND ASSESSMENT

Consider liver failure in all patients with abnormal liver function tests or coagulopathy whose conscious level deteriorates

Symptoms and signs

- Altered conscious level (hepatic encephalopathy, see **Table 1**)
- Jaundice
- Evidence of coagulopathy (e.g. bruising, petechiae)
- Flap
- Ascites and oedema
- Malaise, nausea, vomiting

Table 1: Grading of encephalopathy

Grade	Symptoms and signs
1	• Confused • Altered mood or behaviour
2	• Drowsy with inappropriate behaviour
3	• Stupor with inarticulate speech • Rousable and can obey simple commands • Severe agitation, wailing and decerebrate posturing
4	• Coma • Unrousable

Decompensated cirrhosis

- Decompensated cirrhosis is a medical emergency – commence **Decompensated Cirrhosis Care Bundle** within first 6 hr of admission (printable version available via trust intranet: http://uhns/clinicians/clinical-guidance/clinical-guidelines/map-of-medicine-guideline-forms/)
- Patients with known or suspected cirrhosis presenting with an acute deterioration in liver function with following:
- jaundice
- increasing ascites
- hepatic encephalopathy
- renal impairment
- GI bleeding
- signs of sepsis/hypovolaemia

Investigations

- FBC, INR
- U&E, bone profile and magnesium
- Blood glucose
- LFT
- ABG

Acute hepatitis e.g. ALT >400

- Hepatitis E IgM, Hepatitis A IgM, HBsAg and HBcIgM, EBV and CMV if virology negative
- Even if there is no evidence of paracetamol overdose, check paracetamol level
- Liver antibodies: SMA, ANA, AMA, LKM (liver-kidney-microsome) and ANCA

Acute on chronic liver failure

- HCVAb, HBV markers
- Liver antibodies:
- SMA, ANA, AMA, LKM (liver-kidney-microsome) and ANCA
- arterial blood gases (on air)
- blood cultures (**mandatory)**
- Ascitic fluid culture and white cell count (**mandatory)**
- Urine cultures
- Chest X-ray
- All patients presenting with decompensated alcohol related liver disease – include blood cultures in initial investigations on admission to hospital
- All patients admitted as an emergency, regardless of specialty, routine electrolytes on admission and appropriately thereafter to assist in the prevention of insidious and unrecognised onset of acute kidney injury

Look for evidence of multiple organ failure

- Patient looks severely ill/exhausted/obtunded
- Hypotension (mean arterial pressure <80 mmHg) despite initial fluid administration +/- inotrope dependency
- Oliguria/anuria
- Spontaneous bruising and/or mucosal bleeding
- Cerebral oedema. Evidence: bradycardia, hypertension, dilated pupils or decerebrate posturing
- Impaired gas transfer – hypoxaemia (PaO_2 <10 kPa) despite 40% oxygen
- Metabolic acidosis
- Hypoglycaemia
- Radiological pulmonary shadowing/oedema

IMMEDIATE TREATMENT AND SUBSEQUENT MANAGEMENT

- Admit to GI ward 230 or critical care – see **Indications for transfer to critical care**
- Inform a senior member of on-call medical team (SpR or above)
- After patient review, contact on-call gastroenterologist via call centre for urgent assistance; where appropriate discuss with regional liver unit (quick dial QEH Birmingham, 15052)

Indications for consideration of transfer to critical care

- Other organ failure in patients with acute liver failure e.g. respiratory failure and cardiovascular instability
- Grade 3 or 4 encephalopathy
- Features of cerebral oedema

Fluid management

- If hypoglycaemia or hyperglycaemia, regulate blood glucose using regimen recommended in **Control of hyperglycaemia in the ill patient** guideline
- Correct intravascular fluid depletion with albumin 4.5%
- Give maintenance crystalloid 3 L/day to maintain serum Na^+ >130 mmol/L. Give pre-mixed bags of sodium chloride 0.9% with 20 or 40 mmol/L potassium chloride to maintain serum K^+ >3.5 mmol/L
- Correct hypophosphataemia with phosphate polyfusor (Fresenius Kabi) IV. A 500 mL bag gives 81 mmol sodium, 9.5 mmol potassium and 50 mmol phosphate
- moderate hypophosphataemia (0.5–0.7 mmol/L), treat with 0.1–0.2 mmol phosphate/kg (equivalent to 1–2 mL/kg) over 12 hr
- severe hypophosphataemia (<0.5 mmol/L), treat with 0.2–0.5 mmol phosphate/kg (equivalent to 2–5 mL/kg) over 12 hr
- total maximum dose of 50 mmol per infusion
- repeat doses may be required on subsequent days
- reduce dosage in elderly patients and those with reduced renal function

Respiratory failure

- Correct hypoxia – see **Oxygen therapy in acutely hypoxaemic patients** guideline

Coagulopathy

- If INR >1.4 with significant bleeding or need to perform an invasive procedure, give phytomenadione (Konakion MM) 10 mg IV daily by slow IV infusion in 55 mL glucose 5%. Do not give fresh frozen plasma unless clinical evidence of bleeding. If bleeding, discuss with on-call haematologist

Infection

Treat all infections as serious as these patients exhibit few clinical signs of infection

Timing	First line	Alternative (penicillin allergy)
	Co-amoxiclav 1.2 g IV 8-hrly Oral step down: co-amoxiclav 625 mg oral 8-hrly (check sensitivity results)	If allergy is rash: Ceftriaxone 1 g IV daily If allergy is anaphylaxis: ciprofloxacin 400 mg IV 12-hrly Oral step down: Ciprofloxacin 500 mg orally 12-hrly (check sensitivity results)
In all patients	Add fluconazole 200 mg IV by infusion daily for 2 days, then fluconazole 200 mg oral daily for 5 days If still not responding after another 48 hr discuss with consultant/SpR microbiologist	
If not responding after 48 hr or further deterioration in liver or renal function	Discuss with consultant microbiologist/ID	
Duration	If culture negative and ascitic fluid polymorphonuclear leukocytes (PMN) before antimicrobial <50 $\times$ 10^6/L, discontinue after 5 days, or sooner if significantly improved and >48 hr apyrexial	

[1] Check iPortal for IC alert under patient alerts; if CARB present then discuss with microbiologist for empirical treatment

Encephalopathy

- Consider giving Pabrinex IV – see **Alcohol withdrawal** guideline
- Assess for precipitant
- If clinical doubt in a confused patient request CT head to exclude subdural haematoma
- Except in fulminant liver failure, give lactulose 30–50 mL oral or via nasogastric (NG) tube 8-hrly, or phosphate enema rectally daily. Adjust dosage to produce 2–3 soft stools daily. It is not necessary to produce diarrhoea
- Avoid sedatives (benzodiazepines, phenothiazines, opioids)

Complications

Varices

- If evidence of upper GI haemorrhage, refer to gastroenterology team for advice on terlipressin infusion (must be used with caution in acute liver failure) and possible endoscopy and variceal banding – see **Acute upper gastrointestinal haemorrhage** guideline

Ascites

Do not treat urgently unless it is causing symptoms. If encephalopathic, avoid or stop diuretics even if symptomatic

- If ascites symptomatic, give spironolactone 100 mg oral daily, increasing by 100 mg every 2–3 days if necessary (max 400 mg daily) to achieve weight reduction of 0.5–1 kg/day. Furosemide 40 mg oral daily (max 40 mg 12-hrly) may be added if spironolactone not effective – discontinue both diuretics if hyponatraemia Na <120 mmol/L or creatinine increases x 2 or above 200 micromol/L
- If drainage thought necessary, stop diuretics for 48 hr around period of paracentesis and replace fluid volume drained with IV infusions of albumin (albumin 20% 100 mL IV over 1 hr at outset, repeated for every 3 L of fluid drained)

Spontaneous bacterial peritonitis (non CAPD)

- If condition deteriorates or there is evidence of sepsis, exclude SBP as it carries a high mortality. Arrange urgent ascitic tap for MC&S and ascitic fluid WCC
- if SBP confirmed (ascitic PMN >250 $\times$ 10^6/L), start antimicrobials and antifungals (see **Table** below). Give albumin 1.5 g/kg IV over 24 hr and 1 g/kg day 3 over 24 hr
- with clinical improvement, switch to oral antimicrobials (total duration 5–10 days)
- at end of course, in cirrhotic patients only after first confirmed episode of SBP, start prophylactic ciprofloxacin 500 mg oral once daily on discharge and continue until ascites resolved

Timing	First line	Alternative (penicillin allergy)
First 48 hr	Piperacillin-tazobactam 4.5 g IV 8-hrly **Oral step down:** according to sensitivity results when available	**If allergy is rash**: Ceftriaxone 1 g IV daily **If allergy is anaphylaxis:** ciprofloxacin 400 mg IV 12-hrly **Oral step down:** ciprofloxacin 500 mg orally 12-hrly (check sensitivity results)
In all patients	**Add** fluconazole 200 mg IV by infusion daily for 2 days, then fluconazole 200 mg oral daily for 5 days	
If not responding after 48 hr with temperature >38°C or further deterioration in liver or renal function	Discuss with consultant microbiologist/ID	
	If tagged for ESBL[1]: Check previous sensitivities for ESBL and choose empiric treatment based on these results according to sensitivity. Discuss with consultant microbiologist/ID.	
Prophylaxis Started after completion of treatment course	**Only in cirrhotic patients after first confirmed episode of spontaneous bacterial peritonitis** Ciprofloxacin 500 mg orally daily	
Duration	**Treatment – review IV route after 24–48 hr:** convert to oral therapy, if improving and organism sensitive. Usual duration 7 days but may require prolonged therapy	**Prophylaxis:** Until ascites resolved

[1]Check iPortal for IC alert under patient alerts: if ESBL present then treat as tagged for ESBL; if CARB present then discuss with microbiologist for empirical treatment

Electrolyte disturbance and renal failure

- If patient develops hyponatraemia (<120 mmol/L) or doubling of serum creatinine, stop diuretics and restrict fluid and salt intake **only** if no renal impairment

Acute kidney injury (AKI) and/or hyponatraemia (Na <125 mmol/L)	
AKI defined by RIFLE criteria	1: Increase in serum creatinine ≥26µmol/L within 48 hr **or**
	2: ≥50% rise in serum creatinine over the last 7 days **or**
	3: Urine output (UO) <0.5 mL/kg/hr for more than 6 hr based on dry weight **or**
	4: Clinically dehydrated
• Suspend all diuretics and nephrotoxic drugs	
• Fluid resuscitate with human albumin solution 5% or sodium chloride 0.9% (250 mL boluses with regular reassessment: 1–2 L will correct most losses)	
• Initiate fluid balance chart/daily weights	
• Aim for MAP >80 mmHg to achieve UO >0.5 mL/kg/hr based on dry weight	
• At 6 hr, if target not achieved or EWS worsening consider escalation to higher level of care	

Cerebral oedema

- **Refer to critical care**
- Disturb as little as possible and nurse at 45 degrees – head up
- Treat seizures – see **Status epilepticus** guideline
- Avoid terlipressin
- **With critical care support**
- aim to maintain serum Na^+ >140 mmol/L with sodium chloride 1.8% by IV infusion
- for acute episodes, give mannitol 20% (200 g in 1 L) 0.25–2 g/kg by IV infusion (use 15–30 micron in-line filter) through large peripheral or central vein over 30–60 min. If urine output and/or serum osmolality fail to rise or vital signs deteriorate, repeat 1–2 times after 4–8 hr

MONITORING TREATMENT

- In-day
  - pulse oximetry (continuously)
  - urine output (hourly)
  - blood glucose (2-hrly)
  - BP (4-hrly)
  - pulse (4-hrly)
  - temperature (4-hrly)
  - conscious level (4-hrly)
- Daily (if following paracetamol overdose, twice daily)
  - FBC, INR
  - U&E
  - weight and fluid balance
- Alternate days
  - LFT, bone profile and magnesium

DISCHARGE AND FOLLOW UP

- Discuss need for follow-up with gastroenterology team

ACUTE ULCERATIVE COLITIS AND CROHN'S DISEASE ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Severe diarrhoea, tenesmus
- Abdominal pain
- Anorexia, weight loss
- Malaise
- Variable amount of blood in stool
- Dehydration
- Tachycardia
- Fever
- Anaemia

Life-threatening features

- Severe sepsis/septic shock
- Toxic dilatation of colon
- Perforation of colon
- Profound electrolyte disturbance
- Massive haemorrhage
- Obvious weight loss
- Secondary multi-organ failure

Investigations

- FBC
- U&E
- LFT
- CRP
- Blood glucose
- Abdominal X-ray
- Erect chest X-ray – look for gas under diaphragm
- Stool culture (Salmonella, Shigella, Campylobacter), *Clostridium difficile* toxin
- Crossmatch: group and save
- Arterial blood gases

Differential diagnosis

- Bacterial and amoebic colitis (history of travel)
- Pseudomembranous colitis (history of antimicrobial use)
- Diverticular disease
- Ischaemic colitis
- Bowel cancer
- Abdominal lymphoma
- Radiation colitis
- Ileocaecal TB

IMMEDIATE TREATMENT

- Contact on-call consultant gastroenterologist if needed (via call centre)
- In patients with life-threatening features inform duty surgical team
- Barrier nurse – inflammatory bowel disease can at first be indistinguishable from infective diarrhoea
- Admit to GI ward 230
- Establish IV access and correct dehydration/electrolyte disturbance
- If Hb <80 g/L, give blood transfusion (4 units plus an extra unit for each g/L below 80)
- Hydrocortisone – 200 mg 8-hrly by slow IV injection over 1 min
- Metronidazole – 500 mg IV 8-hrly, by infusion given over 20 min
- Ensure all patients receive prophylactic dalteparin

DO NOT GIVE anti-diarrhoeal drugs in acute phase – they increase the risk of toxic dilatation
DO NOT PERFORM barium enema or colonoscopy in acute phase – there is a high risk of perforation of the colon

SUBSEQUENT MANAGEMENT

- Once infective element has been excluded, relax barrier nursing restrictions and stop antimicrobial therapy
- Ensure patient discussed with consultant gastroenterologist

If improving

- If antimicrobial therapy still needed convert to metronidazole 400 mg oral 8-hrly
- Substitute prednisolone (not enteric coated) 40 mg oral daily in place of hydrocortisone
- Start restricted oral feeding. Seek dietetic opinion
- Give mesalazine (Octasa® MR) 800 mg oral 8-hrly
- For distal disease, consider hydrocortisone foam enema 10% 12–24 hrly for 2–3 weeks
- If extent and severity of inflammation not apparent from supine plain abdominal X-ray, plan colonoscopy or barium enema in convalescent phase in consultation with consultant gastroenterologist

If not improving

- If no improvement, after 48 hr, consider escalation therapy with either IV ciclosporin (unlicensed) or infliximab **only after discussion with a consultant gastroenterologist**
- if still no improvement by day 5, consider surgery

MONITORING TREATMENT

- **2-hrly:**
- temperature
- pulse
- BP
- respiration
- **Twice daily:**
- abdominal examination – look for local peritonism and check bowel sounds
- measure abdominal girth
- **Daily:**
- FBC, U&E, stool culture
- abdominal X-ray – look for free abdominal gas or colonic dilatation >6 cm
- count stools and inspect for blood
- **Alternate days:**
- erect chest X-ray: look for gas under diaphragm

DISCHARGE AND FOLLOW-UP

- Plan home treatment regimen:
- prednisolone (not enteric coated) – reduce daily dosage by 5 mg each week to zero or previous maintenance dosage
- hydrocortisone foam enema 10% 12–24 hrly
- mesalazine (Octasa® MR) – usually 800 mg 8-hrly but higher doses (up to 4.8 g/day) can be used if needed
- nutritional support, as advised by dietitian
- If outpatient colonoscopy or barium enema not already performed, arrange in consultation with consultant gastroenterologist
- Arrange follow-up in gastrointestinal outpatient clinic after 4 weeks
- Give patient information literature (available from gastroenterology department) and encourage membership of Crohn's and Colitis UK (www.crohnsandcolitis.org.uk)

ASSESSMENT OF CHEST PAIN SUSPECTED TO BE CARDIAC IN ORIGIN ● 1/2

Use this guideline after an initial clinical assessment fails to identify a more likely explanation for chest pain other than angina or acute myocardial infarction. Do not use indiscriminately in all patients presenting with chest pain

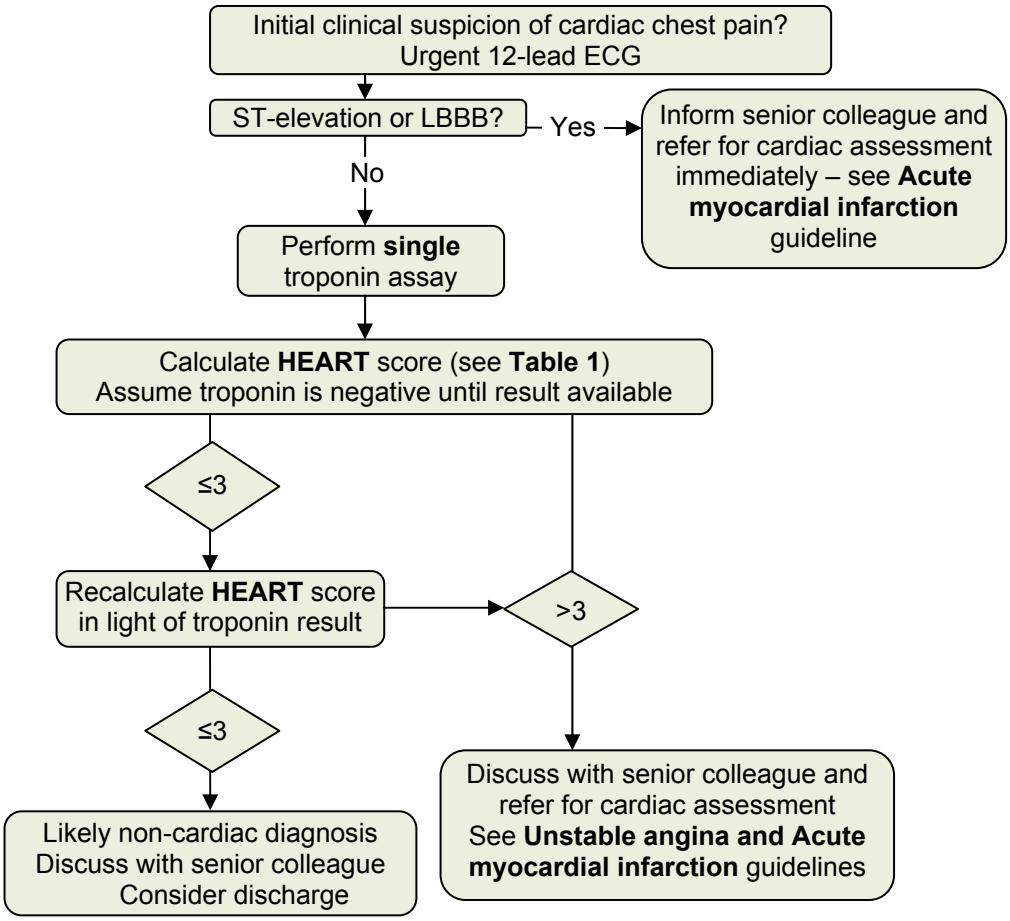
CLINICAL ASSESSMENT

- Evaluate clinical presentation and assess cardiac risk factors (see **Figure 1**)
- Perform 12-lead ECG on arrival and before discharge. Repeat if further episodes of pain occur
- If ST elevation present – see **Acute myocardial infarction** guideline

TREATMENT

- Aspirin 300 mg oral (chew and swallow)
- Glyceryl trinitrate 400 microgram/metered dose, spray 1–2 doses under tongue then close mouth
- Diamorphine – see **Acute myocardial infarction** guideline

Figure 1: Initial management of emergency presentation with suspected cardiac chest pain



HEART SCORE IN EMERGENCY PRESENTATION WITH SUSPECTED CARDIAC CHEST PAIN

- HEART score is a clinical risk scoring system for predicting adverse outcome (death, myocardial infarction or coronary revascularisation procedure)
- HEART score is the sum of scores from each of 5 'predictor domains' – see **Table 1**
- The calculation of a **total score** stratifies patients into 3 risk groups for adverse outcomes:
- low (total score 0–3)
- moderate (total score 4–6)
- high (total score ≥7)

ASSESSMENT OF CHEST PAIN SUSPECTED TO BE CARDIAC IN ORIGIN ● 2/2

Table 1: Composition of HEART score

Domain	Classification	Score
History Level of suspicion of cardiac chest pain (see **Table 2**)	• Highly suspicious: specific features dominate	2
	• Moderately suspicious: mixture of specific and atypical features	1
	• Non-specific: no specific features	0
ECG	• Significant ST depression (in the absence of bundle branch block, left ventricular hypertrophy or digoxin therapy)	2
	• Any other abnormality	1
	• Normal	0
Age	• >65 yr	2
	• 45–65 yr	1
	• <45 yr	0
Risk factors (see text for details)	• ≥3 risk factors or known atherosclerosis	2
	• 1 or 2 risk factors	1
	• 0 risk factors	0
HS Troponin I	• >80 ng/L	2
	• 40–80 ng/L	1
	• <40 ng/L	0

Table 2: Specific features of cardiac chest pain

Site	Character	Radiation	Provoking factors	Relieving factors	Associated symptoms	Duration
• Central • Retrosternal	• Pressure • Heaviness • Squeezing • Burning, indigestion like	• Arm(s) • Neck • Jaw • Gums	• Exercise • Stress • Cold temperature • Lying down	• Rest • GTN	• Nausea • Sweating • Breathlessness	• >15 min

Risk factors

- The number of risk factors for coronary artery disease that are present determines the score for this domain. The risk factors taken into account are:
  - diabetes mellitus
  - smoking – current or recent (<90 days)
  - hypercholesterolaemia
  - family history of coronary artery disease
  - obesity
- If patient has none of these risk factors, score zero points
- For 1 or 2 risk factors, score 1 point
- For ≥3 risk factors, score 2 points
- Two points are also scored for a history of:
  - coronary revascularisation
  - myocardial infarction
  - stroke
  - peripheral arterial disease

DISCHARGE FROM EMERGENCY PORTAL

- Ensure patient is pain free
- Repeat ECG before discharge
- Request senior doctor review
- Complete discharge summary – inform GP of ECG and troponin I results
- Give patient an information sheet

UNSTABLE ANGINA ● 1/3

RECOGNITION AND ASSESSMENT

Definition

- Acute coronary artery syndromes comprise myocardial infarction and unstable angina, and are currently distinguished by history, ECG and presence or absence of cardiac biomarkers of myocardial injury. The history is important and severe disease can be present even without elevation of cardiac biomarkers of myocardial injury
- Raised markers signify myocardial infarction, not unstable angina
- A raised troponin I concentration can suggest myocardial necrosis but can also occur in a number of other conditions:
- auto-immune disease
- congestive cardiac failure
- critical illness
- dilated cardiomyopathy
- extreme physical effort
- hypertension
- hypothyroidism
- multiple injury
- myocarditis
- pericarditis
- pneumonia
- pulmonary embolism
- renal failure
- sepsis/septic shock
- subarachnoid haemorrhage
- tachyarrythmias
- vasculitis

Notes on clinical interpretation of troponin I results

- Two serial results <40 ng/L indicate a low risk of myocardial necrosis
- A rise **or** fall in troponin I of 20% reflects a potentially significant change. The greater the magnitude of change between 2 results, the greater the likelihood of acute myocardial infarction (AMI)
- Troponin I is a marker of myocardial necrosis and **not** a specific marker of AMI. Always interpret results in conjunction with **clinical history and ECG findings**
- A stable elevation in troponin I indicates chronic structural heart disease. All troponin I results ≥40 ng/L are important and predict an adverse outcome; it is therefore important to determine the cause
- Troponin is a tool to **assist** in diagnosis. Other findings and clinical judgement **must** be used when determining the cause of acute chest pain
- **Unstable angina is:**
- onset of **frequent** attacks of angina for the first time, **or**
- sudden worsening of previously stable angina without change in medical treatment, **or**
- recurrent angina at rest

An attack of angina that lasts >20 min or keeps recurring despite repeated use of glyceryl trinitrate (GTN) is an indication for immediate admission to hospital

Symptoms and signs

- Central chest pain/tightness or discomfort (pain can also occur in arms, shoulders, throat, jaw, teeth, back or upper abdomen)
- Breathlessness

Investigations

- ECG on admission, during further episodes of chest pain, and 24 hr after admission
- ST segment **depression** occurring only during pain suggests myocardial ischaemia (consider acute posterior infarction if seen in leads V1–3 only and slow to resolve; check V4R and V7–9)
- ST segment **elevation** occurring only during pain suggests coronary artery spasm (Prinzmetal angina) or acute infarction
- ST segment **elevation** that does not resolve rapidly after giving GTN suggests acute infarction – see **Acute myocardial infarction** guideline
- subsequent occurrence of deep symmetrical T-wave inversion without Q waves suggests ischaemia or NSTEMI
- Locally available cardiac biomarkers FBC, INR, APTT U&E
- Random cholesterol
- Random glucose and HbA_{1c}

UNSTABLE ANGINA ● 2/3

Differential diagnosis

Chest pain with possible ECG changes

- Pulmonary embolism
- Aortic valve disease
- Hypertrophic cardiomyopathy

Chest pain where ECG changes unlikely

- Biliary colic
- Peptic ulcer
- Oesophageal pain
- Musculoskeletal pain
- Mitral valve prolapse

IMMEDIATE TREATMENT

- Aspirin 300 mg oral (chew and swallow)
- Glyceryl trinitrate spray to relieve symptoms: 400 microgram/metered dose spray 1–2 doses under tongue then close mouth
- Bisoprolol 2.5 mg oral daily (or diltiazem 60 mg oral 8-hrly if beta-blocker contraindicated)
- Prescribe fondaparinux 2.5 mg once daily by SC injection

Risk of bleeding is increased in patients with low body weight (<50 kg), physiological frailty, severe liver or renal failure (eGFR <20 mL/min), thrombocytopenia or defective platelet function and following surgery, trauma or haemorrhagic stroke. Seek advice from appropriate team e.g. cardiology, renal, liver or haematology

Referral to cardiology

- Admit all patients with unstable angina with **dynamic** ECG changes (ST or T wave inversion) under the care of the duty consultant cardiologist via CCU

Patients with ST segment depression on ECG – consider for urgent coronary angiography with a view to revascularisation. Contact on-call cardiology SpR

- If troponin I raised and myocardial necrosis suspected, start clopidogrel (300 mg loading dose followed by 75 mg daily) whilst awaiting cardiology opinion – see **Management of NSTEMI** in **Acute myocardial infarction** guideline
- Refer to on-call cardiology team (07936 182946), for further management, patients who have:
- failed to respond to initial treatment
- ECG changes as above
- ongoing pain or ST segment depression/T-wave inversion
- positive cardiac biomarkers indicative of myocardial injury
- haemodynamic instability, arrhythmia
- early post-infarction unstable angina

SUBSEQUENT MANAGEMENT

- Aspirin 75 mg oral daily
- Continue beta-blocker (use diltiazem only if beta-blocker contraindicated)
- Atorvastatin 80 mg once daily for all acute coronary syndromes, unless history of CKD present when atorvastatin 20 mg once daily is used
- **If responding:**
- after 48 hr, if pain controlled, substitute isosorbide mononitrate SR 60 mg each morning for GTN spray (to minimise possibility of headache
- **If not responding:**
- GTN infusion – see **Glyceryl trinitrate** guideline

Patients who fail to settle or whose GTN infusion cannot be withdrawn – consider for urgent coronary angiography with a view to revascularisation. Contact on-call cardiology SpR

- Diamorphine 5 mg (2.5 mg in elderly or frail patients) by slow IV injection (1 mg/min)
- Metoclopramide 10 mg IV over 1–2 min (5 mg in young adults 15–19 yr <60 kg); allow ≥8 hr before repeating
- If ECG changes or markers of myocardial injury suggest acute infarction – see **Acute myocardial infarction** guideline

UNSTABLE ANGINA ● 3/3

MONITORING TREATMENT

- Hourly pulse and BP during GTN infusion until stable, then 4-hrly
- Repeat ECG after 24 hr

DISCHARGE AND FOLLOW-UP

- Discharge patients whose pain has settled; whose ECG had no dynamic ECG changes and markers of myocardial injury did not become abnormal
- Patients should be fully mobile and be able to climb stairs (assuming no other handicap precludes this)
- Patients with ongoing chest pain or dynamic ECG changes during their admission – refer to cardiology
- Positive troponin in the context of typical chest pain and dynamic ECG changes constitutes myocardial infarction in most cases – refer to cardiology

Reconsider diagnosis and investigate further if appropriate

- If no alternative diagnosis more likely than unstable angina:
- continue aspirin, and beta-blocker or diltiazem (convert to equivalent once daily dose), statin and isosorbide mononitrate SR. Ensure GTN 400 microgram spray for sublingual use has been prescribed TTO and patient has been counselled on use
- give dietary advice to all patients
- review and address risk factors (smoking, hypertension, hyperlipidaemia, diabetes, obesity)
- if patient suitable for revascularisation, refer to cardiologist for further evaluation by stress testing. If patient able to perform exercise test and has no clinical signs suggestive of aortic stenosis or hypertrophic cardiomyopathy, request exercise ECG testing at the same time as an outpatient appointment
- If diagnosis of cardiac chest pain speculative, order an exercise test directly under admitting consultant rather than through a cardiologist

ACUTE MYOCARDIAL INFARCTION ● 1/5

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Severe, persistent chest pain
- Dyspnoea
- Fear
- Pallor
- Sweating
- Anxiety
- Peripheral vasoconstriction
- Shock

Investigations

- ECG (see below)
- Locally available cardiac biomarkers of myocardial injury
- Acute coronary artery syndromes comprise myocardial infarction and unstable angina, and are currently distinguished by history, ECG and presence or absence of cardiac biomarkers of myocardial injury
- Raised cardiac biomarkers signify myocardial infarction, not unstable angina
- A raised troponin I concentration can suggest myocardial necrosis but can also occur in a number of other conditions:
  - auto-immune disease
  - congestive cardiac failure
  - critical illness
  - dilated cardiomyopathy
  - extreme physical effort
  - hypertension
  - hypothyroidism
  - multiple injury
  - myocarditis
  - pericarditis
  - pneumonia
  - pulmonary embolism
  - renal failure
  - sepsis/septic shock
  - subarachnoid haemorrhage
  - tachyarrythmias
  - vasculitis
- Plasma cholesterol (within 12 hr of onset of symptoms; otherwise leave for at least 6 weeks)
- Venous blood glucose and HbA_{1c}
- FBC, INR, APTT

IMMEDIATE TREATMENT

- Aspirin 300 mg (chew and swallow)
- Diamorphine 1 mg/min IV until pain relieved, up to maximum 10 mg (5 mg in elderly or frail patients)
- Metoclopramide 10 mg IV over 1–2 min (5 mg in young adults 15–19 yr <60 kg) with ≥8 hr before repeating
- Oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Bisoprolol 2.5 mg oral daily, **unless contraindicated** (e.g. decompensated heart failure, bradycardia) – see BNF
- Atorvastatin 80 mg once daily for all acute coronary syndromes, unless history of CKD present. Start with atorvastatin 20 mg once daily if history of CKD
- **Admit** all patients with **acute myocardial infarction (MI)**, or **unstable angina with acute ST depression** and/or **raised troponin I** to CCU under the care of duty consultant cardiologist
- If ECG shows **ST elevation MI (STEMI**), follow **Management of STEMI**
- If patient has a **Non-ST elevation MI (NSTEMI)**, follow **Management of NSTEMI**

MANAGEMENT OF STEMI

- Default strategy for STEMI management for patients presenting within UHNM is primary angioplasty (pPCI)
- Contact on-call cardiology SpR (07936 182946) **immediately** for immediate transfer and treatment
- Administer loading dose of aspirin (300 mg oral) if not already given, and either clopidogrel [600 mg oral (unlicensed dose)] or prasugrel (60 mg oral) immediately
- (prasugrel if age <75 yr, weight >60 kg, and no previous TIA/stroke or severe liver impairment; clopidogrel if age >75 yr, weight <60 kg or previous stroke or TIA)
- if decision is **not** for primary angioplasty, only give thrombolytic therapy if directed by on-call cardiology service – then follow **Thrombolytic therapy (STEMI)**. Usually a contraindication for primary angioplasty is a contraindication for thrombolysis
- If thrombolysis is to be administered, contact on-call cardiology SpR (07936 182946) **immediately** for transfer to ward/CCU

Primary PCI

- Ensure patient loaded with appropriate antiplatelet agents; aspirin 300 mg oral plus prasugrel 60 mg oral **or** clopidogrel 600 mg. Contact on-call cardiology team
- Transfer patient directly to catheterisation laboratory or CCU, after discussion with cardiology SpR

Thrombolytic therapy (STEMI)

Indications

- Presentation within 12 hr of onset of symptoms
- Typical cardiac chest pain persisting for >30 min
- >1 mm ST segment elevation in 2 or more precordial leads or 2 or more bipolar leads **or** >1 mm ST segment depression in leads V1–V3 (suggesting acute posterior infarction) **or** LBBB with any of the following in leads V1–V3:
- >1 mm ST segment depression
- >1 mm ST segment elevation where QRS complex positive
- >5 mm ST segment elevation where QRS complex negative

Contraindications

- **Absolute:**
- active bleeding
- **Relative:**
- major trauma/major surgery within previous 4 weeks
- stroke/TIA within previous 3 months
- confirmed subarachnoid haemorrhage at any time
- traumatic cardiac massage or intracardiac injection
- known bleeding disorder
- active dyspepsia or history of GI haemorrhage
- sustained systolic BP ≥180 mmHg
- proliferative retinopathy
- recent head injury
- pericarditis
- INR >2.0

Cardiogenic shock and ventricular arrhythmias are not contraindications to thrombolysis. There is no upper age limit for this treatment

Choice of agent

- Standard agent is tenecteplase (Metalyse). Tenecteplase should be administered on the basis of body weight, with a maximum dose of 10,000 units (50 mg tenecteplase) according to the table below

Body weight (kg)	Tenecteplase (units)	Tenecteplase (mg)	Corresponding volume of reconstituted solution (mL)
<60	6,000	30	6
≥60 to <70	7,000	35	7
≥70 to <80	8,000	40	8
≥80 to <90	9,000	45	9
≥90	10,000	50	10

- Administer by giving unfractionated heparin 5000 units by IV bolus, followed by tenecteplase administered as a single IV bolus over approximately 10 seconds, then give unfractionated heparin 1000 units/hr via infusion pump for 48 hr, adjusting dose to maintain APTT ratio 1.5–2.0
- In the elderly (>75 yr) not already given thrombolysis, give streptokinase 1.5 million units in 100 mL of sodium chloride 0.9% by IV infusion over 1 hr
  Streptokinase can be re-administered within 3 days of first administration but, after 5 days, the likely presence of streptokinase antibodies precludes its further use for at least 12 months

Complications

- Hypotension – if occurs *de novo*, review for cardiogenic shock, mitral regurgitation or tamponade. If streptokinase being administered, stop IV infusion and recommence at a slower rate after BP has recovered
- Bradycardia – usually responds to atropine 300 microgram IV
- Ventricular tachycardia or idioventricular rhythm – usually self-limiting and requires no therapy. If sustained – see **Cardiac arrhythmias** guideline
- Avoid arterial puncture, central venous cannulation and IM injections in patients undergoing thrombolytic therapy, unless essential to patient care

MANAGEMENT OF NSTEMI

Treatment of choice for most patients for NSTEMI is inpatient cardiac catheterisation with early revascularisation, either by percutaneous intervention (PCI) or CABG. For patients unlikely to be suitable for an early invasive strategy because of frailty or multiple co-morbidities should have that decision made early and by an experienced clinician Refer to on-call cardiology SpR (07936 182946)

- Prescribe fondaparinux 2.5 mg once daily by SC injection
- Give clopidogrel loading dose 300 mg oral [(600 mg (unlicensed dose) in those who are unstable and likely to require catheter lab management within 24 hr)]

Risk of bleeding is increased in patients with low body weight (<50 kg), physiological frailty, severe liver or renal failure (eGFR <20 mL/min), thrombocytopenia or defective platelet function and following surgery, trauma or haemorrhagic stroke. Seek advice from appropriate team e.g. cardiology, renal, liver or haematology

NON-DIABETIC PATIENTS WITH BLOOD GLUCOSE >11 mmol/L AND ALL PATIENTS WITH DIABETES MELLITUS

- On admission, check blood glucose/HbA1c and, if blood glucose is >11 mmol/L, refer to locally approved guidance for management of hyperglycaemia in ACS patients
- In patients with diabetes/raised blood glucose, seek advice from endocrinologist/diabetes nurses early

SUBSEQUENT MANAGEMENT

- Aspirin 75 mg oral daily (to be continued indefinitely) plus:
- if STEMI and treated by pPCI with no history of CVA or TIA or cerebral bleed and age <75 yr and weight >60 kg, prasugrel 10 mg daily for 12 months
- otherwise clopidogrel 75 mg oral daily for 1 year
- Bisoprolol 2.5 mg oral daily, or atenolol 25 mg 12-hrly (to be titrated to maximum tolerated dosage and continued indefinitely)
- If no clinical suspicion of significant mitral/aortic stenosis or hypertrophic cardiomyopathy, plasma creatinine <300 µmol/L and there is no other contraindication to using ACE inhibitor, start ramipril – see **Introduction of an angiotensin-converting enzyme (ACE) inhibitor** guideline. Check electrolytes on day 3–5. Increase titration rapidly to achieve a dose on discharge as near to 10 mg as achievable
- Check statin (atorvastatin) has been prescribed, subject to renal function (see above)
- give patient information sheet
- If pain persistent, consider glyceryl trinitrate (GTN) infusion – see **Glyceryl trinitrate** guideline, or further dose atenolol 5 mg IV if heart rate >70 beats/min and systolic BP >100 mmHg
- If pain persists, contact duty cardiology team to facilitate transfer to ward /CCU

- Unless complications ensue, recommend early return to physical activity:
- mobilisation depends on revascularisation strategy, with early mobilisation and discharge by day 3 the norm post STEMI managed with an early invasive strategy
- **Refer all patients to rehabilitation co-ordinator,** who will arrange for **all** suitable patients for assessment by cardiac rehabilitation team as soon as practically possible before discharge
- patients not wishing to join rehabilitation programme – provide appropriate dietary advice
- Refer all patients treated with glucose and insulin infusions to diabetes nurse specialist to confirm presence of diabetes vs stress-induced hyperglycaemia

MONITORING TREATMENT

- Continuous ECG monitoring for 24–48 hr (longer if continuing instability or arrhythmia)
- Measure BP 4-hrly for 24 hr, then twice daily
- Daily 12-lead ECG. Plasma CK and AST on 2 consecutive days, unless troponin I already positive. If troponin is positive, no further cardiac enzyme assessments are warranted
- Observe for specific complications (more likely to occur if patient not re-perfused)

Arrhythmias

- See **Cardiac arrhythmias** guideline (seek further cardiological input)

Cardiac failure

See **algorithm** (seek further cardiological input)

- In patients with left ventricular failure (LVF) or impaired LV function, introduce an ACE inhibitor as soon as this is practical – see **Acute heart failure** guideline
- In patients with significant LVF and/or anterior Q wave infarct, arrange echocardiogram as outpatient, to document LV function and exclude LV aneurysm and/or thrombus

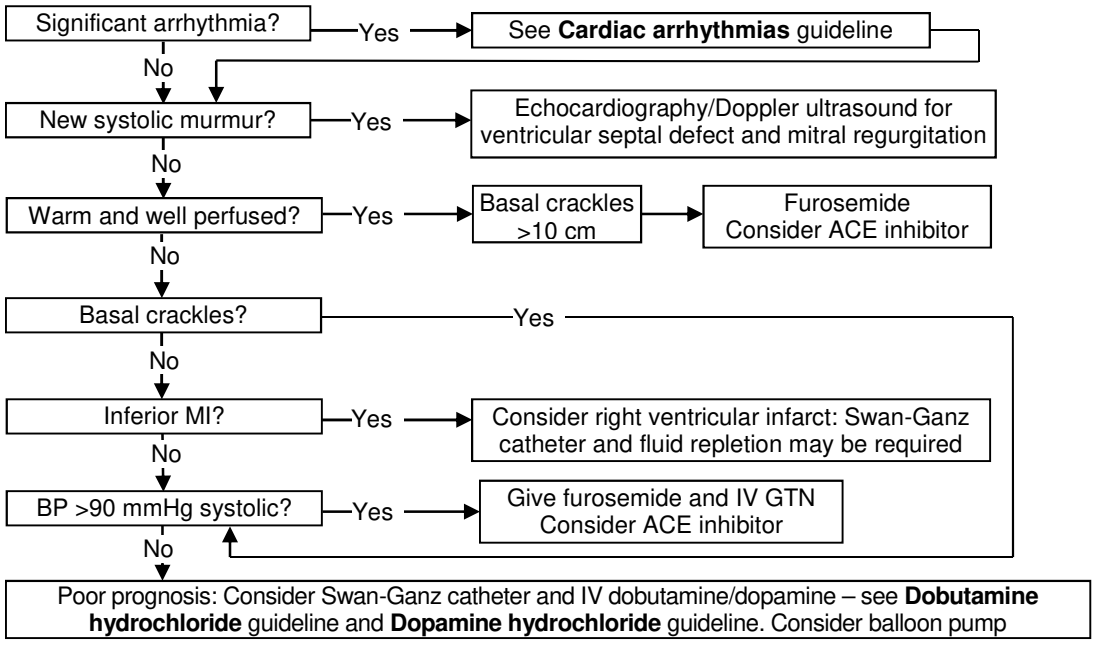
Pericarditis

- More likely after large infarcts (seek further cardiological input)
- Pain with persistent/intermittent pericardial rub 2–5 days after infarction
- Adequate analgesia (may need diamorphine). Give indometacin 25 mg oral 8-hrly if no contraindication (beware fluid retention and antagonism of loop diuretic)

Recurrent ischaemic pain (seek further cardiological input)

- Isosorbide mononitrate SR oral (GTN infusion if necessary – see **Glyceryl trinitrate** guideline)
- If persistent chest pain occurs, refer to duty cardiology team for consideration of inpatient stress testing, coronary angiography and possible inpatient revascularisation
- If re-infarction occurs during admission, contact duty cardiology team immediately

Management of cardiac failure after acute MI



Dopamine must only be used in critical care and in the coronary care unit and administered preferably via a central line

DISCHARGE AND FOLLOW-UP

- If no complications, discharge home on day 3–7
- Check risk factors for recurrent MI (e.g. smoking, hyperlipidaemia, hypertension, obesity) and advise or treat accordingly (mortality in first 2 years is doubled in those who continue to smoke and is 3.5-times greater if total cholesterol >6.5 mmol/L)
- Explain graded return to full activity (see advice booklet)
- Where appropriate, ensure patient has climbed stairs to assess for chest pain/shortness of breath
- Ensure advice booklet and chest pain alert card have been issued
- If taking atorvastatin, ensure GP letter regarding intensive statin therapy accompanies patient on discharge
- Warn about post-infarct angina
- Ensure GTN 400 microgram spray for sublingual use has been prescribed TTO and patient has been counselled on use
- Advise not to drive as per DVLA rules and check with insurer (Group 2 drivers must notify DVLA, taxi drivers must notify local council)
- Ensure referral has been made to cardiac rehabilitation team
- Check that rehabilitation plan has been made
- Middle grade in cardiology will be able to review patients who attend as an outpatient at cardiac rehabilitation. Rehabilitation co-ordinator will arrange
- If patient declines cardiac rehabilitation or is unsuitable for programme, refer to cardiology follow-up clinic
- Check that follow-up has been arranged in diabetic clinic for all patients treated with glucose and insulin infusions

Follow-up clinic visit

- Ask about smoking, exercise and weight reduction
- Ask about angina – if occurring, consider referral for angiography
- Look for signs of heart failure and measure BP
- Check cholesterol
- If patient has not been to catheter laboratory, consider treadmill exercise
- Encourage return to work 1–3 months after infarction
- Resume driving 1 month after infarction (except Group 2 drivers)
- Unless there are contraindications, all patients should be taking the following treatment

STEMI

- ACE inhibitor (target dose ramipril 10 mg or equivalent)
- Statin therapy (target dose atorvastatin 80 mg or equivalent, unless history of CKD)
- Beta-blocker (target dose to achieve heart rate of 60 bpm at rest)
- Aspirin (75 mg) indefinitely
- If STEMI and treated by pPCI with no history of CVA or TIA or cerebral bleed and age <75 yr and weight >60 kg, prasugrel 10 mg daily for 12 months
- otherwise clopidogrel 75 mg oral daily **for 1 yr**

NSTEMI

- ACE inhibitor (target dose ramipril 10 mg or equivalent)
- Statin therapy (target dose atorvastatin 80 mg or equivalent, unless history of CKD)
- Beta-blocker (target dose to achieve heart rate of 60 bpm at rest)
- Aspirin (75 mg) indefinitely
- Clopidogrel 75 mg oral daily **for 1 yr**

THORACIC AORTIC DISSECTION ● 1/3

TYPE A AORTIC DISSECTION

Type A dissection involves the ascending aorta; and usually requires surgery

RECOGNITION AND ASSESSMENT

If aortic dissection suspected, refer for urgent investigation. Do not delay; mortality is 1% per hour and can be reduced by prompt treatment

"Type A" thoracic dissection involves the ascending aorta and managed by cardiothoracic surgery. Uncomplicated "Type B" dissection does not and is managed conservatively by cardiology.
(Abdominal aortic dissection is managed by vascular surgeons)

AID TO DIAGNOSIS OF ACUTE AORTIC DISSECTION (AD)

- Presentation of acute aortic syndromes can be very variable and a high index of suspicion is required
- The following table and diagnostic aid can help improve diagnostic accuracy and guide investigation

Clinical data useful to assess the probability of acute aortic syndrome

High risk conditions	High risk pain features	High risk examination features
• Marfan syndrome • Other connective tissue disease • FH of aortic disease • Known aortic valve disease • Known thoracic aortic aneurysm • Previous cardiac surgery or cardiological procedure	• Abrupt onset • Severe intensity • Ripping or tearing • Pain can be in any of: chest, back or abdomen	• Systolic BP difference (≥20 mmHg) • Focal neurology associated with pain • Evidence of pulse/perfusion deficit • AR murmur (new and with pain) • Hypotension/shock

Each of the above features scores 1. (Patients who have had previous cardiac surgery, hypertension and within 6 weeks of pregnancy are also of increased risk of aortic dissection)

If patients are haemodynamically unstable with likely aortic dissection – discuss urgently with cardiothoracic surgeon and cardiologist. Meanwhile arrange CT with appropriate monitoring

Low Probability (Score 0–1)

- Carry out a D-Dimer + chest X-ray. If results are suggestive of a dissection and or clinical doubt remains: organise an urgent CT scan

High Probability (Score 2–3) or typical chest pain

- Urgent CT scan
- Urgent discussion with cardiology and cardiothoracic surgical team
- Urgent TTE for LV/RV function, aortic valve status and possible cardiac tamponade

Notes regarding symptoms and clinical signs

- Chest or back pain may radiate retrosternally or to neck, arms, interscapular area or abdomen
- Loss of consciousness or dyspnoea might be present
- Initial BP may be elevated, normal or low
- BP discrepancy between limbs may be present but pressure may be equal
- Pulse deficit, which may be variable affecting any arm or leg combination
- Perfusion deficits can lead to any of the following:
  - abdominal pain, bloody diarrhoea, absent bowel sounds
  - renal failure
  - paraplegia
  - limb ischaemia
- Cardiac tamponade or evidence of myocardial infarction (MI) if dissection affects aortic root
- CVA symptoms

THORACIC AORTIC DISSECTION ● 2/3

INVESTIGATIONS

- Chest X-ray: PA film may show mediastinal widening but is not always present – absence does not exclude the diagnosis
- ECG: may be normal or can show myocardial ischaemia
- U&E, glucose
- FBC, clotting
- Group & save
- D-Dimer
- Arrange contrast CT scan of chest without delay regardless of renal function. CT imaging should extend from the jaw to knee (to assess dissection extent, organ mal-perfusions, and sites for safe cannulation)

The role of D-Dimer

- If D-dimers are elevated, the suspicion of aortic dissection is increased
- Typically, the level of D-dimers is immediately very high, compared with other disorders in which the D-dimer level increases gradually
- D-dimers yield the highest diagnostic value during the first hour
- If the D-dimers are negative, aortic intra-mural haematoma or penetrating aortic ulcer may still be present, but D-Dimers are a useful addition to the diagnostic approach

IMMEDIATE TREATMENT

Nil-by-mouth. Do not give anti-platelet or anticoagulation medications
Refer urgently to cardiothoracic surgeons – call 71491

Pain and BP

- Control pain initially with intravenous opiates
- Maintain systolic BP between 100–120 mmHg. Give labetalol by IV bolus injection over at least 1 min – see **Labetalol** guideline and repeat if necessary until systolic BP <120 mmHg
- Once systolic BP 100–120 mmHg, maintain with IV infusion of labetalol – see **Labetalol** guideline
- If labetalol infusion fails to control BP, **ADD** IV infusion of glyceryl trinitrate (GTN) [50 mg in 50 mL sodium chloride 0.9% at 0.6 mL/hr (10 microgram/min), increasing to a maximum of 12 mL/hr (200 microgram/min)] – see **Glyceryl trinitrate** guideline

Surgery

- **Surgery is the treatment of choice for acute type A aortic dissection which has a mortality of 50% within the first 48 hr if not operated on**
- Despite improvements in surgical and anaesthetic techniques perioperative mortality (25%) and neurological complications (18%) remain high. However, surgery reduces 1-month mortality from 90% to 30%

TYPE B AORTIC DISSECTION

- Can be managed medically unless complicated. Consider surgical correction if:
- increasing aortic size (propagation) or increasing haematoma size
- compromise of major branches of the aorta
- impending rupture
- persistent pain despite adequate pain management
- bleeding into the pleural cavity
- development of saccular aneurysm

OTHER ACUTE AORTIC SYNDROMES

- Intra-mural haematomas (IMH) and penetrating atherosclerotic ulcers (PAU) can also present acutely with similar pain to dissection and should be managed in the same way as AD

MONITORING TREATMENT

- Early involvement of ITU/CCU with transfer to the appropriate level 2/3 facility
- Temperature, pulse, BP every 30 min, until clinically stable
- Urine output hourly, until clinically stable

DISCHARGE AND FOLLOW-UP

- Rehabilitation from neurological or vascular complications may be necessary before discharge
- Discharge when BP controlled and clinically stable
- Initial follow up in cardiac surgical clinic
- Consider referral to specialised aorta clinic – particularly if any of the following features are present:
- family history of aortic disease or sudden death
- aged ≤55 yr
- bicuspid aortic valve or Marfan syndrome
- Patients with severe/difficult to control hypertension should be referred to a hypertension clinic

Specialist aorta clinics – consultants in charge

University Hospital Birmingham:	Dr Paul Clift
University Hospitals of Coventry and Warwickshire:	Dr Dawn Adamson
University Hospitals of North Midlands:	Dr Diane Barker
Royal Wolverhampton Hospital Trust:	Dr Paul Woodmansey

CARDIAC TAMPONADE ● 1/2

RECOGNITION AND ASSESSMENT

Patients at risk

- Recent cardiac surgery
- Diagnosis of malignancy
- Following myocardial infarction
- Chest trauma

Symptoms and signs

- Dyspnoea
- Decreased conscious level
- Right heart failure (if tamponade chronic)
- Hypotension (systolic BP <100 mmHg)
- Systolic BP falls by >10 mmHg during inspiration
- Raised jugular venous pressure (JVP)
- Rise in JVP with inspiration (it normally falls with inspiration)
- Soft heart sounds
- Heart rate >80 beats/min
- Oliguria or anuria

Investigations

- U&E
- Chest X-ray
- ECG
- Echocardiogram

Life-threatening features

- Severe symptoms
- Signs of shock (tachycardia >100 beats/min, BP <100 mmHg) with marked hypotension during inspiration
- Large effusion on chest X-ray and/or echocardiogram, with evidence of right ventricular (RV) diastolic collapse on echocardiogram

IMMEDIATE TREATMENT

- If life-threatening features are present, contact cardiology team to arrange immediate echocardiography to confirm diagnosis:
  - if effusion confirmed, cardiology team will arrange immediate aspiration
  - a pericardial drain can be left *in situ* for several days to facilitate drainage of a large effusion
- If features of effusion present without life-threatening features, contact cardiology team to arrange echocardiography within 24 hr to confirm diagnosis:
  - if echocardiogram suggests effusion is large, pericardial aspiration for diagnostic purposes can be carried out safely
- Ensure pericardial fluid sent for biochemical (protein, glucose, LDH), microbiological (MC+S, mycobacterial culture, differential cell count) and cytological investigation, to aid diagnosis

SUBSEQUENT MANAGEMENT

- Consider possible causes of pericardial effusion and refer to cardiology and other appropriate specialities (e.g. renal/haematology)
- Arrange appropriate further investigations (seek specialist advice if necessary) for:
  - malignant disease
  - acute pericarditis
  - chronic renal failure
  - connective tissue disease
  - cardiac rupture complicating myocardial infarction, trauma or cardiac catheterisation
  - recent cardiac surgery
  - extension of aortic dissection
- If effusion recurs, contact cardiology team to consider instillation of chemotherapeutic agents into pericardial space or creation of percutaneous or surgical pericardial window

CARDIAC TAMPONADE ● 2/2

MONITORING TREATMENT

- Temperature, pulse, BP and urine output hourly if shocked, decreasing to 4-hrly and then twice daily in stable patients

DISCHARGE AND FOLLOW-UP

- When haemodynamically stable and effusion tapped, remove aspirating needle or drain
- Follow-up and further treatment depends on underlying diagnosis

OVERVIEW OF HEART FAILURE

- The table below provides definition criteria, risk stratification and management strategies for heart failure syndrome, considering the aetiology and mechanism of cardiac dysfunction

1. Suspicion of heart failure i.e. at time of first clinical assessment		
Key points of heart failure diagnostics	**Considerations and actions**	**Potentially high risk – refer to cardiology as inpatient**
Clinical diagnosis of the heart failure syndrome – **probable heart failure syndrome**	• Diagnosed by: ◦ symptoms of congestion ◦ signs of congestion such as oedema/elevated JVP ◦ elevated BNP ◦ presentation unlikely to be by any other non-cardiac cause • Actions: ◦ fluid management with diuretics ◦ co-morbidity optimisation ◦ contact heart failure nurses for help with fluid management or patient suitable for SHINE clinic	High risk = heart failure syndrome **and** additional: • Acute pulmonary oedema • Cardiogenic shock • New or worsening valve disease or murmur • ACS • Syncope • Arrhythmia poorly responsive to simple therapies • Recurrent hospitalisation for heart failure • Heart transplant candidate
Ensure echocardiogram within past 6 months matches clinical presentation, if not order echo		
2. Confirmation of heart failure and 'commonality ' treatments i.e. after availability of imaging – for heart structure and function		
Mechanism of heart failure – **definitely heart failure syndrome – refer to heart failure team**	**Ensure heart failure team contacted** **If LVSD then:** • Fluid and co-morbidity management and if suitable start (preferably pre-discharge): ◦ ACEI/ARB ◦ B-blocker once euvolaemic ◦ aldosterone antagonist **If not LVSD then:** • Fluid and co-morbidity management • Ensure that imaging result commensurate with clinical presentation	High risk includes: • Failure to respond to diuretics • Severe valve disease • Causal pericardial disease • EF<35% +/- bundle branch block • Cardiomyopathy suspected • Pulmonary hypertension with normal left heart size and function • Intra-cardiac mass or thrombus
Refer to heart failure nurses for full patient self-management and education programme pre-discharge		
3. Specific treatments aimed at specific aetiologies of the heart failure syndrome i.e. consider pre-discharge treatments for specific aetiologies		
Aetiology of mechanism **– if relevant discuss with on-call cardiology registrar/heart failure nurse**	• Unknown and: ◦ immaterial ◦ investigations pending ◦ awaiting discussion with cardiology • Known/newly diagnosed and caused by: ◦ ischaemic heart disease ◦ valvular heart disease ◦ hypertension ◦ pericardial disease ◦ cardiomyopathy ◦ arrhythmia related	High risk includes: • ACS/ongoing angina • Severe valve disease • Pericardial disease • Malignant hypertension • Cardiomyopathy • Refractory arrhythmias • Suspected pulmonary arterial hypertension • Intra-cardiac mass or thrombus
4. Ensure holistic care and reduce risks of readmission		
5. Ensure co-morbidities pre-disposing to aetiology optimally managed		
Discharge planning – ensure seen by heart failure team pre-discharge		
6. Follow up – ensure all suitable patients referred to heart failure nurse service and to cardiac rehabilitation and documented if referred to cardiology or palliative care as outpatient		

Specialist contact numbers

- Heart failure nurses – contact via heart failure bleep 07623611301, an OrderComs generated on ICM, email h.failure@nhs.net or in SHINE clinic on 01782 672800
- Cardiology on-call registrar (bleep 15107 or 07623615254) – see pathway for high risk features

RECOGNITION AND ASSESSMENT

Heart failure is not a diagnosis in itself, and always has an underlying cause

Symptoms and signs

- Breathlessness
- Swelling of feet and ankles
- Orthopnoea
- Paroxysmal nocturnal dyspnoea
- Wheeze

- Tachycardia
- Hypertension/hypotension
- Raised jugular venous pressure (JVP)
- Gallop rhythm
- Valvular heart disease – murmur
- Peripheral oedema
- Pulmonary oedema – crackles on chest auscultation
- Hepatic congestion – hepatomegaly, ascites

Differential diagnosis

- Chronic obstructive pulmonary disease (COPD)
- Acute severe asthma
- Pneumonia
- Pulmonary embolism
- Interstitial lung disease
- Anaemia
- Dependent oedema resulting from immobility
- Renal failure/nephrotic syndrome
- Cirrhosis

Investigations

- Chest X-ray – other causes of SOBOE
- ECG – useful for rate rhythm or dynamic ischaemic abnormalities
- FBC – exclude anaemia as a cause of symptoms
- U&E, LFT, Troponin I, TSH, glucose and fasting serum lipids
- BNP – see below
- If patient has dyspnoea at rest or severe pulmonary oedema, arterial blood gases (ABG)

BNP

Remember BNP is not a diagnostic test for heart failure it is merely a marker of heart strain (Table 3). Its utility is mainly as a rule-out test but a BNP <100 ng/L does not mean patient does not have heart failure it just means it is less likely

- Measure serum natriuretic peptides (BNP or NT-proBNP) before referral for echocardiography

Table 1: Interpretation

BNP (ng/L)	Interpretation	Action
<100	Heart failure unlikely	Explore alternative diagnosis
100–400	Heart failure possible if other causes of clinical presentation excluded	Echocardiogram (see guidance)
>400	Heart failure likely	Echocardiogram (see guidance)

Echocardiogram

- **Consider inpatient request** if suspected heart failure – request echocardiogram **only** if no prior echo **or**:
- no echo in last 6 months that explains symptoms **and** BNP >100 ng/L
- new or worsening symptoms (or murmur) since last echo (and last echo did not show severe cardiac structural abnormality)
- in patients presenting with murmurs likely to have caused heart failure, likely to be candidates for cardiac surgery
- where heart failure is unresponsive to initial treatment, (**and** more aggressive treatment would be appropriate for patient) discuss with cardiology registrar for an urgent echocardiogram

IMMEDIATE TREATMENT

- Treatment options for probable heart failure involves fluid and co-morbidity optimisation – contact specialist heart failure nurses

Fluid management

- If patient has congestive symptoms unresponsive to their admission dose of diuretics consider either the equivalent 24 hr total diuretic dose or higher (up to 2 times usual dose) of furosemide by either a slow IV injection (as single or multiple doses) or 24 hr infusion. Choice of repeated/single or continuous 24 hr regimen does not affect clinical outcome. Larger doses resolve dyspnoea sooner, but can be at the expense of increasing creatinine
- Give IV dose no faster than 4 mg/min to reduce risk of ototoxicity
- Aim to achieve >0.5 kg weight loss daily. If not achieved and patient remains congested, either increase 24 hr total furosemide by 40–80 mg IV (to a maximum of 240 mg over 24 hr) or add a low dose of thiazide diuretic e.g. 1.25–5 mg metolazone as one off single dose
- Continue until JVP normal before changing to maintenance oral dose, to maintain stable 'dry' weight. Discharge patient when maximally decongested to optimise clinical outcome
- If patient is ambulatory but still congested- discuss with SHINE clinic – see below
- Remember that cause of persistent peripheral oedema, especially in the elderly, can be multi-factorial and does not always reflect fluid status
- If optimal fluid management difficult or complicated with deteriorating worsening renal function contact heart failure nurses

Metolazone can induce massive diuresis. Monitor patients carefully to prevent hypovolaemia or electrolyte disturbance

Refractory heart failure or probable heart failure with worsening renal function

- Contact heart failure specialist nurses for advice
- If in new atrial fibrillation with rapid ventricular rate, add digoxin – see **Digoxin** guideline
- If resistant to treatment despite these additional measures, seek advice on further management from cardiology team (15107)

Acute pulmonary oedema and cardiogenic shock

High-risk manifestations of heart failure syndrome – if appropriate consider early discussions with cardiology for help with symptom management and to determine cause for heart failure syndrome'

Table 2: Examples of causes of pulmonary oedema on chest X-ray

Cardiac Low-output heart failure	**IHD** • Arrhythmia • Valve disease • Cardiomyopathy • End-stage pericardial processes
Non-cardiac	• Infective/ARDS • Drug-related • Secondary to raised intracranial pressure • Hypoalbuminaemia • Lymphangitis carcinomatosa • Iatrogenic fluid overload
Apparent pulmonary oedema	• Lung fibrosis • Pulmonary hypertension • Underexposed chest X-ray

Improving symptoms

Avoid empirical fluid resuscitation in patients with pulmonary oedema, hypotension and normal JVP, even after right ventricular infarction
Arrange immediate echocardiogram or seek advice from cardiology team (15107)

- Nurse patient in sitting position in bed/chair
- In hypoxic patient give oxygen to maintain SpO_2 between 94–98% or, if patient at risk of CO_2 retention, 88–92%. See **Oxygen therapy in acutely hypoxaemic patients** guideline
- If previously on furosemide – see **Fluid management** above. If never been on diuretics consider furosemide 40–80 mg by slow IV injection
- if no response within 20 min, repeat similar dose by slow IV injection
- in patients with severe renal dysfunction (CKD4-5), consider giving up to 500 mg over 24 hr by IV infusion
- Consider IV glyceryl trinitrate (GTN) in specific situations such as coronary ischaemia, severe aortic or mitral regurgitation, hypertension etc. It should be initiated in a ward familiar with its monitoring and titration – see **Glyceryl trinitrate** guideline
- if GTN alone is not effective in lowering diastolic BP to <110 mmHg, consider alternatives – see **Accelerated (malignant) hypertension** guideline
- **Do not routinely give opiates**, but use with caution for specific indications such as pain or anxiety e.g. diamorphine 5 mg (1.25–2.5 mg in elderly or frail patients, or if serum creatinine >300 µmol/L) by slow IV injection (1 mg/min)
- **Consider ventilation** (invasive or non-invasive) if a person has cardiogenic pulmonary oedema with severe breathlessness and acidosis
- failure to respond to therapy
- a background of known significant lung disease
- reduced consciousness or physical exhaustion
- **Treat cardiac arrhythmias** aggressively – see **Cardiac arrhythmias** guideline
- **Assess venous thromboembolism** (VTE) risk and prescribe prophylactic low-molecular-weight heparin accordingly – see **Prophylaxis against venous thromboembolism** guideline

Treating the cause and improving haemodynamics

- **Determine aetiology of the pulmonary oedema** (see **Table 2**) and, if ACS, acute valvular dysfunction or cardiac arrhythmia, refer to cardiology urgently
- Contact cardiology registrar in appropriate patients if:
- a reversible cause for cardiogenic shock is present -Cardiogenic shock is defined as a BP falling to below 90 mmHg systolic with evidence of hypoxia, poor end organ perfusion including urine output below 0.5 mL/kg/hr
- or if patient is candidate for circulatory support e.g. dobutamine – see **Dobutamine hydrochloride** guideline, intra-aortic balloon pump (e.g. in patients suitable for revascularisation, who have reversible causes of heart failure or who are potential candidates for heart transplantation)

Always identify cause(s)/trigger factor for current decompensation and if a primary cardiac cause is suspected, refer to cardiology team as inpatient. Optimise treatment of non-cardiac conditions responsible for, or contributing to, heart failure (see Table 3)

Table 3: Examples of causes of heart failure presentations

Primary cardiac cause of heart failure Seek cardiology advice, **and** use rate control strategies for AF with digoxin in the first instance	• ACS • Valve disease • Arrhythmia – including AF • Cardiomyopathy • Significant pericardial disease • Diastolic dysfunction • Pulmonary hypertension/primary right heart failure
Heart failure secondary to comorbidity Treat the precipitant primary co-morbidity Seek cardiology advice in suitable patients if structural cardiac abnormality on echo or significant ischaemia precipitated heart failure secondary to non-cardiac presentation	• COPD • Pneumonia • Sepsis • Anaemia • Hypertension • Renal failure • Endocrine abnormalities (e.g. thyroid disease) • Nutritional deficiencies • Hypoventilatory syndromes including obesity, sleep apnoea and neuromuscular problems

- Optimising all contributory co-morbidities (**Table 3** above) will help improve patient's symptoms

Further management and discharge planning

- Patient requiring intensive heart failure treatments, but is ambulant and self-caring, not euvolaemic but would benefit from ongoing intensive heart failure treatment, consider patient for SHINE clinic

Definite heart failure

- Contact heart failure specialist nurses for patient education, self-management and treatment advice if heart failure is likely to appear on the discharge diagnosis list

SHINE – AMBULATORY HEART FAILURE CLINIC

Consider whether patients who do not have any exclusion criteria for SHINE clinic could have intensive heart failure management on an outpatient or home based basis. If so (or if you are not sure) contact SHINE clinic (01782 672800) to discuss

Inclusion criteria for SHINE clinic

- Possible/probable heart failure syndrome with 'fluid overload' – if discussed with heart failure nurses before discharge
- Patient preference is OPD care
- Patient able to attend daily to SHINE if required
- None of the exclusion criteria applies

Exclusion criteria for SHINE

- Cardiac cause mandating hospitalisation – ACS, haemodynamically unstable arrhythmia present or suspected as cause for presentation, cardiogenic shock, acute pulmonary oedema, severe acute valvular heart disease
- Need for greater supplemental oxygen than usual
- Other co-morbidity mandating hospitalisation
- Social circumstances or frailty do not permit daily visits to SHINE

SUBSEQUENT MANAGEMENT

General advice if responding

- Reduce salt intake (no added salt, avoid salty food)
- Avoid excessive fluid intake
- Smoking cessation

Specific management based on mechanism of heart failure

- Confirmed with either pre-existing or current imaging of the heart that confirms a mechanism for cardiac dysfunction

Heart failure with preserved [LV] ejection fraction

- Treatment options remain:
  - fluid
  - co-morbidity management
- **ACEI/B blockers/aldosterone antagonists have no role to play specifically for the management of this mechanism of heart failure**
- Optimise co-morbidities [e.g. hypertension, angina, renal function, AF rate control (and thromboprophylaxis), diabetes, sleep apnoea, anaemia, BMI etc.]
  - if cor-pulmonale optimise oxygenation
  - if pulmonary hypertension unrelated to pre-existing lung disease then discuss with cardiology registrar
- **If echo is truly normal reconsider the diagnosis of heart failure**
- Discuss with cardiology registrar if a restrictive cardiomyopathy such as amyloidosis suspected as underlying cause

Heart failure with reduced [LV] ejection fraction

- Treatment options are the commonality treatment considerations of:
- ACEI/ARB – see below
- b-blockers – once patient is euvolaemic – see below
- MRA
- complex device therapy if LVEF <35% and patient already on good commonality medical therapy as above

Valsartan/sacubitril (Entresto®) is a neprolysin/ARB combination drug used for chronic heart failure with reduced ejection fraction.
DO NOT START AN ACEI/ARB IF TAKING THIS MEDICATION

- **ACE inhibitors (usually first line medication before b-blockers)**
- unless clinical suspicion of critical aortic stenosis, renal function severely impaired (eGFR 20 mL/min/1.73m^2), bilateral renal artery stenosis or prior allergic reaction, introduce ACE inhibitor (ACEI) in all cases as soon as renal function stable and blood pressure sufficient for systemic perfusion – see **Introduction of an angiotensin-converting enzyme (ACE) inhibitor** guideline
  - raise dosage empirically every 2 days to maximal tolerated by time of discharge. In patients with systolic BP <90 mmHg, eGFR <30 mL/min/1.73m^2 or serum potassium >5.0 mmol/L, the very elderly and if renal artery stenosis suspected (e.g. symptoms/signs of peripheral vascular disease), proceed more slowly and by smaller dose increments
- if ACEI not tolerated because of cough, substitute angiotensin-II receptor antagonists such as candesartan
  - confirm cough not caused by pulmonary congestion before changing to candesartan
- in patients unsuitable for ACEI/ARB or with ongoing symptoms despite optimal ACEI/ARB and beta-blocker, consider hydralazine (25 mg 8-hrly) and isosorbide mononitrate/dinitrate (10–20 mg 8-hrly)
  - aim to discharge patient on maximum tolerated dose of ACEI
- **Aldosterone antagonists (eplerenone or spironolactone).** Consider starting at a dose of 12.5–25 mg daily if:
- serum creatinine <220 µmol/L
- serum potassium <5.0 mmol/L
- **Beta-blockers**
- continue b-blockers in patients admitted taking b-blockers
- reduce b-blockers in patients considered for inotropes or with bradycardias and heart failure
- **increase or initiate b-blocker once patient is euvolaemic** with heart rate >65/min and systolic BP >95 mmHg: start with low dose (e.g. bisoprolol 1.25 mg daily)
- if b-blocker initiated or increased ensure patient remains stable over next 48 hr or refer to SHINE clinic for 48 hr of monitoring – to facilitate earlier hospital discharge
- if b-blocker not initiated as inpatient, detail plan for outpatient initiation and titration

Contact cardiology registrar re complex device therapy for suitable patients on optimal medical 'commonality' treatment with an EF <35%

SPECIALIST REVIEW

- NICE recommend **early** involvement of the specialist heart failure team and discharge planning for patients with heart failure. Especially when patient on non-cardiology wards
- Heart failure nurses will provide the following services for patients with different stages of heart failure diagnosis:
- probable heart failure – fluid and co-morbidity and palliative care advice
- definite heart failure – as above and additionally patient self-management, discharge care bundle, commonality treatment (for patients with heart failure with reduced ejection fraction)
- Consider cardiologist review for the high risk features in the pathway above

Optimise time spent in hospital after an acute admission – in addition to sustaining a diuresis, take opportunity to introduce and adjust dosage of medicines that will improve symptoms, prolong life and reduce re-admission. Optimise co-morbidity management

Patients managed on non-cardiac wards

- Ensure early referral to heart failure team
- Remember specific heart failure care on a non-cardiac ward may be entirely appropriate for some patients e.g.:
  - co-morbidity expected to shorten life more than heart failure
  - co-morbidity limiting quality of life and function more than heart failure
  - profound cognitive impairment making compliance difficult
  - management plans suggesting symptom relief and palliation are the only treatment options

PALLIATIVE CARE TEAM INVOLVEMENT

- Patients with intractable symptoms and signs, whose life expectancy is likely to be <12 months
- Patients with persistent dyspnoea, nausea, vomiting, pain or depression, who are unsuitable for prognostic interventions and may, therefore, be in the palliative phase of heart failure for ≥12 months, or those who want advice about terminal care planning/hospice care
  - some patients in palliative phase of heart failure may still benefit from aggressive active cardiac interventions (e.g. IV diuretics, IV inotropes, palliative angioplasty)
  - **if likely to die of pump failure within 6–12 months,** consider to be in end-stage heart failure – highlight to GP for inclusion on **Gold Standards Framework registry** on discharge

MONITORING INPATIENT TREATMENT

- If pulmonary oedema or hypoxia suspected, ABG – repeat 2 hr after starting oxygen
- Pulse, BP and respiratory rate 4-hrly until no longer dyspnoeic at rest
  - if patient unwell or while up titrating vasoactive drugs (e.g. nitrates, inotropes), measure vital signs more frequently than 4-hrly
- Weight and fluid balance daily
- U&E – daily/alternate days
  - more frequent U&Es required when titrating up diuretic or ACEI, and in higher risk patients
- Chest X-ray – repeat after 3 or 4 days to assess response if patient presented with LVF or significant pleural effusion

DISCHARGE AND FOLLOW-UP

Preparation for discharge

- Mobilise once dyspnoea at rest subsides – prolonged bed rest is counterproductive
- Stop dalteparin on day before discharge
- Encourage patient to exercise as much as possible where symptoms allow
  - ensure patients have had red amber green self management plan and heart failure nurse pre-discharge visit before discharge
  - **ensure all patients referred to cardiac rehab service**
  - **ensure all patients referred to community heart failure nurses**

Criteria for discharge

- Discharge home once:
  - free from central and peripheral congestion (e.g. JVP normal or normalising, third heart sound resolved, etc)
  - heart failure symptoms minimised
  - renal function stable

Before discharge, give patient traffic light warning system for action should symptoms worsen

Discharge letter should include

- Confirmation of diagnosis of heart failure and evidence of cardiac dysfunction and aetiology of cardiac dysfunction. If aetiology unknown, investigations to determine aetiology or statement that aetiology will not influence future management – see pathway above
- Cause of current deterioration and subsequent inpatient treatment
- Current and planned pharmacological treatment
- Relevant co-morbidities and management plans
- Request to monitor U&E at 1–2 weeks and then after 1 month
- Whether patient referred as an outpatient or seen as an inpatient by heart failure nurses, cardiologist or palliative care team
- If patient has LVSD – who will review after titration of medications by heart failure nurses (i.e. details of follow-up for community heart failure nurses)
- Plan of action should patient deteriorate during or after titration

CARDIAC ARRHYTHMIAS ● 1/3

RECOGNITION AND ASSESSMENT

Mode of presentation dictates urgency of assessment and treatment. Treat patient first and arrhythmia second. Accurate diagnosis is not possible without a 12-lead ECG

Symptoms (in order of increasing severity/urgency)

- Palpitation
- Dyspnoea
- Chest pain
- Dizziness
- Syncope
- Cardiac arrest

Signs

- Heart rate <60 or >100 beats/min
- Hypotension (systolic BP<100 mmHg)
- Hypoperfusion
- Jugular venous pressure (JVP) elevated
- Cannon waves or flutter waves in internal jugular vein
- Variable intensity of first heart sound
- Signs of heart failure

Investigations

- Always obtain a 12-lead ECG **during attack**, unless patient unconscious with no pulse, when resuscitation takes priority – see **Cardiopulmonary resuscitation – life support procedure** guideline. A single-lead rhythm strip is an inferior alternative, but better than no ECG at all
- Urgent U&E

IMMEDIATE TREATMENT

Successful management of cardiac arrhythmias often requires specialist experience

- Correct any abnormalities of potassium – see **Electrolyte disturbances – Hypokalaemia/Hyperkalaemia** guideline

Indications for seeking urgent advice from cardiology team

- Tachycardia or bradycardia with hypotension, cardiac failure, chest pain, shock or requiring pacing
- Atrial fibrillation/flutter (AF) suitable for urgent (present for <12 hr) or elective cardioversion
- Wolff-Parkinson-White syndrome
- Junctional re-entry or ventricular tachycardia unresponsive to treatment recommended in this guideline
- Ventricular arrhythmias excluding single ectopics
- All recurrent arrhythmias

Monitor the effects of all the following treatments by continuous ECG recording

Bradycardias

- **Sinus bradycardia** may need no treatment – if symptomatic, give atropine 500 microgram IV, and repeat **once** after 5 min if necessary
- **Sinus pauses and sino-atrial block** – if episodes prolonged and symptomatic, consider pacing: contact cardiology team
- **Sino-atrial disease** manifest as tachycardia-bradycardia – seek urgent advice from cardiology team
- **Atrio-ventricular (AV) conduction block**
- first degree: no treatment necessary
- second and third degree: contact on-call cardiology SpR with 12-lead ECG
- **Intraventricular conduction block/bundle branch block** – consider pacing if:
- new appearance of bifascicular block (right bundle branch block and left axis deviation) or alternating left and right bundle branch block
- bifascicular block/trifascicular block with otherwise unexplained syncope

CARDIAC ARRHYTHMIAS ● 2/3

Tachycardias

If tachycardia associated with hypotension, shock, or cardiac failure, before giving any anti-arrhythmic drug IV, seek urgent advice from cardiology team to discuss DC cardioversion (or overdrive pacing for selected tachycardias)

- Clinical significance depends upon site of origin. Accurate diagnosis requires 12-lead ECG (paper speed 25 mm/sec, 40 msec = 1 small square)
- **Narrow (<110 msec) QRS complexes** originate from sinus node, atrium or AV junction (see below)
- **Broad (>110 msec) QRS complexes** should be considered ventricular in origin unless/until proved otherwise
- If diagnosis in doubt, try carotid sinus massage (CSM) first
- recent CVA/TIA, or known established carotid disease are contraindications to CSM
- If CSM unsuccessful, unless there is a history of wheezing, give adenosine 3 mg IV over 2 sec via a large bore cannula into antecubital fossa vein with sodium chloride 0.9% flush
- **NB:** in patients taking **dipyridamole** (which decreases adenosine metabolism), initial dose of adenosine should be 1 mg IV and subsequent doses should be halved
- if no response after 1–2 min, give 6 mg IV over 2 sec. If no response after a further 1–2 min, give 12 mg IV over 2 sec
- **NB:** in patients taking **theophylline** (which antagonises the anti-arrhythmic effect of adenosine), higher doses will usually be necessary
- obtain rhythm strip
- following adenosine, atrial tachycardias should be revealed (P waves with AV block) and junctional re-entrant tachycardias terminated; ventricular tachycardias will be unaffected, though retrograde conduction will be blocked
- If patient with pathological tachycardia haemodynamically stable with no overt heart failure or impaired ventricular function, an anti-arrhythmic drug may be given by slow IV injection provided full resuscitation facilities are available, preferably on CCU. Seek urgent cardiology team advice

Specific rhythms

- **Sinus tachycardia** is usually physiological – identify and treat cause (e.g. blood loss, heart failure, thyrotoxicosis, anaemia)
- if no obvious underlying cause, cardiac function adequate, and tachycardia inappropriate and distressing, consider oral atenolol 50 mg daily
- **Atrial tachycardia** arises from atrial myocardium – seek urgent cardiology team advice about giving flecainide 2 mg/kg IV (up to 150 mg) over 20 min
- flecainide **contraindicated** in angina, MI and heart failure, consider amiodarone for acute management
- **Atrial fibrillation** – see **Atrial fibrillation** guideline
- **Wolff-Parkinson-White syndrome** can present as AF – QRS complexes will be pre-excited (i.e. wide and bizarre) and ventricular response very fast with a tendency to degenerate to ventricular flutter and fibrillation (VF). **Never** give digoxin or verapamil but seek urgent advice of cardiology team with a view to restoring sinus rhythm with flecainide or sotalol, or DC cardioversion
- **Junctional re-entry tachycardia** usually involves AV node in re-entry circuit and is likely to be terminated by AV nodal blockade – give adenosine as above (adjust dose in patients taking dipyridamole/theophylline); or seek urgent cardiology team advice about giving verapamil 5 mg IV over 2 min (3 min if patient >65 yr), repeated if necessary at 5–10 min intervals to total 10 mg

Do not give verapamil if patient already taking a beta-blocker

- **Ventricular tachycardia** arises from ventricular myocardium. Haemodynamic consequences are related to ventricular rate and underlying left ventricular function – give lidocaine 100 mg (50 mg if patient is or estimated to be <50 kg, or whose circulation is severely impaired) IV over 2 min, repeated **only once** if necessary after 10 min
- seek urgent cardiology team advice, with a view to DC cardioversion under general anaesthesia
- **Torsade de pointes (polymorphic VT)** usually self-terminating, but often produces haemodynamic collapse – seek urgent cardiology team advice
- stop any precipitating drugs (call medicines information)
- do **not** give further anti-arrhythmic drugs
- correct serum K^+ to >4.5. Give sodium chloride 0.9%. 500 mL with potassium chloride 20 mmol IV, **as commercially prepared pre-mixed bag,** over 2 hr, with continuous ECG monitoring
- if not given earlier, give magnesium sulphate 2 g (equivalent to 8 mmol) made up to 50 mL with sodium chloride 0.9% by IV infusion over 10–15 min
- consider beta-blocker/pacing
- **VF**, if sustained, leads to cardiac arrest and must be treated by immediate electrical defibrillation (when patient unconscious)

SUBSEQUENT MANAGEMENT

General

- After any emergency treatment to revert or stabilise patient's heart rhythm, further assessment should include:
- **accurate** identification of arrhythmia – a 12-lead ECG during arrhythmia will give the diagnosis in most cases, sometimes with the addition of specific manoeuvres, such as carotid sinus massage/adenosine, or by comparison with ECG in sinus rhythm. Electrophysiological testing may be required where there is doubt
- diagnosis of cause – ECGs in sinus rhythm, Troponin I, thyroid function tests, chest X-ray
- definition of underlying heart disease – echocardiography, cardiac catheterisation where appropriate
- identification of precipitating/contributing factors – electrolytes (including Ca^{2+}, Mg^{2+}), ECG monitoring
- provocation testing where necessary (e.g. exercise testing, tilt testing, carotid sinus pressure, drug challenge, invasive electrophysiologic testing)
- for most patients with SVT/atrial tachycardia/atrial flutter, radiofrequency ablation – refer to cardiology SpR for outpatient review with electrophysiologists

If specialist intervention required for patients with serious or recurrent arrhythmias, seek advice of cardiology team

Do not use amiodarone as a first-line agent for long-term treatment because of the risk of serious adverse effects. Reserve for life-threatening arrhythmias not responding to other agents

Specific

- **Atrial fibrillation** – see **Atrial fibrillation** guideline
- **VF** – treat as per ALS guideline and seek urgent cardiology team advice to consider the following:
- if arrhythmia fails to terminate or recurs, consider and deal with possible trigger factors:
  – electrolyte abnormalities (hypokalaemia, hypocalcaemia, hypomagnesaemia)
  – anti-arrhythmic or anti-psychotropic drug toxicity
  – underlying relative bradycardia (temporary pacing will be necessary)
  – acute MI – consider urgent revascularisation by angioplasty
- for recurrent episodes, try lidocaine (with ECG monitoring) by IV infusion 4 mg/min for 30 min, then 2 mg/min for 2 hr, then 1 mg/min – reduce concentration further if continued beyond 24 hr
- for electrical storm (e.g. recurrent VF), maintain plasma K^+ >4.5, give sodium chloride 0.9% 500 mL with potassium chloride 20 mmol IV, (**as commercially prepared pre-mixed bag**) over 2 hr, with continuous ECG monitoring
- give IV magnesium sulphate 2 g (equivalent to 8 mmol Mg^{++}) made up to 50 mL with sodium chloride 0.9% by IV infusion over 10–15 min, repeated once if necessary AND atenolol 2.5 mg IV at rate of 1 mg/min, repeated at 5 min intervals to a maximum of 10 mg
- in peri-arrest situation, give IV amiodarone 300 mg as bolus injection
- in patients with ventricular tachycardia or VF occurring $\geq$48 hr after acute MI or with no obvious reversible factors, consider implantable cardioverter defibrillator
- 24-hr tape for patients with impaired LV function and IHD – if non-sustained VT present, refer to electrophysiology service for assessment for ICD implant

If intracardiac electrophysiological studies or ablation therapy contemplated, send formal referral to cardiac electrophysiology department

DISCHARGE AND FOLLOW-UP

- Refer patients with recurrent arrhythmias requiring prophylactic anti-arrhythmic treatment to a cardiologist
- Make appropriate arrangements with anticoagulation management service for follow-up of patients with AF who are anticoagulated

ATRIAL FIBRILLATION • 1/3

RECOGNITION AND ASSESSMENT

Symptoms, signs and investigations

- See **Cardiac arrhythmias** guideline

IMMEDIATE TREATMENT

There are 2 strands to effective management of AF, whether presentation acute or chronic:

- Thromboembolic risk reduction
- Rhythm/rate control

Acute AF with a rapid ventricular rate

- If patient in peri-arrest situation, follow advanced life support – see **Cardiopulmonary resuscitation – life support procedure** guideline

Rhythm control

Low priority as rate control affords the same clinical benefit as rhythm control. Be certain that AF started <24 hr previously

- If AF present for ≥24 hr or unsure of duration, follow **Rate control** below
- If AF present for <24 hr**,** seek **urgent cardiology advice** – aim is to restore sinus rhythm immediately using DC cardioversion or anti-arrhythmic drugs (amiodarone, flecainide or propafenone), unless there is a persistent underlying cause (e.g. thyrotoxicosis, mitral valve disease, pneumonia). **Drugs other than amiodarone carry a risk of pro-arrhythmia and must be used with caution**
- if unable to cardiovert immediately, give unfractionated heparin IV – see **IV unfractionated heparin** guideline, and cardiovert as soon as practicable

If unfractionated heparin commenced – see* Heparin-induced thrombocytopenia *guideline

Rate control

- **Wolff-Parkinson-White (WPW) syndrome** can present as AF. QRS complexes will be pre-excited (i.e. wide and bizarre), and ventricular response very fast with a tendency to degenerate to ventricular flutter and fibrillation (VF). **Never** give digoxin or verapamil but seek urgent cardiology advice from on-call SpR with a view to restoring sinus rhythm with flecainide or sotalol, or with DC cardioversion
- Once confident not WPW syndrome and if ventricular response to AF rapid during high sympathetic stress (e.g. pneumonia, myocardial infarction or postoperatively) and systolic BP >100 mmHg, options include:
- **either** a beta-blocker (atenolol 2.5 mg IV at 1 mg/min, which can be repeated at intervals of 5 min to a maximum of 10 mg, or 50–100 mg oral) **or** a rate-limiting calcium channel blocker (verapamil 2.5 mg IV over 3 min, which can be repeated at intervals of 5 min to a maximum of 10 mg)

Do not give beta blockers and calcium antagonists: including patients already on either drug orally

- if rate does not fall sufficiently, add digoxin (for chronic use) – see **Digoxin** guideline
- Where heart failure is a clinical issue, consider digoxin (see **Digoxin** guideline) but amiodarone for acute not chronic management – conveys greater efficacy (contact on-call cardiology re use of amiodarone)

Anticoagulation

- Consider thromboprophylaxis with DOAC or warfarin (maintenance INR 2.5) for **all** patients with sustained or paroxysmal AF or flutter. See **At a Glance Guide for the Prevention of Stroke and Systemic Embolism in Patients with Non-valvular Atrial Fibrillation** available on Trust intranet>clinicians>support-services>pharmacy>approved-guidelines or http://uhns/media/575342/150212%20At_a_glance_AF_anticoagulation_guide_FINAL_v1.0_Jan2015.pdf

ATRIAL FIBRILLATION ● 2/3

Choosing for the individual patient

The decision whether to anticoagulate is patient-specific, guided by weighing the risk of thromboembolic stroke against the adverse risk of bleeding

- Assess the risk of stroke, using the **CHA_2DS_2VASc** score
- Assess the risk of major bleeding from anticoagulation (a bleed requiring hospital admission, a blood transfusion or causing stroke) by the **HAS-BLED** score
- **If patient receiving clopidogrel for coronary stent, DO NOT DISCONTINUE, contact cardiology SpR**

CHA_2DS_2VASc score

Add 1 point for each category, except 2 points for previous stroke/TIA and age ≥75 yr

C	Congestive heart failure (or LVEF <40%)	1
H	Hypertension (ever, treated/untreated)	1
A	Age ≥75 yr	2
D	Diabetes mellitus	1
S	Stroke/TIA	2
V	Vascular disease (MI, peripheral vascular disease, complex aortic plaque)	1
A	Age 65–74 yr	1
S	Sex female	1
	Score 0 or female 1	**No antithrombotic therapy**
	Score 1 male	**Consider DOAC or warfarin**
	Score ≥2	**Offer DOAC or warfarin unless contraindicated**

HAS-BLED score. Add 1 point for each of the following categories:

H	Hypertension (systolic >160 mmHg)	1
A	Abnormal renal function (chronic dialysis, transplant, serum creatinine ≥200 µmol/L)	1
	Abnormal liver function (chronic hepatic disease or biochemical evidence (e.g. bilirubin >2 x upper limit of normal plus AST/ALT/alk phos >3 x upper limit of normal)	1
S	Stroke	1
B	Bleeding (history or predisposition e.g. diathesis, anaemia)	1
L	Labile INR (unstable/high INR)	1
E	Elderly (age >65 yr)	1
D	Drugs or alcohol (e.g. NSAIDs, antiplatelet agents, or alcohol abuse)	1 or 2
	Score ≥3	**Bleeding risk high. Caution and regular review following start of DOAC or warfarin**

- In considering whether to start DOAC or warfarin, discuss with patient and carers the risks and benefits and the need for regular therapy and, in the case of warfarin, INR checks
- HAS-BLED scoring assesses bleeding risk. A score of ≤3 indicates bleeding risk is low. However, a score of >3 does not mean patients are contraindicated for anticoagulation but caution and closer monitoring is required

If a decision is made not to anticoagulate the patient document the reason in the notes

SUBSEQUENT MANAGEMENT

Chronic AF

- For rate control, digoxin will control resting rate but not exercise rate
- prefer bisoprolol 2.5–10 mg/atenolol 50–100 mg oral daily or (if no LV systolic dysfunction/heart failure) consider calcium antagonist (verapamil 40–80 mg 8-hrly or diltiazem SR up to 300 mg/day)
- For thromboembolic risk reduction – see **Immediate treatment**

Other issues

- If sinus rhythm restored after recurrent episode of AF with no obvious precipitant (e.g. pneumonia), consider long-term prophylactic therapy
- patients with evidence of ischaemic heart disease/LV systolic dysfunction/LV hypertrophy, or hypertensive disease, use a beta-blocker (e.g. bisoprolol/atenolol). If contraindicated, seek advice from on-call cardiologist SpR
- patients with no evidence of ischaemic heart disease/LV systolic dysfunction/LV hypertrophy, consider Class Ic agent (e.g. propafenone, flecainide) after seeking advice from on-call cardiology SpR
- If DC or chemical cardioversion unsuccessful, consider long-term control of the ventricular response
- if heart failure present, use digoxin +/- beta-blocker or, if beta-blocker contraindicated, seek cardiology advice from on-call SpR on use of amiodarone
- if no heart failure present, use beta-blocker or, if beta-blocker contraindicated, diltiazem or verapamil
- Avoid combinations of anti-arrhythmic drugs (including beta-blockers, diltiazem and verapamil) except after specific cardiological advice
- Avoid combinations of anti-arrhythmic drugs and diuretics if possible as hypokalaemia worsens pro-arrhythmic potential
- For prevention of AF in the bradycardia/tachycardia form of sino-atrial disease, consider pacing
- Consider ablation therapy (refer to EP consultant) for patients:
- with Wolff-Parkinson-White syndrome
- with persistent AF in whom ventricular response cannot be satisfactorily controlled with drug therapy
- with recurrent AF
- taking an anti-arrhythmic agent and paroxysmal AF with symptoms

DISCHARGE AND FOLLOW-UP

For new diagnosis of AF/flutter or known AF, not under current cardiology follow-up, requiring ongoing management of rate/rhythm control, refer to AF/arrhythmia nurse team via OrderComms

- Request outpatient echocardiogram
- if echocardiogram abnormal, refer to cardiologist
- If acute AF, consider cardiology referral for DC cardioversion
- If taking warfarin, follow guidance in **yellow anticoagulation book**
- If taking DOAC ask for GP review in 6 months for renal function/adherence

Do NOT discharge patient from hospital taking rhythm-controlling agents (unless advised to by a cardiologist) as these are unlikely to restore sinus rhythm and expose patient unnecessarily to risk of drug-induced arrhythmia

INFECTIVE ENDOCARDITIS ● 1/5

RECOGNITION AND ASSESSMENT

Presentation of infective endocarditis (IE) is highly variable and can affect almost any organ system. Symptoms can be non-specific and of insidious onset. A high index of suspicion is required in the febrile patient with significant risk factors. Clinical presentation of IE is changing and classic findings, such as haemorrhagic lesions, are becoming less common. Consider a diagnosis of endocarditis in all patients presenting with bacteraemia without an obvious source, especially if patient has one of the risk factors outlined below

Symptoms and signs

- Lethargy
- Nausea, vomiting
- Anorexia, weight loss
- Fever, night sweats
- Shortness of breath
- Musculoskeletal pain
- Haemorrhagic lesions:
- mucocutaneous petechiae
- Janeway lesions (painless, haemorrhagic, macular plaques most frequently seen on palms and soles of feet)
- Roth spots (small, retinal haemorrhages with pale centres, seen near optic nerve)
- splinter haemorrhages
- Anaemia
- Clubbing (if prolonged disease)
- Splenomegaly
- New mitral, aortic or tricuspid murmur
- New embolic event which is unexplained

Risk factors

- Previous IE
- Cardiovascular disease, especially:
- ventricular septal defect
- aortic regurgitation
- mitral regurgitation
- aortic stenosis
- patent ductus arteriosus
- coarctation of aorta
- Prosthetic heart valve
- IV drug use (right sided valve lesions more common)
- Immunosuppressed patients
- Indwelling IV catheter
- Rheumatic heart disease

Investigations

Aseptic technique vital. Follow* Collection of blood culture specimens *guideline
Draw each sample at >1 hr intervals by separate venepuncture and not from an indwelling catheter

- Inform microbiologist of suspected IE

Patient acutely ill

- Take 3 sets of blood cultures within first 24 hr **before starting antimicrobial therapy** with at least 1 hr interval between each set (one aerobic and one anaerobic bottle per set)
- do not delay antimicrobial therapy in acutely ill patients

Patient not acutely ill

- Take 3 sets of blood cultures within first 48 hr
- If patient not acutely ill but antimicrobials have already been commenced, discontinue antimicrobial therapy and take 2 sets of blood cultures daily for 3 days (6 sets)
- If patient is IV drug user, or has prosthetic heart valve or central venous catheter, consider fungal cultures. State suspicion of endocarditis on form; blood culture will then be incubated for 3 weeks

All patients

- FBC and differential WCC:
- look for leucocytosis, usually with neutrophilia
- look for anaemia, usually normochromic normocytic
- ESR
- CRP
- Complement C3, C4, CH50
- ECG, look for conduction defects such as first or second degree block
- Urinalysis, look for protein and microscopic haematuria
- Consider echocardiography in patients on the basis of a balanced clinical assessment by a suitable experienced senior clinician

Diagnostic criteria

- See **Tables 2, 3** and **4**

IMMEDIATE TREATMENT

Do not prescribe antimicrobials until at least three separate sets of blood cultures have been taken UNLESS patient has severe sepsis or septic shock in which case: take 2 separate sets of blood cultures and administer empirical antimicrobials within 1 hr of diagnosis

- In endocarditis, the valve may be damaged at an early stage. In an ill patient, **do not wait** for blood culture report or echocardiographic confirmation
- start empirical treatment (see **Table 1) .**Treatment without beta lactams is sub-optimal to treatment with beta lactams. **Penicillin allergy should be challenged and patient referred to Endocarditis MDT**

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.
True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

- Gentamicin and vancomycin require careful monitoring, especially in patients with renal impairment
- Both carry an increased risk of ototoxicity and nephrotoxicity. If using aminoglycosides perform baseline renal and auditometry tests. Monitor for signs of deafness and balance problems which may occur at normal levels
- **Pre-dose** gentamicin concentration should be <1 mg/L. Measure serum gentamicin levels after 24 hr. See **Gentamicin** guideline – **Adjunctive once-daily gentamicin (3 mg/kg) for infective endocarditis**
- **Pre-dose** vancomycin concentration should be 15-20 mg/L**. Peak** concentration has no clear significance and will be measured only with approval of consultant microbiologist (see Vancomycin calculator and **Vancomycin** guideline)

Table 1: Empirical treatment (pending blood culture results)

Type of endocarditis		First line	Alternative (penicillin allergy)
Native valve – indolent presentation		Amoxicillin 2 g IV 4-hrly	Vancomycin IV by infusion (see prescribing regimen)
Native valve, severe sepsis (no risk factors for ESBL/multi-resistant enterobacteriacea, *Pseudomonas*)		Vancomycin (see **Vancomycin** calculator and guideline) **plus** gentamicin 3 mg/kg IV. Do not use Gentamicin calculator see **Gentamicin** guideline – **Adjunctive once-daily gentamicin (3 mg/kg) for infective endocarditis** If there are concerns about nephrotoxicity, seek advice from consultant microbiologist/ID	
Native valve, severe sepsis AND risk factors for multi-resistant enterobacteriacea, *Pseudomonas*		Vancomycin (see **Vancomycin** calculator and guideline) **plus** meropenem 2 g IV 8-hrly	
Intra-cardiac prosthetic material, or reason to suspect MRSA infection		Vancomycin (see **Vancomycin** guideline) **plus** gentamicin 3 mg/kg IV. Do not use Gentamicin calculator see **Gentamicin** guideline – **Adjunctive once-daily gentamicin (3 mg/kg) for infective endocarditis** **plus** rifampicin 600 mg oral (if unable to swallow or absorb oral drugs, IV by infusion) 12-hrly	
Duration	Culture positive	Choice of antimicrobials should be directed by results of blood culture and sensitivity with guidance of a consultant microbiologist/ID Treat prosthetic valve endocarditis for at least 6 weeks	
	Culture negative	Up to 30% of all cases of IE are blood culture negative. Failure to culture may be explained by: • pre-treatment with antimicrobials • inadequate number/poor quality of samples • infection with atypical pathogen, (e.g. *Chlamydia* spp., *Coxiella burnetii*, *Brucella* spp., *Bartonella* spp, *Legionella* spp, *Tropheryma whipplei)* • infection with a fastidious organism (e.g. members of the HACEK group) • Continue antimicrobials in definite or probable IE • In patients with negative blood cultures, vegetations, metastatic infection, peri valvular invasion or embolism, consider candida or aspergillus. Consult microbiologist • In culture negative endocarditis seek opinion of cardiologist and microbiologist for advice on need for serology, culture with special media and subsequent treatment	

Once diagnosis confirmed or highly likely based on the criteria below, arrange transfer to cardiology ward with on-call cardiology team

Table 2: Duke classification in the diagnosis of IE

Definite clinical IE	2 major clinical criteria (see **Table 3**) **or** 1 major and 3 minor criteria **or** 5 minor criteria (see **Table 4**)
Probable IE	Clinical findings consistent with IE but fall short of 'definite' and cannot be 'rejected'
Reject diagnosis	Firm alternative diagnosis for manifestations of IE and resolution of manifestations without antimicrobial therapy or with antimicrobial therapy of ≤4 days

Table 3: Definitions of Duke major clinical criteria

Major criteria
1 Positive blood culture for IE **a** Typical micro-organisms from 2 separate blood cultures i *Strep. viridans, Strep. bovis, Haemophilus* spp., *Cardiobacterium hominis, Eikenella* spp. *or Kingella* spp. **or** ii community-acquired *Staph. aureus* or enterococci, in the absence of a primary focus **b** Blood culture persistently positive for organisms consistent with IE i 2 positive cultures drawn >12 hr apart **or** ii all of 3, or majority of >4 cultures (where first sample and last sample drawn >1 hr apart)
2 Evidence of endocardial involvement **a** Positive echocardiogram for IE i oscillating intracardiac mass on valve or supporting structures **or** ii abscess **or** iii new partial dehiscence of prosthetic valve **b** New valvular regurgitation
3 Positive serology for causes of culture negative IE i Q-fever (*Coxiella burnetii)* **or** ii E.g. *Bartonella, Chlamydia psittaci*
4 **Identification of micro-organism from blood or tissue using molecular biology**

Table 4: Definitions of Duke minor clinical criteria

Minor criteria
1 Predisposition: predisposing heart condition or IV drug use
2 Fever: temperature >38.0°C
3 Vascular phenomenon: major arterial emboli, septic pulmonary infarct, mycotic aneurysm, intracranial haemorrhage, conjunctival haemorrhage, Janeway lesions, newly diagnosed clubbing, splinter haemorrhages, splenomegaly
4 Immunogenic phenomena: glomerulonephritis, Roth spots, RhF +ve, high ESR (>1.5 × upper limit of normal), CRP >100 mg/L
5 Microbiological evidence: positive blood cultures not meeting definition of major criteria or serological evidence of active organism consistent with IE
6 Echocardiographic evidence of IE which does not meet major criteria

SUBSEQUENT MANAGEMENT

Serum concentrations of vancomycin and gentamicin must be monitored to avoid toxicity. Monitor for signs of deafness and balance problems which may occur at normal levels

Culture positive

- Choice of antimicrobials should be directed by results of blood culture and sensitivity with guidance of a microbiologist and/or infectious diseases consultant. Treat prosthetic valve endocarditis for at least 6 weeks

Culture negative

- Up to 30% of all cases of IE are blood culture negative
- Failure to culture may be explained by:
- pre-treatment with antimicrobials
- inadequate number/poor quality of samples
- infection with atypical pathogen, (e.g. *Chlamydia* spp., *Coxiella burnetii*, *Brucella* spp., *Bartonella* spp, *Legionella* spp, *Tropheryma whipplei)*
- infection with a fastidious organism (e.g. members of the HACEK group)
- Continue antimicrobials in definite or probable IE
- In case of cardiac surgery, surgeon to send a tissue from valvular biopsy to microbiology requesting 'PCR to identify causative organism'
- In patients with negative blood cultures, vegetations, metastatic infection, peri valvular invasion or embolism, consider candida or aspergillus. Consult microbiologist
- Seek opinion of cardiologist and microbiologist for advice on need for serology, culture with special media and subsequent treatment

MONITORING TREATMENT

- ESR can remain raised for up to 4 weeks
- Temperature usually settles within first 2–4 days, and a subsequent rise may indicate uncontrolled infection but may also indicate antimicrobial resistance, or superinfection with another pathogen
- In cases of aortic valve endocarditis, repeat ECG daily – looking for development of conduction defect (prolonged PR interval)
- Repeat echocardiogram weekly on cardiology advice

Complications

- Heart failure
- Vegetation embolisation, threatening limbs/organs and/or leading to metastatic abscess (pneumonia/lung abscess in right-sided disease)
- Abscess in aortic valve ring – can produce heart block
- Immune complex disease – vasculitic rash, arthritis, glomerulonephritis

Early surgical intervention indicated

- Decision to undertake valve surgery as part of treatment of infective endocarditis can be extremely challenging. Early consultation will help the timing of surgery – consider an early referral where there is:
- development of heart failure from acute, severe, valvular regurgitation
- evidence of annular or aortic abscess (prolongation of PR interval on daily ECG)
- evidence of significant valve dysfunction and persistent infection after 7–10 days of appropriate antimicrobial treatment
- early prosthetic valve endocarditis (within 2 months of surgery)
- *Staph. aureus* prosthetic valve endocarditis
- resistant infection, especially associated with prosthetic valve
- fungal endocarditis
- large vegetations (>10 mm)

DISCHARGE AND FOLLOW-UP

- Arrange discharge in consultation with cardiology, infectious diseases and microbiology teams involved. Decision will be based on:
- settling of physical signs
- improvement in appetite
- patient's sense of wellbeing
- improvement in inflammatory marker (even if still raised)
- Arrange outpatient follow-up in cardiology clinic. Arrange to repeat inflammatory markers and, if possible, echocardiogram before this appointment
- Discuss follow-up with patient. Emphasise need for antimicrobial prophylaxis for future dental and surgical procedures

PROPHYLAXIS AGAINST VENOUS THROMBOEMBOLISM ● 1/3

All adult patients (aged ≥18 yr) admitted to hospital must undergo risk assessment for venous thrombosis. Use of low-molecular-weight heparin (LMWH) reduces incidence of venous thromboembolism by at least 50% with a very small risk of bleeding. Note that even a small risk of bleeding may be unacceptable in some circumstances – see detailed guidance below

VENOUS THROMBOEMBOLISM RISK ASSESSMENT

- Complete all sections of the **inpatient venous thromboembolism risk assessment** proforma situated on the inside front page of the inpatient prescription chart. This needs to be completed within 12 hr of admission to hospital and a reassessment carried out within 24 hr and whenever the clinical condition changes
- For pregnant and postpartum patients **use separate obstetric risk assessment proforma** from Trust intranet >Clinical section>Hospital venous thrombosis prevention>Obstetric VTE risk assessment proforma
- assess for presence of risk factors for VTE and bleeding
- Refer to **Table** to choose appropriate thromboprophylaxis: Do not offer pharmacological prophylaxis to patient with any risk factor for bleeding. Discuss with senior to confirm if VTE risk outweighs risk of bleeding
- prescribe on prescription chart
- give patient leaflet **'How to avoid blood clots while in hospital and after surgery'**
- sign, date and time the assessment proforma

Remember to read contraindications and precautions on the risk assessment proforma

RISK FACTORS

For VTE

- Age >60 yr
- Obesity (BMI >30 kg/m^2)
- Personal/family history of DVT/PE
- Pregnant or postpartum
- Current use of combined contraceptive pill or HRT
- Varicose veins **with** phlebitis
- Active cancer or ongoing cancer treatment
- Medical patients with reduced mobility >2 days
- Medical comorbidities (e.g. heart disease, dehydration, or metabolic, endocrine, respiratory, acute infectious or inflammatory conditions)
- Acute surgical patient with inflammatory or intra-abdominal condition
- Surgical procedure lasting >90 min
- Surgery involving pelvis or lower limb lasting >60 min
- Surgical: if significant immobility expected
- Critical care admission
- Inherited thrombophilia (hyperhomocysteinaemia, protein C, S or antithrombin deficiency, Factor V Leiden or prothrombin 20210A gene mutation)
- Any of the following:
- antiphospholipid syndrome
- Behçet's disease
- myeloproliferative disease
- nephrotic syndrome
- paraproteinaemia
- paroxysmal nocturnal haemoglobinuria

For bleeding

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with international normalised ratio [INR] >2)
- Lumbar puncture/epidural/spinal anaesthesia expected within the next 12 hr
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hr
- Acute stroke
- Thrombocytopenia (platelets less than 75 x 10^9/L)
- Uncontrolled systolic hypertension (230/120 mmHg or higher)
- Untreated inherited bleeding disorders (e.g. haemophilia and von Willebrand's disease)

PROPHYLAXIS AGAINST VENOUS THROMBOEMBOLISM • 2/3

PROPHYLAXIS REGIMENS

Type of surgery/medical admission	Prophylaxis regimen[1]	
	At least one risk factor present	No risk factor present
Medical (excluding stroke)	1	GM
Active cancer (non-ambulant patient)	1	1
Stroke	GM +/- IPC	GM +/- IPC
Surgery		
Hip replacement/fracture	5	5
Total knee replacement	4	4
Multiple trauma or haemorrhagic surgical patient	6	6
Other orthopaedic surgery	3	2
Lower limb plaster cast	3	GM
Cancer surgery (abdomen/pelvis)	5	5
GI/bariatric surgery (procedure lasting >60 min)	3	2
Laparoscopic surgery/day surgery	3	2
Neurosurgery and spinal surgery (unless patient has ruptured vascular malformation, not secured)	6	2
Cardiac surgery (unless patient already anticoagulated)	3	2
Thoracic surgery	3	2
Gynaecological surgery (excl. caesarean section)	3	2
Major urological surgery	3	2
Vascular surgery	3	2
Assess risks and benefits of thromboprophylaxis for each patient and exercise clinical judgement		

Regimen[1]	Suggested prophylaxis (discuss start time with consultant surgeon)
1	GM + LMWH (until discharge)
2	GM + GCS
3	GM + GCS + LMWH (until mobile ~ 5–7 days)
4	GM + GCS + LMWH* for 10 days
5	GM + GCS + LMWH* for 28 days
6	GM + GCS + LMWH (start 48 hr post-op and only when haemodynamically stable and clotting normal)
Instead of LMWH, dabigatran or rivaroxaban can be used for thromboprophylaxis after hip/knee replacement surgery	

GM = General measures
GCS = Graduated compression stockings
IPC = Intermittent pneumatic compression

General measures (GM)

- Do not allow patient to become dehydrated
- Encourage patient to mobilise when possible

Surgical patients

- For cardiac surgery patients or those who have received unfractionated heparin (UFH) in the last 100 days, check baseline FBC and monitor platelet count as per **Heparin-induced thrombocytopenia** guideline
- If due for afternoon surgery, consider IV fluids but ideally ensure they take clear fluids liberally until 1100 hr – see **Pre-operative fasting** guideline in the **Surgical** guidelines
- If appropriate, consider using regional anaesthesia (risk of VTE higher with general anaesthesia in specific patient groups)
- Encourage patient to mobilise
- if immobilised, arrange leg exercise as soon as possible after surgery

Graduated compression stockings (GCS)

- Unless contraindicated (see below) offer **all surgical inpatients** knee-length class 2 graduated compression/anti-embolism stockings on admission
- Show patient how to wear stockings correctly and monitor their use
- Encourage patient to wear GCS from admission until returning to their usual level of mobility

Intermittent pneumatic compression (IPC) device

- **Surgical patients:** post-operatively as advised by consultant
- **Stroke patients:** immobile patients following acute stroke as advised by consultant

CONTRAINDICATIONS TO TREATMENT

GCS

- Peripheral vascular disease
- Cellulitis
- Severe dermatitis
- Recent skin graft
- Leg deformity
- Peripheral neuropathy

IPC

- Known arteriosclerosis, peripheral neuropathy or peripheral vascular disease
- Massive oedema of the legs or pulmonary oedema secondary to congestive heart failure
- Local leg infection, dermatitis, vein ligation or skin graft
- Extreme deformity of leg
- Suspected pre-existing DVT or acute DVT
- Presence of malignancy in legs

LMWH

- Active bleeding
- Risk of significant bleeding
- Platelet count <75 x 10^9/L
- Coagulopathy
- Known bleeding disorder
- Allergy to heparin/LMWH
- Haemorrhagic stroke
- Renal impairment (reduced dose LMWH or UFH – see **IV unfractionated heparin** guideline)
- Previous heparin-induced thrombocytopenia
- Anticoagulated with INR in therapeutic range
- Uncontrolled hypertension (>230 mmHg systolic or >120 mmHg diastolic)
- Acute infective endocarditis
- Planned spinal/epidural catheter, lumbar puncture or deep peripheral nerve block within next 12 hr

DOSES

Precautions – LMWH

- If patient normally receives anticoagulant and INR sub-therapeutic, contact anticoagulation management team. Out-of-hours, contact on-call haematologist
- Monitor for any bleeding
- If renal function deteriorates, reduce dose of LMWH or use UFH
- **Do not give prophylactic LMWH in the 12 hr period preceding insertion of a spinal/epidural catheter, lumbar puncture or deep peripheral nerve block**
- LMWH can be administered 4 hr following insertion/withdrawal of a spinal/epidural catheter

Medical patients

- **Standard thromboprophylaxis dose:** Dalteparin 5000 units SC once daily
- if eGFR 10–30 mL/min **or** patient weight <45 kg – use dalteparin 2500 units SC once daily

Surgical patients

- **Dose:** Dalteparin 2500–5000 units SC once daily. Senior surgeon to decide dose and timing of first dose by case and risk

MONITORING

- **Monitor for heparin-induced thrombocytopenia** in surgical patients and if patient has received UFH – see **Heparin-induced thrombocytopenia** guideline
- Reassess risk of bleeding and thrombosis risk at 24 hr and whenever clinical situation changes
- Report all bleeding events related to LMWH via DATIX or to anticoagulation service via email: anticoagulation.uhns@nhs.net

DEEP VENOUS THROMBOSIS (DVT) ● 1/5

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Swelling of limb (arm, calf or leg)
- Pain and stiffness of affected limb
- Pitting oedema
- Increased skin temperature
- Erythema
- Tenderness
- Mild fever
- In rare cases, arterial circulation may be **severely** compromised – characterised by severe pain, swelling, cyanosis and rapid development of tense oedema (phlegmasia caerulea dolens)
- If patient is an injection drug user examine for:
- localised infection e.g. erythema or fluctuance suggesting infected clot, deep soft tissue infection, abscess at injection site, necrotising fasciitis, acute arterial occlusion, and/or myositis
- systemic infection and septic embolic abscesses e.g. cardiac murmurs suggesting infective endocarditis, sepsis, haemoptysis and cough with purulent sputum

Differential diagnosis

- Ruptured Baker's cyst
- history of arthritis or trauma to knee
- swelling behind knee
- examine for arthropathy and effusion
- Torn calf muscles/damage to Achilles tendon
- sudden pain in calf following twisting of leg
- examine for haematoma
- disruption of tendon indicates severe rupture
- Cellulitis – see **Cellulitis** guideline

INVESTIGATIONS AND DIAGNOSIS

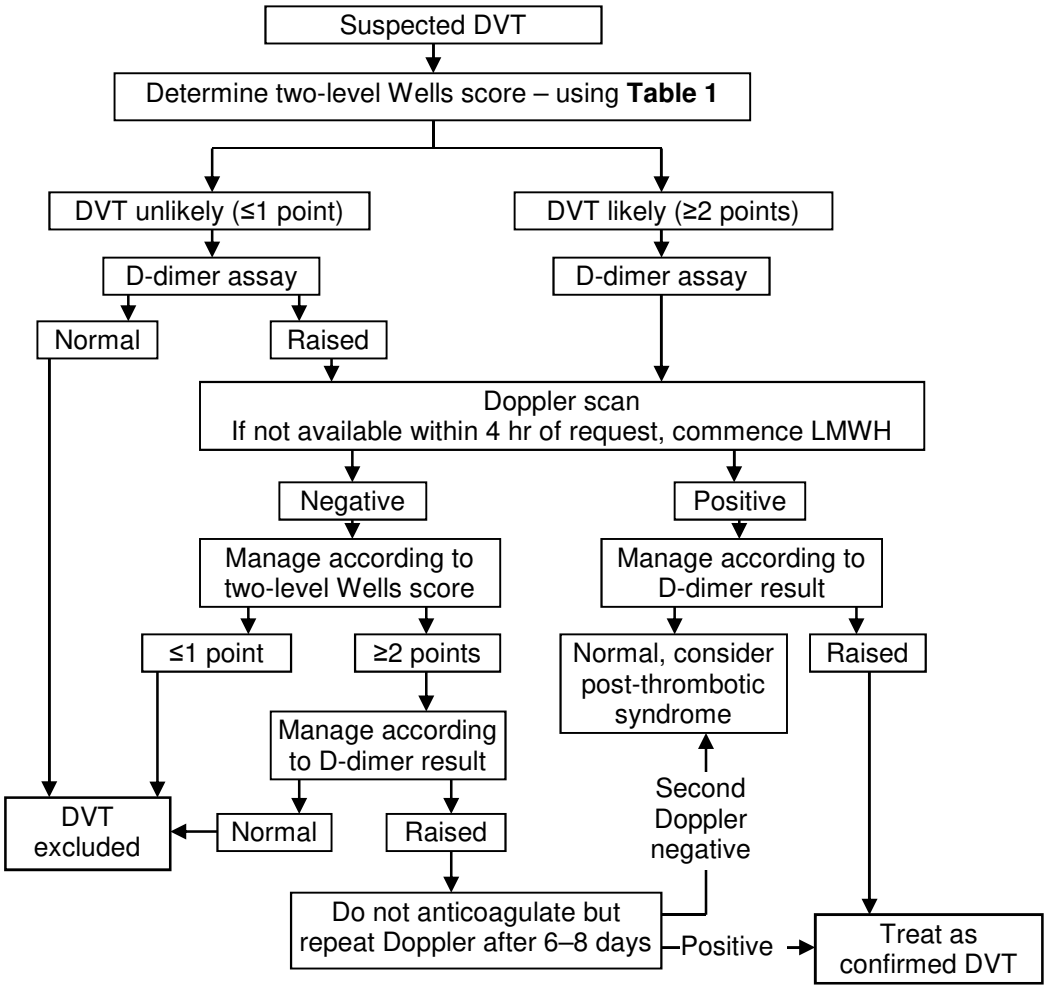
***If patient pregnant, contact obstetric team. See* Management of a pregnant woman with a non-obstetric problem *guideline* and VTE – Deep venous thrombosis *guideline* in Obstetric guidelines**

- FBC, INR, APTT and U&E
- **If patient is an injection drug user or has signs of infection**:
- CRP
- blood cultures
- chest X-ray (to exclude septic embolic lung abscesses)
- ultrasound of groin area (localised collection)
- echocardiogram if murmur, positive blood cultures or chest X-ray suggestive of septic embolic lung abscesses
- offer testing for blood borne viruses (HIV, HBV, HCV) – see **HIV infection testing** guideline
- Determine two-level DVT Wells score (**Table 1**)
- Refer to **algorithm** for guidance
- If Doppler ultrasound indicated:
- call acute medical unit (AMU) and provide patient details to arrange appointment
- take notes and completed request form (from Trust intranet>Clinicians>Support services>Imaging>General imaging referral forms) to AMU
- If Doppler ultrasound scan cannot be arranged within 4 hr of request, but patient can otherwise be discharged:
- give suitable single dose of SC dalteparin (see **Dalteparin for VTE** guideline)
- if there is a delay of >24 hr (e.g. bank holiday), patient to attend AMU between 0900–1000 hr next day for dalteparin
- **issue information leaflet and inform patient of date of Doppler, before patient leaves Emergency department**

Table 1: Two-level DVT Wells score

Clinical feature	Points
Paralysis, paresis or recent plaster immobilisation of lower extremities	1
Recently bedridden for ≥3 days or major surgery within 12 weeks requiring general or regional anaesthesia	1
Localised tenderness along distribution of deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than asymptomatic side	1
Pitting oedema confined to symptomatic leg	1
Malignancy (on treatment, treated in last 6 months or palliative)	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	–2
Clinical probability simplified score	
DVT likely	≥2 points
DVT unlikely	≤1 point

Algorithm for DVT management



IMMEDIATE TREATMENT

- Unless symptoms severe, or patient an injection drug user, or requires admission to hospital for reasons other than suspected DVT, treat as outpatient
- Encourage ambulation
- Elevation of leg when seated
- Simple analgesia (e.g. co-codamol)
- **Commence dalteparin** – see **Dalteparin for VTE** guideline

If outpatient, ensure form authorising daily injections of dalteparin is completed once diagnosis confirmed

If anticoagulation contraindicated, consultant physician, staff physician must decide which carries most risk – complications of therapy, or the DVT and consider a vena caval filter

Suspected phlegmasia cerulea dolens (painful blue oedema)

- An uncommon manifestation of massive deep vein thrombosis compromising venous outflow and causing ischemia and manifesting as a painfully swollen blue leg
- Elevate bed foot to 40° and ensure fluid replacement adequate to compensate for extravasation
- Refer **urgently** to on-call general surgical team (bleep via call centre)

Concomitant infection

- Treat cellulitis or sepsis – see **Cellulitis** guideline and **Sepsis management** guideline
- If evidence of groin abscess, refer to on-call surgical team (via call centre)
- If evidence of septic pulmonary embolism on chest X-ray, admit to respiratory or infectious diseases ward and start treatment for pneumonia, including cover for staphylococcal infection (see **Pneumonia** guidelines)

Symptomatic ileo-femoral DVT

- Consider catheter guided thrombolysis or mechanical thrombectomy if:
  - symptoms of less than 14 days duration
  - good functional status
  - life expectancy of ≥1 yr
  - low risk of bleeding (for thrombolysis)
- Discuss with interventional radiologist and vascular surgeon

Compression hose

Do not prescribe elastic graduated compression stockings to prevent post-thrombotic syndrome or VTE recurrence after a proximal DVT

SUBSEQUENT MANAGEMENT (NON-PREGNANT PATIENTS)

- For subsequent management of pregnant woman, go to relevant section below

Dalteparin

- Continue dalteparin at a suitable dosage (see **Dalteparin for VTE** guideline) for at least 5 days and until INR established within therapeutic range 2–3 (3–4 for recurrent DVT occurring while INR within the range 2–3) for 2 consecutive days, whichever is the longer
- If patient well enough to leave hospital before warfarin initiated, provide 5 days' supply of dalteparin and refer to primary care on discharge (patients taught to self-inject or arrangements made with the appropriate district nurse team)
- Initiate warfarin as outpatient [see **Warfarin initiation** guideline **(outpatient)]**
  - if patient injection drug user or has active cancer, consider continuing therapeutic dalteparin treatment, rather than converting to warfarin

Monitoring dalteparin treatment

- See **Dalteparin for VTE guideline**

Rivaroxaban

- If LMWH or warfarin not suitable, consider rivaroxaban, particularly if:
  - previous intracranial bleed
  - ≥12 months anticoagulant therapy is required
  - anticipated difficulties with INR monitoring and understanding dose adjustments
  - needle phobia
  - other comorbidities (e.g. deranged LFT, excessive alcohol intake) increasing risk of bleeding on warfarin
- Discuss with haematologist
- Dosage: 15 mg 12-hrly oral for first 3 weeks, 20 mg daily oral thereafter, for duration of therapy
- No monitoring is required
- If eGFR <50 mL/min, discuss with haematologist and renal physician. Contraindicated if eGFR <15 mL/min, in pregnancy and if breastfeeding

Inferior vena caval filter (IVCF)

- Temporary IVCF can be used if patient:
- cannot have anticoagulation treatment, which will need to be removed when patient becomes eligible for anticoagulation therapy
- recurrent VTE despite increasing INR target range to 3–4 or trial of dalteparin – discuss with haematology
- ensure strategy for removing IVCF at earliest possible opportunity is planned and documented

Further investigations

- If no clear precipitating cause for thrombosis, particularly if this is a recurrent event, consider occult malignancy or other cause of thrombophilia
- if patient aged <45 yr with unprovoked DVT, discuss screening for inherited or acquired thrombophilia with haematology consultant

Screening for cancer

- Perform chest X-ray, FBC, LFT, calcium and urinalysis in all patients with a confirmed DVT
- If patient aged >40 yr has first unprovoked DVT, consider performing an abdominal–pelvic CT scan and (for women) a mammogram

INITIATING WARFARIN

See **Warfarin initiation** guideline – **Referral to anticoagulation management service (AMS)**

Duration of warfarin treatment

- If DVT occurred post-operatively in an otherwise healthy patient, continue for 6 weeks for calf DVT and for 3 months for proximal DVT
- After a first proximal DVT without a clear underlying cause or if permanent risk factors present, continue for 3 months (see **Discharge and follow-up**)
- If recurrent DVT, discuss duration of treatment with haematology

DISCHARGE AND FOLLOW-UP (NON-PREGNANT PATIENTS)

- If patient has active cancer, reassess risks and benefits of continuing anticoagulation at 6 months
- After a first proximal DVT without a clear underlying cause or if permanent risk factors present, arrange follow-up in 3 months to assess VTE risk and to determine, after discussion with patient, if anticoagulation should be continued
- Before discharge from AMU, a 10–12 week follow-up appointment will be arranged for appropriate medical clinic
- unless a shorter course of treatment or need for investigation requires earlier follow-up; patients with confirmed DVT will remain under the care of duty physician for the day on which diagnosis was confirmed
- on receipt of referral form (which must give date on which warfarin to be stopped), contact referring clinician in writing advising that, unless notified of any change, warfarin will be stopped on the planned date
- send copy of letter to patient's GP
- advise patient that many drugs (including alcohol) interact with warfarin and to remind their GP, if additional medication is added, that they are taking warfarin
- If anticoagulation to be monitored by GP, supply GP with written information (on separate sheet, stapled to discharge letter) about:
- indication for anticoagulation
- proposed duration of treatment
- proposed target range for INR
- details of anticoagulation in hospital (give dates, INR results and dosage taken)
- Anticoagulant nurse specialist will advise if patient's GP will take over monitoring as opposed to haematology anticoagulant management service

SUBSEQUENT DRUG MANAGEMENT AND FOLLOW-UP (PREGNANT PATIENT)

- See **VTE – Deep venous thrombosis** guideline in **Obstetric** guidelines
- Continue dalteparin until term
- Liaise with obstetric team for follow-up

Maintenance treatment

- Choose one of the following 2 options after discussion with consultant haematologist
- therapeutic LMWH for 8–12 weeks followed by prophylactic dose for the rest of the pregnancy and at least 6 weeks postnatally **or**
- therapeutic LMWH throughout pregnancy and at least 6 weeks postnatally

Anticoagulant therapy during labour and delivery

- Discontinue LMWH maintenance therapy 24 hr before planned delivery
- If DVT occurred in last 4 weeks of pregnancy, consider temporary IVC filter when anticoagulation is interrupted but remove IVC filter when patient becomes eligible for anticoagulation
- Advise woman that once she is established in labour or thinks she is in labour, no further heparin or other anticoagulant medication should be injected
- Do not administer regional anaesthetic or analgesic until at least 24 hr after last dose of therapeutic LMWH

Postnatal anticoagulation

- If no bleed, restart anticoagulation treatment 4 hr after delivery
- Continue therapeutic anticoagulant therapy for at least 6 weeks postnatally and until at least 3 months of treatment has been given in total. Offer a choice of LMWH or oral anticoagulant (warfarin)
- Heparin and warfarin are not contraindicated in breastfeeding
- If woman chooses to commence warfarin postpartum, avoid until at least the third postnatal day
- Daily INR testing is recommended during the transfer from LMWH to warfarin to avoid over-anticoagulation

Monitoring dalteparin treatment

- See **Dalteparin in VTE guideline**

DISCHARGE AND FOLLOW-UP (PREGNANT PATIENT)

- As part of medical discharge, offer women who have been diagnosed with VTE during pregnancy or postnatal period a 6 week postnatal appointment with consultant haematologist via GP

HAEMODYNAMICALLY UNSTABLE (MASSIVE) PULMONARY EMBOLISM ● 1/2

DEFINITION

- A haemodynamically unstable PE with a systolic BP <90 mmHg or a drop in systolic blood pressure of ≥40 mmHg
- If after initial resuscitation BP does not meet the above criteria, treat as haemodynamically stable PE – see **Haemodynamically stable (submassive) pulmonary embolism** guideline

SYMPTOMS AND SIGNS

Massive PE highly likely if there is:

- Collapse/hypotension
- Unexplained hypoxia
- Engorged neck veins
- Right ventricular gallop (often)
- Cardiac arrest

INVESTIGATIONS

- Urgent CTPA and echocardiogram

MANAGEMENT

Cardiac arrest

- Resuscitation (CPR)
- Give alteplase 50 mg IV as bolus injection (CTPA or echocardiogram confirmation not required)
- Reassess after 30 min

General

- See also **Haemodynamically stable (submassive) pulmonary embolism** guideline
- Oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Adequate analgesia for pleuritic pain
- A high right atrial pressure (i.e. JVP) is common and does not need to be treated
- **AVOID** diuretics
- Give intravenous fluids to restore perfusion see **Fluid resuscitation** guideline
- If it is felt that right heart catheter monitoring would be helpful, arrange to transfer patient to critical care

PREGNANCY

If a pregnant woman has collapse or shock associated with a massive pulmonary embolism, consider thrombolytic therapy – associated with 1–6% maternal bleeding complication rate, 1.7% fetal mortality, but no maternal mortality – discuss with on-call obstetric consultant

Nurse women in the second and third trimester on a left lateral tilt (never supine) or with manual displacement of the uterus to prevent aortocaval compression –
***see* VTE – Pulmonary embolism guideline *in* Obstetric guidelines**

D-dimer is not relevant in probable massive PE

Specific

Thrombolysis

- **Cardiac arrest** give alteplase 50 mg IV as bolus injection
- **Confirmed PE with haemodynamic instability:**
- for ≥15 min either systolic blood pressure <90 mmHg or drops ≥40 mmHg from baseline
- hypotension that requires vasopressors or inotropic support
- clear evidence of shock
- give alteplase 10 mg by IV injection over 1–2 min, followed by 90 mg by IV infusion over 2 hr (max 1.5 mg/kg in patients weighing <65 kg). If there is high risk of bleeding, use a half-dose regimen
- if thrombolysis contraindicated discuss with cardiothoracic surgery or interventional radiology. If mechanical intervention not possible, commence unfractionated heparin with loading bolus dose – see **IV unfractionated heparin** guideline
- **Unconfirmed PE with haemodynamic instability:**
- if CTPA not available or is considered unsafe arrange urgent bedside echocardiogram to support a diagnosis of PE e.g. right ventricular enlargement/hypokinesis, or visualisation of clot, before empiric administration of thrombolytic therapy

- if echocardiography is delayed or unavailable, discuss with consultant to consider empirical thrombolysis or to commence unfractionated heparin with loading bolus does – see **IV unfractionated heparin** guideline

If there are contraindications to giving alteplase or anticoagulation, a consultant physician, or SpR must make a decision as to which carries most risk – possible complications of therapy, or embolism

Contraindications

- **Absolute:**
- active bleeding
- **Relative:**
- active pulmonary disease with cavitation
- acute pancreatitis
- aneurysm
- aortic dissection
- bacterial endocarditis
- major trauma/major surgery within previous 4 weeks
- stroke/TIA within previous 3 months
- confirmed subarachnoid haemorrhage at any time
- traumatic cardiac massage or intracardiac injection
- known bleeding disorder
- active dyspepsia or history of GI haemorrhage and oesophageal varicies
- sustained systolic BP ≥180 mmHg
- proliferative retinopathy
- recent head injury
- pericarditis
- INR >2.0

Thrombolysis contraindicated

- Commence unfractionated heparin with loading bolus – see **IV unfractionated heparin** guideline

Post-thrombolysis

- After thrombolytic therapy has ceased, wait until APTT ratio has fallen below 2 before commencing or recommencing anticoagulation as follows:
- in all patients, start with **unfractionated heparin with no loading bolus –** see **IV unfractionated heparin** guideline. In pregnant women, monitor anti-Xa concentration as a guide to dosage adjustment
- if pregnant, change unfractionated heparin to dalteparin when APTT stable – see **Dalteparin for VTE** guideline
- if **not** pregnant, start warfarin – follow **Haemodynamically stable (submassive) pulmonary embolism** guideline – **Management of a non-pregnant patient,** from **Subsequent management – maintenance anticoagulation**

Cardiothoracic surgery and interventional radiology

- If there is failure to respond to alteplase or thrombolysis contraindicated, refer for emergency direct thrombolysis, catheter thrombo-embolectomy or pulmonary embolectomy, if available. Contact interventional department/interventional radiologist and cardiothoracic surgeon to discuss

Thrombolysis not required

- If **not** thrombolysing, anticoagulate:
- if pregnant, go to **Haemodynamically stable (submassive) pulmonary embolism** – guideline – **Management of a pregnant patient** – **Immediate treatment** and see **VTE – Pulmonary embolism** guideline in **Obstetric** guidelines
- if **not** pregnant, go to **Haemodynamically stable (submassive) pulmonary embolism** guideline – **Management of a non-pregnant patient – Immediate treatment**

DISCHARGE AND FOLLOW-UP

- See **Haemodynamically stable (submassive) pulmonary embolism** guideline

HAEMODYNAMICALLY STABLE (SUBMASSIVE) PULMONARY EMBOLISM ● 1/6

DEFINITION

- Haemodynamically stable PE with a systolic BP ≥90 mmHg
- PE range from small with normal BP to large with borderline BP and right ventricular dysfunction
- Patients may become haemodynamically unstable during management, necessitating treatment as massive PE – see **Haemodynamically unstable (massive) pulmonary embolism** guideline

RECOGNITION

- Pulmonary venous thromboembolism (PE) is often missed clinically, particularly in:
- severe cardiorespiratory disease
- elderly patients
- Suspect the diagnosis in any patient who does not respond to initial therapy, or in whose condition there has been an unexplained deterioration
- Most episodes follow popliteal or iliofemoral DVT

Symptoms and signs (signs may be absent)

- Small emboli present with dyspnoea, whereas moderate-sized emboli present with signs of infarction and pleuritic pain
- Dyspnoea (present in 90% of cases) – may be of sudden onset
- Pleuritic chest pain
- Haemoptysis
- Syncope
- Tachypnoea (>20 breaths/min)
- Fever
- Pleural rub
- Tachycardia

Differential diagnosis

- Pneumonia
- Myocardial infarction (MI)
- Exacerbations of asthma and COPD

ASSESSMENT

Confirming diagnosis

ECG and chest X-ray are often normal and should not be used to confirm/refute the diagnosis, but are useful for identifying other diseases and explaining symptoms. ECG may show sinus tachycardia, an S1 Q3 T3 pattern, right bundle branch block, P pulmonale or right axis deviation. Chest X-ray may show non-specific shadows or a raised hemidiaphragm, pulmonary oligaemia, linear atelectasis or small pleural effusion

- Determine two-level PE Wells score **(Table 1**)

Table 1: Two-level PE Wells score

Clinical feature	Points
Symptoms and signs of DVT (minimum leg swelling and pain with palpation of deep veins)	3
An alternative diagnosis is less likely than PE	3
Heart rate >100 beats/min	1.5
Immobile for >3 days or surgery in previous 4 weeks	1.5
Previous DVT or PE	1.5
Haemoptysis	1
Malignancy (currently being treated, treated in last 6 months, or palliative)	1
Clinical probability simplified score	
PE likely	>4 points
PE unlikely	≤4 points

HAEMODYNAMICALLY STABLE (SUBMASSIVE) PULMONARY EMBOLISM • 2/6

MANAGEMENT OF A NON-PREGNANT PATIENT

Investigations – follow flowchart

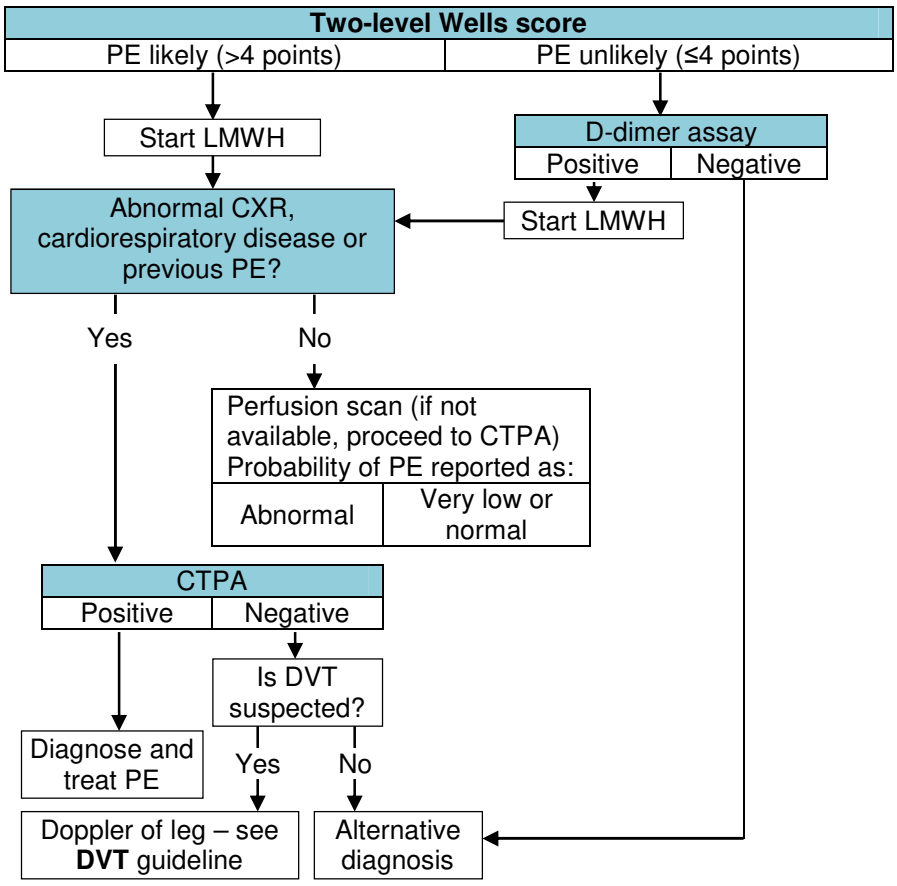
- **FBC, INR, APTT and U&E**
- **D-dimer:** If indicated by two-level PE Wells score
  - many clinical states apart from PE (see – **Table 2**) can raise D-dimer concentration
  - do not request if clinical probability of PE is high, in probable massive PE or where an alternative diagnosis is highly likely. **Only a negative result is of value**
- **Leg Doppler ultrasound:** alternative to lung imaging in patients with clinical DVT

Table 2: Common causes of raised D-dimer concentration

• Acute myocardial infarction (MI) • Chronic subdural haematoma • Disseminated intravascular coagulation • Gram-negative bacteraemia • Leukaemia • Liver disease • Metastatic malignancy • Peripheral vascular disease	• Pregnancy • Recent surgery • Renal disease • Rheumatoid disease • Sickle cell crisis • Subarachnoid haemorrhage • Thrombolytic therapy • Trauma with pathological thrombosis

Whereas a normal D-dimer concentration virtually rules out thrombosis, a raised D-dimer concentration cannot confidently confirm thrombosis has occurred

Flowchart for diagnosis of non-massive PE



HAEMODYNAMICALLY STABLE (SUBMASSIVE) PULMONARY EMBOLISM ● 3/6

IMMEDIATE TREATMENT

General

- Oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Adequate analgesia for pleuritic pain – paracetamol alone is unlikely to be adequate
  - if well hydrated and eGFR ≥30 mL/min, ibuprofen 400 mg oral 8-hrly
  - in dehydrated patient or if eGFR <30 mL/min, to prevent renal damage, prefer morphine sulphate 10 mg oral 4-hrly – ibuprofen may be substituted once adequate fluid replacement achieved if eGFR ≥30 mL/min
  - if patient pregnant, prefer morphine sulphate 10 mg oral 4-hrly
  - if patient taking ACE inhibitor avoid NSAIDS, including ibuprofen
- A high right atrial pressure (i.e. JVP) is common and does not need to be treated
- **AVOID** diuretics
- If patient pregnant, see **Management of a pregnant patient – Immediate treatment**

Specific

- Commence dalteparin as soon as PE suspected – see **Dalteparin for VTE** guideline

If anticoagulation contraindicated, a consultant physician, staff physician or SpR must decide which carries most risk – possible complications of therapy, or embolism and consider a vena caval filter

SUBSEQUENT MANAGEMENT

Assess suitability for ambulatory care

- Assess patients with PE for suitability for ambulatory care (in emergency portal – ED, AEC or acute medical unit) by confirming low risk sPESI score and absence of exclusion criteria

1) Simplified Pulmonary Embolism Severity Index (sPESI) – Table 3

- If sPESI score ≥1 manage as inpatient but can be considered for early discharge when low risk score. If score 0, check for exclusion criteria

Table 3: Simplified Pulmonary Embolism Severity Index (sPESI)

Parameter	Score
Age >80 yr	1
Active cancer (diagnosed within 12 months or undergoing treatment)	1
Chronic cardiopulmonary disease	1
Pulse ≥110 bpm	1
Systolic blood pressure <100 mmHg	1
Oxygen saturation ≤90% (with or without supplemental oxygen)	1
Risk Class	
Low	0
High	≥1

2) Patients with any of the following exclusion criteria are unsuitable for ambulatory care of PE

i.	**Patient unstable:** • Syncopal episode • Haemodynamically unstable – systolic BP <100 mmHg; pulse ≥110; requirement for inotropes and critical care; requirement of thrombolysis or embolectomy • Respiratory instability – RR >24, SaO_2 <90% on air • PE while on full dose anticoagulation • Chest pain not managed by oral analgesia or requiring opiates
ii.	**Severe renal dysfunction (CKD stage 4 or 5, eGFR <30) or severe liver disease**
iii.	**Active malignancy within 6 months**
iv.	**Pregnant**
v.	**Bleeding risk** • Active bleeding, trauma or surgery in last 4/52 • Recent intracranial haemorrhage event
vi.	**Allergy to heparin or history of HIT**

vii. Outpatient therapy not feasible:
- Translator required
- Immobility/unable to walk
- Inadequate social support
- Anticipated inadvertent non-compliance (e.g. alcohol, abuse, mental illness)
- Inability to attend outpatient appointment
- Unable to obtain transport to and from hospital
- Unable to access telephone at home
- Unaware of adverse symptoms and how to obtain help
- Significant comorbidity
- No GP or not local resident
- No fixed abode
- Altered mental state (disorientation, lethargy, stupor or coma)

viii. Other
- History of IVDU
- Any other reason for admission
- Raised troponin: consultant review to consider alternative cause for result
- Right ventricular strain/dilatation on CTPA: if BNP and Troponin normal, consultant review to assess safety of ambulatory care management

3) If suitable for ambulatory care of PE refer to AMU or ambulatory emergency care centre (AEC)
- Provide patient information on signs and symptoms of recurrence, major bleeding and additional complications
- AMU and AEC contact details in event of complications and concerns
- Complete the PE Ambulatory proforma
- Arrange review in AEC within a week of discharge
- Refer to respiratory clinic

Monitoring on ward
- Daily clinical examination for signs of further embolism, right heart failure, and secondary infection of a pulmonary infarct

Monitoring dalteparin treatment
- See **Dalteparin for VTE** guideline

Inferior vena caval filter (IVCF)
- Temporary IVCF can be used if patient:
- cannot have anticoagulation treatment, which will need to be removed when patient becomes eligible for anticoagulation therapy
- recurrent VTE despite increasing INR target range to 3–4 or trial of dalteparin – discuss with haematology
- ensure strategy for removing IVCF at earliest possible opportunity is planned and documented

Maintenance anticoagulation
- Start warfarin as soon as diagnosis confirmed – see **Warfarin** guidelines
- Continue dalteparin for at least 5 days or when INR has, for 2 consecutive days, been within the therapeutic range: 2–3 (3–4 for recurrent PE occurring while INR within range 2–3), whichever is the longer
- If patient injection drug user or has active cancer, consider continuing therapeutic dalteparin treatment, rather than converting to warfarin

INR may be elevated by heparin if APTT ratio exceeds 2.5 in a patient being given unfractionated heparin, and must not be used as a guide to adjustment of warfarin dosage

Rivaroxaban
- If LMWH or warfarin not suitable, consider Rivaroxaban, particularly if:
- previous intracranial bleed
- ≥12 months anticoagulant therapy is required
- anticipated difficulties with INR monitoring and understanding dose adjustments
- needle phobia
- other comorbidities (e.g. deranged LFT, excessive alcohol intake) increasing risk of bleeding on warfarin. Discuss with haematologist

Dosage and monitoring

- 15 mg 12-hrly oral for first 3 weeks, 20 mg daily oral thereafter, for duration of therapy
- No monitoring is required
- If eGFR <50 mL/min, reduce dose as per BNF – discuss with haematologist
- Contraindicated if eGFR <15 mL/min, in pregnancy and if breastfeeding

Screen for cancer

- Chest X-ray, FBC, LFT, calcium and urinalysis in all patients with a confirmed PE
- If patient aged >40 yr has first unprovoked PE, consider performing a thoraco-abdominal–pelvic/abdominal-pelvic (discuss with radiology) CT scan and (for women) a mammogram

DISCHARGE AND FOLLOW-UP

Duration of treatment and follow-up

- Ensure INR in appropriate range and stable
- After a first provoked thromboembolic event, continue warfarin for 3 months. Continue indefinitely for life-threatening PE. For recurrent or unprovoked PE discuss with haematology and/or respiratory physician
- If patient aged <45 yr with unprovoked PE, discuss screening for inherited or acquired thrombophilia with haematology consultant
- If patient has active cancer, reassess risks and benefits of continuing anticoagulation at 6 months
- Arrange echocardiogram as outpatient if evidence of right ventricular dysfunction or raised Troponin or BNP biomarkers
- Arrange follow-up in respiratory clinic

Administrative

- Advise patient that many drugs (including alcohol) interact with warfarin and to remind their GP, if additional medication is prescribed, that they are taking warfarin
- Give patient a yellow anticoagulation therapy record booklet in which the following information has been entered: indication for warfarin, target INR, start date and duration of therapy, the last 4 INR results and date of next INR
- Refer to anticoagulant management service for follow-up appointment date – obtain anticoagulant referral form from Trust intranet: Clinicians>support services>pathology>anticoagulant management
- If hospital supervision planned, ensure discharge letter includes diagnosis, dosage of warfarin and date of clinic appointment
- If anticoagulation to be monitored by GP – in discharge letter supply information about:
  - indication for anticoagulation
  - proposed duration of treatment
  - proposed target range for INR
  - details of anticoagulation in hospital (give dates, INR results and dosage taken)

Document in medical record that patient has been given written and verbal information about warfarin and has been referred to anticoagulation clinic

MANAGEMENT OF A PREGNANT PATIENT

Investigations

- Contact obstetric team – see **Management of a pregnant woman with a non-obstetric problem** guideline and see **VTE – Pulmonary embolism** guideline in **Obstetric** guidelines
- If pre-test probability low or moderate, request D-dimer assay. **Remember,** D-dimer may be increased in pregnancy. Do not request where an alternative diagnosis is highly likely, clinical probability of PE is high or probable massive PE. **Only a negative result is of value**
- Chest X-ray (with fetal shielding)
  - if another cause for pleuritic chest pain identified, treat appropriately
- Bilateral leg Dopplers:
  - if leg Doppler(s) positive, treat as pulmonary embolism – go to **Immediate treatment**
  - if leg Doppler(s) negative, follow **Flowchart for diagnosis of non-massive PE** above
  - advise patient of very small risk to fetus associated with low-dose perfusion scan or CTPA (1:280,000) compared with a very high risk of maternal death (1 in 7) associated with untreated PE during pregnancy
- Speak directly to radiologist for appropriate session to get examination accepted and expedited urgently and request on OrderComms
- If pulmonary embolism confirmed, go to **Immediate treatment** below

HAEMODYNAMICALLY STABLE (SUBMASSIVE) PULMONARY EMBOLISM ● 6/6

IMMEDIATE TREATMENT

Nurse patients in the second and third trimester on a left lateral tilt (never supine) or with manual displacement of the uterus ***to prevent aortocaval compression – see* VTE – Pulmonary embolism guideline in Obstetric guidelines**

General

- Oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Adequate analgesia for pleuritic pain – prefer morphine sulphate 10 mg oral 4-hrly
- Avoid NSAIDS
- A high right atrial pressure (i.e. JVP) is common and does not need to be treated
- **AVOID** diuretics

Specific

- Commence dalteparin as soon as PE suspected – see **Dalteparin for VTE** guideline
- if close to term or bleeding present, or massive pulmonary embolus, consider IV unfractionated heparin – discuss with obstetric team

If contraindications to anticoagulation, a consultant physician and obstetrician, staff physician or SpR must make a decision as to which carries most risk – possible complications of therapy, or embolism

SUBSEQUENT MANAGEMENT

- Daily clinical examination for signs of further embolisation, right heart failure, and secondary infection of a pulmonary infarct

Maintenance treatment

- Choose one of the following two options after discussion with consultant haematologist
- therapeutic LMWH for 8–12 weeks followed by prophylactic dose for the rest of the pregnancy and for at least 6 weeks postnatally **or**
- therapeutic LMWH throughout pregnancy and for at least 6 weeks postnatally

Anticoagulant therapy during labour and delivery

- Discontinue LMWH maintenance therapy 24 hr before planned delivery
- Advise woman that once she is established in labour or thinks she is in labour, she should not inject any further heparin or other anticoagulant
- Do not administer regional anaesthetic or analgesic until at least 24 hr after last dose of therapeutic LMWH

Monitoring dalteparin treatment

- See **Dalteparin for VTE** guideline

Postnatal anticoagulation

- If no bleed, restart anticoagulation treatment 4 hr after delivery
- Continue therapeutic anticoagulant therapy for at least 6 weeks postnatally and until at least 3 months of treatment has been given in total. Offer a choice of LMWH or oral anticoagulant (warfarin)
- Heparin and warfarin are not contraindicated in breastfeeding
- If woman chooses to commence warfarin postpartum, this should be avoided until at least the third postnatal day
- Daily INR testing is recommended during the transfer from LMWH to warfarin to avoid over anticoagulation

DISCHARGE AND FOLLOW-UP

- As part of medical discharge, offer women who have been diagnosed with VTE during pregnancy or postnatal period a 6 week postnatal appointment with consultant haematologist via GP
- Arrange echocardiogram as outpatient if evidence of right ventricular dysfunction or raised Troponin or BNP biomarkers
- Arrange follow-up in respiratory clinic
- Arrange follow-up with obstetric team

HEPARIN-INDUCED THROMBOCYTOPENIA ● 1/4

Heparin-induced thrombocytopenia (HIT) is a known complication of heparin therapy occasionally seen in patients treated with unfractionated heparin (UFH) or low molecular weight heparin (LMWH). It is an immune-mediated disorder that can result in life-threatening venous and arterial thrombosis despite on-going treatment with heparin. It is extremely important to identify it early, stop heparin **and** substitute alternative anticoagulation

MONITORING

- Inform patients that HIT is a possible complication of heparin therapy
- **Check baseline platelet count for all patients who are to receive heparin**
- Monitor platelet count in the clinical situations below

Patients receiving UFH

- Post-operative patients (including obstetric post-operative patients) who receive UFH, check platelet count on alternate days starting from **day 4 until day 14** of heparin treatment or until heparin is stopped
- Post-operative patients who have received UFH in the previous 100 days and are now receiving UFH or LMWH, start platelet count monitoring **from day 2**

Patients receiving LMWH

- Post-operative **cardiac surgery** patients receiving LMWH (prophylactic or therapeutic), monitor for HIT. Check platelet count on alternate days starting from **day 4 until day 14** of heparin treatment or until heparin is stopped
- Post-operative patients who have received UFH in the previous 100 days and are now receiving LMWH or UFH, platelet count monitoring **from day 2**
- Incidence of HIT in all other patients is <1%, so monitoring for HIT not necessary. However, investigate for HIT if there is an unexplained drop in platelet count >30% of baseline or development of new thrombosis while on UFH/LMWH or any other feature of HIT listed below

RECOGNITION AND ASSESSMENT

Clinical features of HIT

- A >30% fall in platelet count
- Extension of previous thrombus
- New arterial/venous thrombosis
- Thrombosis in an unusual site (cerebral, renal, skin necrosis)
- Acute systemic reaction after UFH IV bolus – cardiorespiratory, neuralgic or unusual symptoms within 30 min
- Disseminated intravascular coagulation (DIC)
- Skin lesions at heparin injection sites

Thrombocytopenia is rarely severe in HIT
Despite low platelet count, bleeding is uncommon

HIT suspected

- Perform pre-test probability scoring for HIT

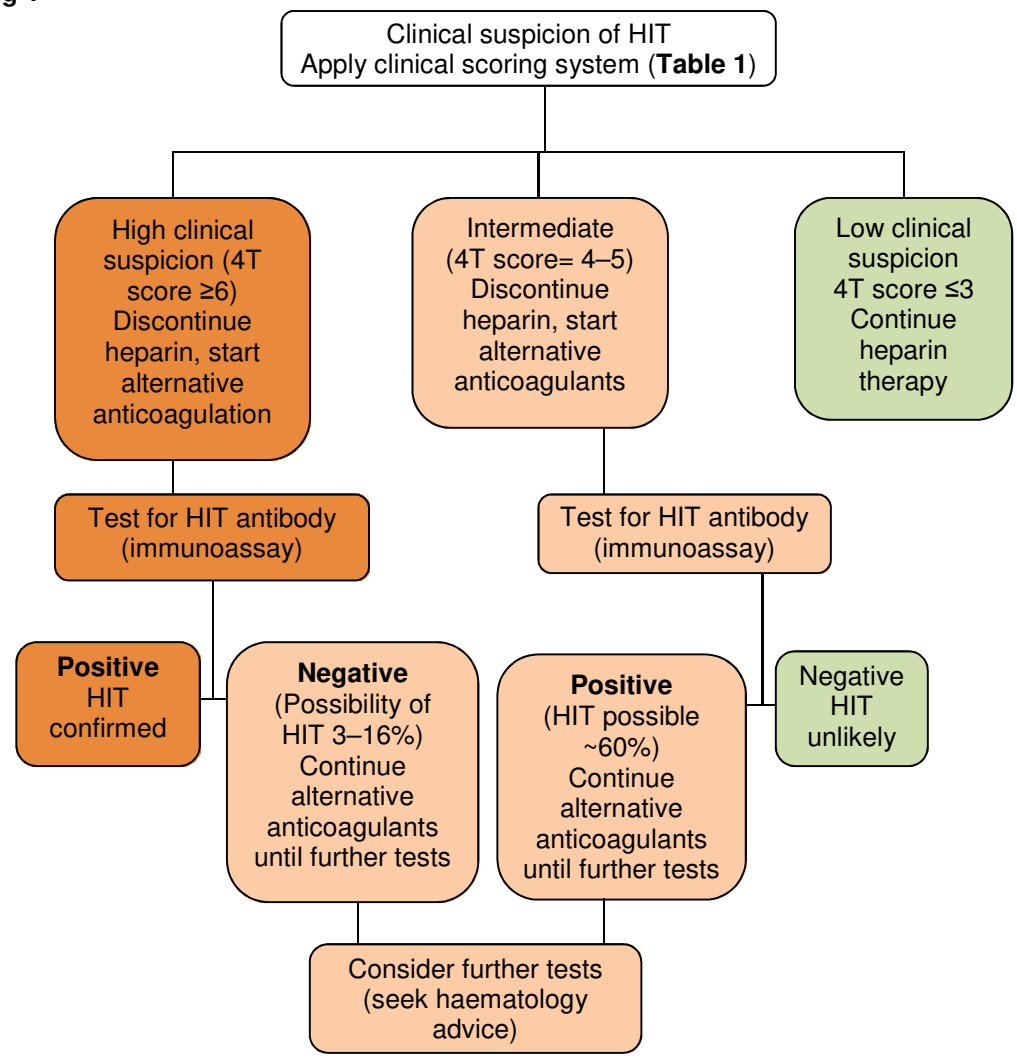
Table 1: Pre-test probability scoring for HIT (four Ts)

Clinical feature	Score		
	2	1	0
Thrombocytopenia	>50% fall from baseline or to nadir of $>20 \times 10^9$/L	30–50% fall from baseline or to nadir of $10–19 \times 10^9$/L	<30% fall from baseline or to nadir of $<10 \times 10^9$/L
Timing of thrombocytopenia (after heparin exposure)	Clear onset between 5 and 10 days (earlier if recent heparin exposure – within 30 days)	Onset after 10 days or Time of onset not clear (missing platelet counts etc)	Onset before 4 days after recent heparin (without heparin exposure within last 100 days)
Thrombosis or other sequelae	New thrombosis Skin necrosis Post-heparin acute systemic reaction	Progressive or recurrent thrombosis Thrombosis not yet proven	None
Other causes of thrombocytopenia evident	No other cause of thrombocytopenia evident	Possible other causes	Definite other cause present

Pre-test probability score

- Add score for each clinical category maximum score = 8
  6–8 = High 4–5 = Intermediate 0–3 = Low
- If patient has intermediate or high pre-test probability**, suspect HIT and start treatment while waiting for laboratory confirmation**

Fig 1



IMMEDIATE TREATMENT

- Treatment decisions should be made on clinical grounds if HIT antibodies results are not immediately available. If in doubt seek haematology advice
- Obtain blood sample for HIT antibody testing. Check with blood bank regarding sample requirement

Patients with intermediate or high pre-test probability of HIT

- **STOP HEPARIN** and start alternative anticoagulant (danaparoid, argatroban, fondaparinux or bivalirudin) in treatment doses (listed below). **Remember just stopping heparin is not enough**
- Argatroban is the first-line anticoagulant for patients with HIT. It is especially beneficial in patients with renal impairment and patients in critical care with confirmed or suspected acute HIT. Use with caution in critical care and hepatic impairment
- Do not start warfarin. If warfarin has already been started, omit further doses and give Vitamin K_1 (phytomenadione) 5 mg by slow IV injection while introducing alternative anticoagulation
- Platelet transfusion is relatively contraindicated. Thrombocytopenia in HIT is rarely severe and is not associated with bleeding

Patients with low pre-test probability

- Continue heparin. Contact haematology consultant for advice about HIT antibody testing

ALTERNATIVE ANTICOAGULANTS

Danaparoid

- Danaparoid is a low-molecular-weight heparinoid, chemically distinct from heparin, used for treatment of suspected or proven HIT (with or without thrombosis) and for prevention of venous thrombosis in patients with a history of HIT
- For patients undergoing dialysis, a specific danaparoid dosage protocol is available from renal ward or critical care
- Obtain baseline platelet count and APTT
- Prepare a danaparoid sodium solution by taking 4500 units (3.6 mL of 1250 units/mL) danaparoid sodium injection to make up to 45 mL in a syringe with sodium chloride 0.9% or glucose 5% to give a concentration of 100 units/mL. The diluted solution is stable for 24 hr

Table 2: Danaparoid dosing for HIT

Clinical indication	Danaparoid dosing schedule		
Treatment of HIT (suspected or proven) whether associated with thrombosis or not Use IV bolus followed by IV infusion. Determine bolus dose from body weight	Body weight <55 kg	Body weight 55–89 kg	Body weight ≥90 kg
	Bolus 1250 units (12.5 mL)	Bolus 2500 units (25 mL)	Bolus 3750 units (37.5 mL)
	Followed by IV infusion 400 units/hr for 2 hr, then 300 units/hr for 2 hr, then 200 units/hr for 5 days		
	• **Monitor** danaparoid therapy (using anti-Xa assay) if patient ◦ weighs <55 kg or >90 kg ◦ has renal impairment ◦ has a life- or limb-threatening thrombosis ◦ has a high risk of haemorrhage • Contact coagulation laboratory for anti-Xa assay. Test can be done only during routine hours after discussion with consultant haematologist ◦ take sample between 6–24 hr of starting or altering IV infusion and repeat at 72 hr in patients with renal failure ◦ target concentration 0.5–0.8 units/mL		
Prevention of venous thrombosis in patients with history of HIT	750 units (0.6 mL of 1250 units/mL) SC every 12 hr		

Argatroban

- Preferred alternative anticoagulant in patients with HIT and is a direct thrombin inhibitor, with a half-life of 50 min. **Use with caution in patients in critical care and hepatic impairment**
- Eliminated by hepato-biliary route and **requires no dose modification in patients with renal impairment. Specific dosage protocol for patients on haemodialysis is available on renal unit and critical care**

Contraindicated in patients with severe hepatic impairment

- Dilute argatroban to make a solution of 1 mg/mL. Dilute each 2.5 mL vial containing 250 mg argatroban with sodium chloride 0.9% to 250 mL to make a 1 mg/mL solution

Standard dosing schedule Initial infusion rate 2 microgram/kg/min		**Critically ill/hepatic impairment** Initial infusion rate 0.5 microgram/kg/min	
Maximum dose 10 microgram/kg/min ***Check APTT 2 hr after initiation of infusion***			
APTT ratio	**Infusion rate change**	**Next APTT**	**Infusion rate change**	**Next APTT**
<1.5	Increase by 0.5 microgram/kg/min	2 hr	Increase by 0.1 microgram/kg/min	4 hr
1.5–3.0	No change	2 hr; after 2 consecutive APTTs within target range, check at least once daily	No change	4 hr; after 2 consecutive APTTs within target range, check at least once daily
>3.0	Stop infusion until APTT between 1.5–3.0; resume at half previous infusion rate and monitor	2 hr	Stop infusion until APTT between 1.5–3.0; resume at half previous infusion rate and monitor	4 hr

Fondaparinux

Use in HIT is unlicensed seek haematology advice before prescribing

- Fondaparinux is an indirect anti-Xa inhibitor and has a half-life of 17–20 hr
- It is licensed for use in treatment and prevention of VTE
- Avoid in patients with renal impairment, use argatroban instead
- Before starting, obtain baseline platelet count and APTT

Table 3: Fondaparinux dosing for adult patients with HIT

Patient body weight	Dose
<50 kg	5 mg SC once daily
50–100 kg	7.5 mg SC once daily
>100 kg	10 mg SC once daily

- If use in patients with renal impairment unavoidable, reduce dose and monitor anti-Xa levels

Bivalirudin

Use in HIT is unlicensed seek haematology advice before prescribing

- Bivalirudin is a direct thrombin inhibitor licensed for use in coronary interventions
- it has a short half-life of 30–40 min which can be prolonged to 3 hr in patients with severe renal impairment – for patients with renal impairment use argatroban
- elimination of bivalirudin is by enzymic metabolism and renal excretion. No dose adjustment is required for hepatic impairment
- there is no known antidote
- rare cases of anaphylactic reaction have been associated with IV bolus or infusion
- Before starting infusion, obtain baseline platelet count and APTT

Table 4: Bivalirudin dosing for HIT for adult patients

Clinical indication	Bivalirudin dosing schedule	
Patients with HIT with normal renal function	0.2 mg/kg/hr IV continuous infusion Monitor APTT to achieve ratio 1.5–2.5 adjust infusion rate*	
	Cr clearance	**Infusion rate**
Patients with renal impairment	30–60 mL/min	0.1 mg/kg/hr
	<30 mL/min	0.05 mg/kg/hr
	Monitor APTT to achieve ratio 1.5–2.5, adjust infusion rate*	
	APTT ratio	
*APTT monitoring: 2 hr after start of infusion and after every change until stable. Thereafter check APTT once every 24 hr	<1.5	Increase infusion rate by 20%
	1.5–2.5	No change
	2.5–4	(no bleeding), reduce infusion rate by 20%
	>4	Stop infusion, repeat APTT in 30 min and start infusion when APTT <2.5 at 50% reduced infusion rate

RESTARTING ORAL ANTICOAGULATION

- Start warfarin only when:
- platelet count has recovered to >150 $\times$ 10^9/L
- patient is fully anticoagulated with alternative anticoagulant
- Start warfarin using lower loading dose of 5 mg (see **Warfarin initiation** guideline) and continue alternative anticoagulant for a minimum of 5 days (after starting warfarin) and until INR in target range for 2 consecutive days
- Ensure platelet count remains stable
- Patients on **argatroban undergoing transition to warfarin should have INR >4 for 2 days before stopping argatroban**
- once stopped, allow INR to revert to usual target range
- Give therapeutic anticoagulation for 3 months after HIT associated with a thrombotic complication and for 4 weeks following HIT without a thrombotic complication

DISCHARGE AND FOLLOW-UP

- Patients are at increased risk of thrombosis if they are given UFH or LMWH during the next 100 days after HIT, inform patient of this risk
- Document HIT in patient notes, electronic records and discharge letter
- If patient requires anticoagulation with heparin after more than 100 days, seek advice from haematology consultant

SPONTANEOUS PNEUMOTHORAX ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Sudden onset, occasionally at rest:
  - chest pain (unilateral)
  - dyspnoea
- Resonance on percussion, with reduced vocal fremitus and breath sounds (if moderate-large)

If patient* in extremis*, very dyspnoeic with circulatory compromise, and trachea or mediastinum (apex beat) displaced, consider TENSION PNEUMOTHORAX (very rare). Give oxygen (10 L/min) through a high concentration (60–100%) mask. Insert a large bore cannula of at least 4.5 cm in length into second anterior intercostal space, midclavicular line, then insert intercostal tube – see* Intercostal tube drainage *guideline. Remove emergency cannula when bubbling in underwater seal system confirms intercostal tube system functioning

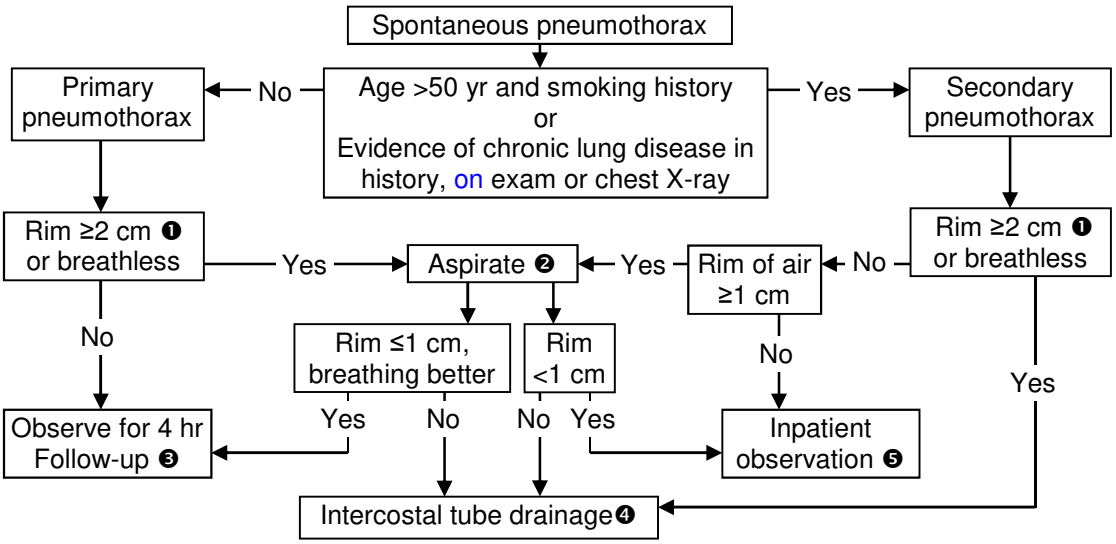
BEWARE: Suspected basal pneumothorax usually implies a bulla. CT scan and previous chest X-rays will differentiate bullae from pneumothorax

Investigations

- PA chest X-ray
  - measure interpleural (rim) distance at level of hilum
- If findings obscured by surgical emphysema or complex bullous disease, CT scan should be considered

IMMEDIATE TREATMENT

- If bilateral or haemodynamically unstable, proceed to chest drain
- Otherwise, follow algorithm



1: Breathlessness:

- Obvious deterioration in usual exercise tolerance

2: Simple aspiration:

- See **Pleural aspiration of air** guideline
- If unsuccessful (patient still symptomatic and >2.5 L of air aspirated) on first attempt in patient with primary pneumothorax, proceed with chest drain insertion

3: Follow-up:

- Pleural clinic in 2–4 weeks
- Give patient discharge letter and written advice to return immediately if deteriorates
- No air travel until full lung re-inflation on chest X-ray

4: Intercostal tube drainage:

- See **Intercostal tube drainage** guideline
- Do not advance chest drain

5: Inpatient observation:

- Administer oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline

SPONTANEOUS PNEUMOTHORAX ● 2/2

SUBSEQUENT MANAGEMENT AND DISCHARGE

- Admit to a Respiratory ward

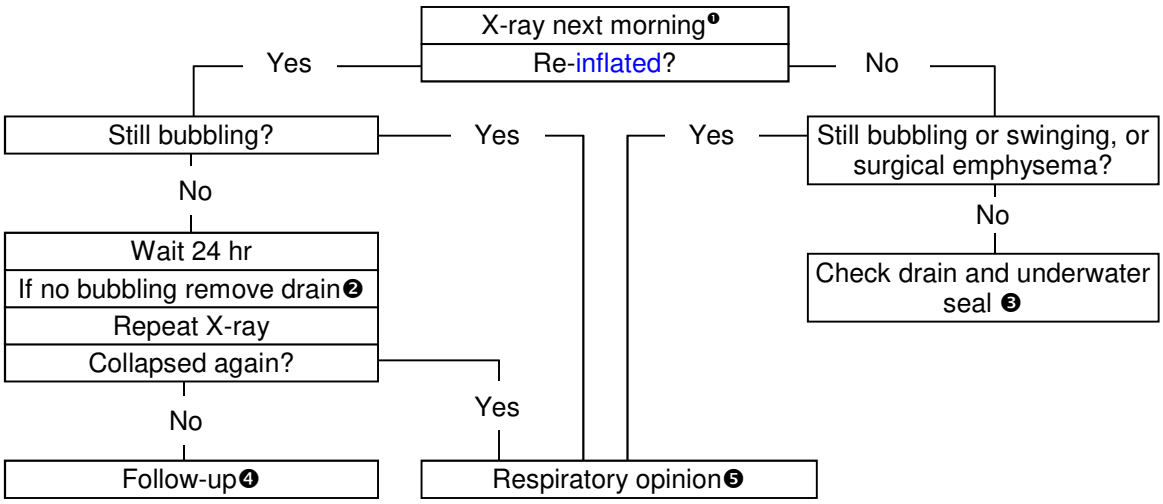
Chronic lung disease after aspiration

- Inpatient care until stable

Recurrent pneumothorax

- If second or subsequent pneumothorax, institute immediate management and refer to pleural team. Contact pleural clinic 75353 or pleural clinical fellow or pleural nurse via call centre

Management of intercostal drains



Do not clamp chest tube unless advised by pleural team or thoracic surgeon

1. **Chest X-ray (non-portable):**
- **Always** keep underwater seal below chest

2. **Removal of chest drain:**
- Bubbling stopped for at least 24 hr
- Cut drain-securing suture
- Withdraw tube while patient holds breath in expiration
- Close wound with remaining sutures

3. **Check drain:**
- **If lung not re-inflated and no bubbling in underwater bottle:** Try to remove **block** or **kink**
- If unsuccessful, contact pleural team

4. **Follow-up:**
- Pleural clinic in 2–4 weeks
- Patient given discharge letter and written advice to return immediately if deteriorates
- No air travel until full lung re-inflation on chest X-ray

5. **Pleural team opinion:**
- Why no re-inflation (e.g. air leak, displaced/blocked tube, broncho-pleural fistula, underlying pulmonary disease)?
- Use of high volume/low pressure suction, –1 to –2 kPa/Barr, (equals –8 to –16 mmHg; –8 to –20 cm H_2O)
- Early discussion with thoracic surgeons. Refer if pneumothorax fails to resolve after 5 days of above management or after 3 days if patient has chronic lung disease
- Patients with secondary spontaneous pneumothorax that are unfit for surgery, consider medical pleurodesis (see **Medical pleurodesis** guideline) or ambulatory management with a Heimlich valve or flutter bag

ACUTE SEVERE ASTHMA IN ADULTS ● 1/3

RECOGNITION AND ASSESSMENT

- Complete the asthma pathway for **ALL patients** attending emergency portals with an asthma exacerbation

Symptoms and signs

- Cannot complete sentences in one breath
- Respiration ≥25 breaths/min
- Pulse ≥110 beats/min
- Use of accessory muscles
- Peak expiratory flow (PEF) <50% of predicted (**Figure 1**) or best (if known)

Life-threatening features

- PEF <33% of predicted (**Figure 1**) or best (if known)
- SpO_2 <92%
- Silent chest, cyanosis, or feeble respiratory effort
- Bradycardia or hypotension
- Exhaustion, confusion or coma

Patients with severe or life-threatening attacks may not be distressed and may not have all these abnormalities. The presence of any one of these should alert the clinical team

Investigations

The only investigations needed before **immediate treatment** are:

- PEF
- Oximetry

If SpO_2 <92% or patient has any life-threatening features or not responding to treatment, measure arterial blood gases (ABG)

ABG markers of a life-threatening attack

- Normal or high $PaCO_2$ (>4.6 kPa)
- Severe hypoxia: PaO_2 <8 kPa irrespective of treatment with oxygen
- Low pH (or high H^+)

IMMEDIATE TREATMENT

- Oxygen: follow **Oxygen therapy in acutely hypoxaemic patients** guideline (CO_2 retention not usually aggravated by oxygen therapy in asthma)
- Terbutaline 10 mg or salbutamol 5 mg plus ipratropium 500 microgram via oxygen-driven nebuliser 6–8 L/min oxygen
- Prednisolone tablets 40 mg (if taking maintenance prednisolone, increase daily dose by 40 mg; maximum 60 mg) or hydrocortisone (preferably as sodium succinate) 100 mg slow IV bolus, or both if very ill
- No sedatives of any kind
- If patient has coincident chronic bronchitis (regularly produces sputum), consider antimicrobial treatment
- Chest physiotherapy **not** indicated
- Assess and treat hypovolaemia and electrolyte imbalance – see **Fluid resuscitation** guideline, **Maintenance fluid therapy** guideline and **Electrolyte disturbances** guidelines

Further investigations

- Chest X-ray
- if not responding to treatment or to exclude pneumothorax, consolidation or life-threatening exacerbation
- U&E (use green top bottle for accurate K^+ level)
- FBC
- If patient on maintenance theophyllines – take bloods for therapeutic levels

Patients with life-threatening features

DO NOT LEAVE THE PATIENT. Ask medical SpR, staff physician or consultant physician, ideally respiratory, to review urgently

- Give magnesium sulphate 2 g made up to 50 mL with sodium chloride 0.9% by IV infusion over 20 min if not already given earlier (e.g. in ambulance). Ensure cardiac monitoring and oximetry *in situ.* Never give a second dose of magnesium sulphate without discussion with consultant respiratory physician
- **Speak to critical care unit (CCU) and transfer patient urgently if continues to deteriorate with:**
- falling PEF, worsening or persisting hypoxia, or hypercapnia
- exhaustion, feeble respirations, confusion, or drowsiness
- coma or respiratory arrest

En-route to CCU, ensure patient is accompanied by a doctor (usually an anaesthetist) prepared to intubate if patient's clinical condition requires it

SUBSEQUENT MANAGEMENT

- Admit to a respiratory ward
- lower threshold for admission in patients attending with history of non-adherence, lives alone, mental health issues, learning difficulties, previous near fatal attack, presenting at night, pregnancy, difficult asthma
- Correct disturbances in fluid and electrolyte balance, especially potassium (K^+)

If patient requires IV fluid with potassium, always use commercially produced pre-mixed bags of sodium chloride 0.9% and potassium chloride. NEVER add potassium chloride to infusion bags

If patient improving

- Continue oxygen – to maintain SpO_2 >94% (see **Oxygen therapy in acutely hypoxaemic patients** guideline)
- Prednisolone daily at dose in **Immediate treatment** section, or hydrocortisone 100 mg 6-hrly as slow IV bolus over 1 min if unable to tolerate oral medication
- Nebulised salbutamol 2.5 mg plus ipratropium 250 microgram 6-hrly
- Continue regular inhaled/oral preventer medication

Fax referral to clinical nurse specialist in asthma on 74072 or call 74068 to review patient

- Change to discharge medication 24 hr before discharge and check inhaler technique

If patient not improving after 15–30 min

- Continue oxygen to maintain SpO_2 >94%
- Give nebulised salbutamol 5 mg more frequently, up to every **15–30 min** – see **Monitoring treatment**
- Give ipratropium 500 microgram 4-hrly until patient improving
- Once patient improving, reduce nebulised salbutamol to 2.5 mg and ipratropium to 250 microgram 6-hrly

If patient still not improving

Ask medical SpR, staff physician or consultant physician, ideally respiratory, to review urgently

- Give magnesium sulphate 2 g made up to 50 mL with sodium chloride 0.9% by IV infusion over 20 min if not already given earlier (e.g. in ambulance). Never give a second dose of magnesium sulphate without discussion with consultant respiratory physician
- Senior clinician to consider use of aminophylline or salbutamol by infusion – see **Aminophylline** guideline and **Salbutamol** guideline for doses. If patient already taking oral theophylline **DO NOT** give loading dose IV aminophylline
- **If any life-threatening features present (see above), transfer to CCU and refer to respiratory physician**

En-route to CCU, ensure patient is accompanied by a doctor (usually an anaesthetist) prepared to intubate if patient's clinical condition requires it

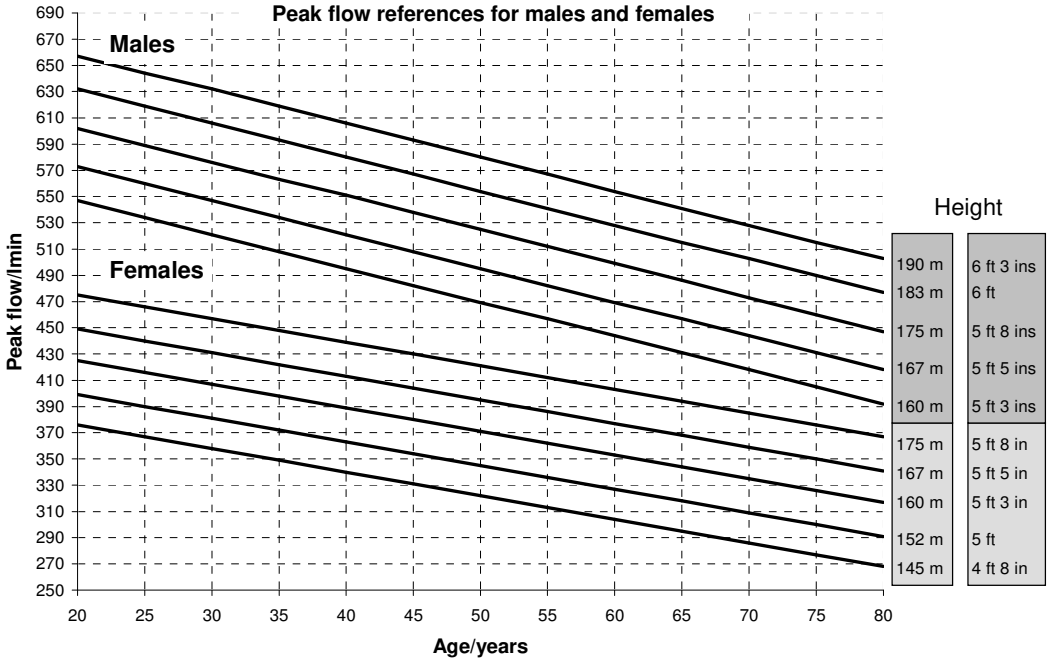
MONITORING TREATMENT

- Repeat measurement of PEF 15–30 min after starting treatment then according to response
- Oximetry: maintain SpO_2 94–98%
- Record heart rate and respiratory rate
- Repeat blood gas measurements within 2 hr of starting treatment if:
- initial PaO_2 <8 kPa (60 mmHg), unless subsequent SpO_2 >92%, **or**
- initial $PaCO_2$ normal or raised, **or**
- patient deteriorates
- In patients requiring frequent doses of salbutamol nebuliser, repeat serum potassium within 2 hr of starting treatment and repeat 2-hrly
- potentially serious hypokalaemia is especially likely to occur in patients taking corticosteroids, theophylline and diuretics, and who are hypoxic
- If theophylline infusion continued for >24 hr, measure theophylline levels (therapeutic range 10–20 mg/L)
- Chart PEF before and 15–20 min after giving nebulised or inhaled salbutamol, and at least 4 times daily until stable; then change to morning and evening before salbutamol dose

DISCHARGE AND FOLLOW-UP

- **When discharged from hospital patients should have:**
- been stable taking discharge medication for 24 hr and had inhaler technique checked and recorded
- PEF >75% of predicted or best and PEF diurnal variability <25% unless discharge agreed with respiratory physician
- treatment with oral corticosteroids for 5 days or until improved and inhaled corticosteroids in addition to bronchodilators
- own PEF meter (prescribable) – advise patient to record PEF morning and evening before inhalers
- a written personal asthma action plan (available from asthma team e-mail: paap@uhns.nhs.uk)
- had reason for exacerbation discussed
- details of admission, discharge and potential best PEF sent to GP on discharge documentation
- GP follow-up within 2 days
- Complete asthma inpatient referral via OrderComms for outpatient clinic follow-up
- Complete discharge checklist at the back of the care pathway

Figure 1: Predicted adult PEF chart for use with EU standard peak flow meters marked with yellow circle around the letters EU



To find predicted PEF value read off from the vertical axis the value corresponding to the point where a vertical line from patient's age intersects with the line on the graph corresponding most closely with patient's height

EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) ● 1/3

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Worsening of cough
- Worsening dyspnoea
- Wheezing
- Increase in sputum volume, tenacity (difficult expectoration) and purulence
- Acute confusion
- Pyrexia (often)
- Tachypnoea
- Tachycardia
- Prominent abdominal movement
- Pursed lip breathing, tracheal tug, prolonged expiration
- Predominant use of accessory muscles
- Inspiratory or expiratory wheezes
- Look for signs of cor pulmonale (peripheral oedema, raised jugular venous pressure, hepatomegaly)
- Look for signs of type 2 respiratory failure (drowsiness, confusion, cyanosis, flapping tremor, papilloedema)

Investigations

- Arterial blood gases (ABG) when breathing air
- if clinical condition does not allow ABG when breathing air, record FiO_2
- Chest X-ray
- ECG
- Sputum (inspect for purulence and viscosity, and send for culture)
- FBC
- If suggestion of systemic infection, blood cultures – see **Collection of blood culture specimens** guideline
- U&E
- CRP

Differential diagnosis

- Pneumonia (consolidation on chest X-ray) – see **Community-acquired pneumonia** guideline
- Exacerbation of asthma, if in doubt treat as such – see **Acute severe asthma in adults** guideline
- Pneumothorax – even small can be dangerous (mortality in advanced COPD complicated by pneumothorax is 50%) – see **Spontaneous pneumothorax** guideline
- Left ventricular failure – see **Acute heart failure** guideline
- Pulmonary embolism – see **Haemodynamically stable (submassive) pulmonary embolism** and **Haemodynamically unstable (massive) pulmonary embolism guidelines**
- Drug-induced deterioration in respiratory function – review medication for sedatives and beta-blockers

IMMEDIATE TREATMENT

Document in medical record patient's functional status before the exacerbation. A consultant, staff physician or SpR must document patient's ventilation and resuscitation status

- Give oxygen to maintain SpO_2 88–92% initially. Then follow **Oxygen therapy in acutely hypoxaemic patients** guideline

High percentage (>24%) oxygen must NOT be given unless ABG confirm absence of CO_2 retention

Antimicrobials

- Check iPortal for recent sputum microbiology results. If last culture report within 3 months treat according to sensitivities. If sensitivities not known treat according to regimen below
- Usual organisms: *Strep. pneumoniae, H. influenzae, Moraxella catarrhalis.* Consider *Staph. aureus* if influenza prevalent
- Doxycycline 200 mg oral on first day, then 100 mg oral daily (avoid oral zinc, calcium, iron, salts and antacids containing magnesium or aluminium within 2 hr of doxycyline)
- if patient unable to swallow or absorb oral antimicrobial, co-amoxiclav 1.2 g IV 8-hrly, or if penicillin allergic, clarithromycin 500 mg IV by infusion into larger proximal vein 12-hrly

Statins contraindicated in combination with clarithromycin (see current BNF for other interactions)

- if patient has symptoms and signs of pneumonia plus new, unexplained chest X-ray shadowing, follow antimicrobial regimen recommended for pneumonia – see **Community-acquired pneumonia** guideline

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.
True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission.
If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or a consultant in infectious diseases

Bronchodilators

- Salbutamol (2.5 mg) or terbutaline (5 mg) via air-driven nebuliser 4–6 hrly
- Consider adding ipratropium bromide (500 microgram) via nebuliser 6-hrly
- If not improving after 4 hr, add aminophylline infusion – see **Aminophylline** guideline

Corticosteroid

- Prednisolone 30 mg oral daily
- If already taking maintenance (long-term) dose of prednisolone, increase daily dose by 30 mg
- If severely ill, give hydrocortisone 100 mg by slow IV bolus 6-hrly
- Correct dehydration

Physiotherapy

- Only aids clearance of sputum

Mechanical ventilation

- See **Respiratory failure** guideline

SUBSEQUENT MANAGEMENT

- Admit to a respiratory ward
- Refer all patients via OrderComs to the oxygen and respiratory service [previously known as the supported early discharge team (SED)] – patients should be reviewed within 24 hr of admission
- **If improving after 48 hr:**
- continue with oral antimicrobials until sputum mucoid
- continue nebulised bronchodilator if already using at home **or** check inhaler technique and substitute appropriate inhaler device for nebulised bronchodilator(s). Continue prednisolone at same dose for 7–14 days before stopping or returning to maintenance dose (no need to taper withdrawal)
- if either PaO_2 >7.3 kPa or SpO_2 >92% while breathing air, stop oxygen but watch for deterioration

If patient conscious and not confused, and has no unstable concurrent clinical conditions, refer to the oxygen and respiratory team (previously known as SED) for assessment of home care

- **If not improving:**
- consider resistant organisms – change antimicrobial based on sputum culture result, where known
- consider underlying disease (e.g. bronchogenic carcinoma, bronchiectasis)

MONITORING TREATMENT

- Peak expiratory flow (PEF) – aim to attain patient's 'best' PEF when well (if known)
- ABG – see **Respiratory failure** guideline
- Sputum volume and conversion from mucopurulent/purulent to mucoid
- Subjective improvement of dyspnoea
- Objective improvement as reflected by increased exercise tolerance

DISCHARGE AND FOLLOW-UP

- Check inhaler technique when changing from nebuliser therapy to metered dose inhaler or spacer devices
- Refer to oxygen and respiratory service via OrderComs who will check inhaler technique, refer to the community respiratory team for pulmonary rehabilitation and oxygen assessments if appropriate
- Review home medication
- Advise to stop smoking
- Advise to see own doctor whenever sputum becomes purulent
- Advise GP to arrange prophylactic influenza vaccination annually and offer pneumococcal vaccination if not already given
- If chest X-ray suggests consolidation, repeat as outpatient after 6 weeks

COMMUNITY-ACQUIRED PNEUMONIA ● 1/5

Guideline to be used in conjunction with Community Acquired Pneumonia Pathway

RECOGNITION AND ASSESSMENT

Treat as pneumonia if patient has symptoms and signs below plus new unexplained chest X-ray shadowing, and the illness is the primary clinical problem

Symptoms

- Malaise, fever, rigors
- Vomiting, diarrhoea
- Confusion (especially in the elderly)
- Dyspnoea, cough
- Sputum (may be blood-stained, viscid and difficult to expectorate)
- Pleuritic pain

Signs

- High fever (often absent in the elderly, where hypothermia may be seen)
- Tachycardia
- Tachypnoea
- Localised crackles
- Bronchial breathing (in about one third of hospital admissions)
- Chest signs may be absent or masked by other respiratory signs (e.g. COPD, CCF)

Enquire about pet birds (psittacosis, chlamydial infection) and recent hotel residence away from home (legionellosis)

Investigations

- Chest X-ray
- Oximetry

If SpO_2 <94% or features of severe pneumonia (see severity assessment below), measure arterial blood gases

- FBC, U&E, LFT, CRP
- Microbiology:
- include full clinical history on request
- sputum – culture and sensitivity
- blood cultures in all patients requiring IV antibiotics, irrespective of temperature – see **Collection of blood culture specimens** guideline
- in the seriously ill, nose and throat swab in viral transport media for atypical organisms (influenza A and B, *Chlamydia psittaci, Coxiella burnetii, Mycoplasma pneumoniae, Legionella pneumophila*). Date of onset must be clearly indicated on request form
- in the seriously ill (see **Flowchart** overleaf to access severity), send urine for legionella antigen and pneumococcal antigen

Check on iPortal whether patient is positive for Extended-Spectrum Beta-Lactamase-producing Gram-negative bacilli (ESBL), Meticillin-Resistant Staphylococcus Aureus (MRSA) or Multi-Resistant Gram-Negative Bacilli (MGNB). If unavailable, then check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL

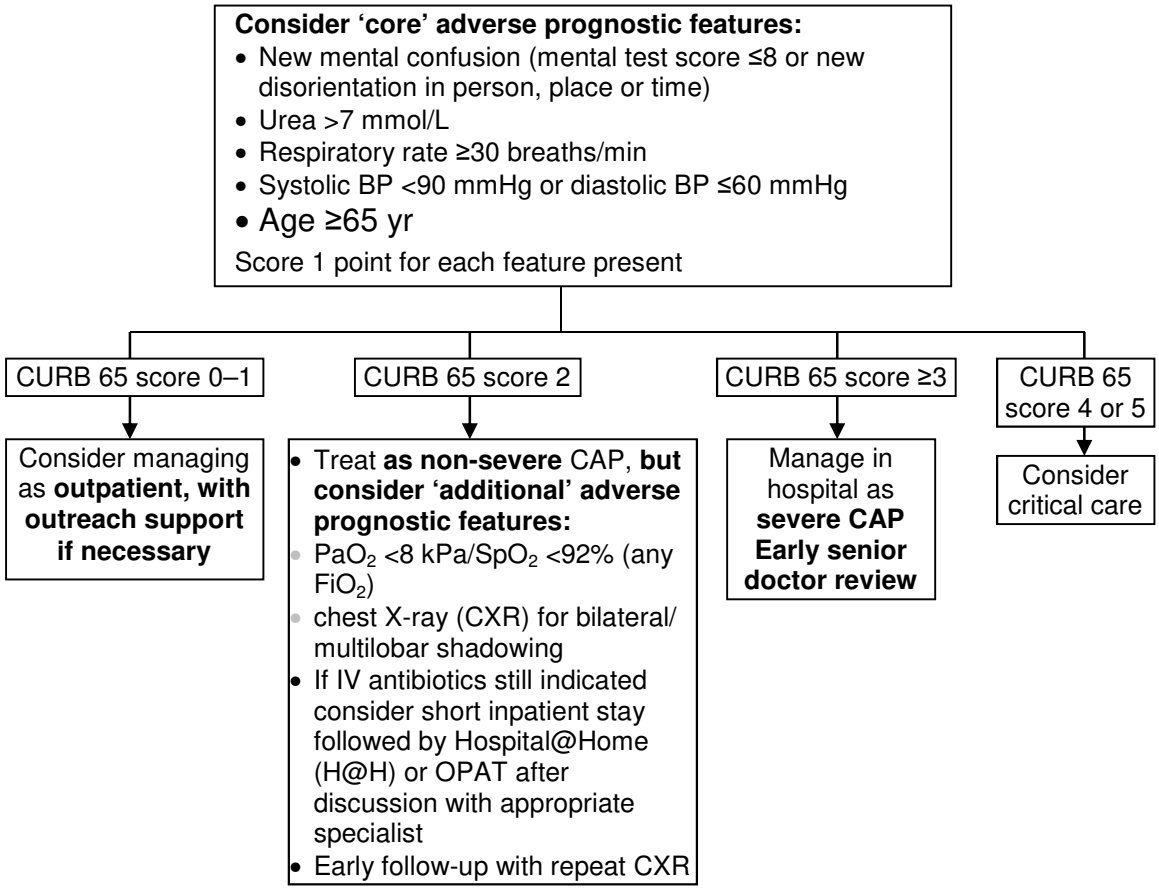
- If patient tagged for ESBL in iPortal, re-screen for carriage of multi-resistant Gram-negative bacilli with rectal swab, and CSU if urinary catheter *in situ*

Differential diagnosis

- Pulmonary thromboembolism
- Lung cancer
- Left ventricular failure

Severity

- Management is based on the CURB 65 assessment of severity. The following diagram (based on CURB 65 scoring system) is an aid to clinical judgement



IMMEDIATE TREATMENT

If a previously healthy young adult presents with acute necrotising pneumonia with rapid lung cavitation, suspect Panton-Valentine leukocidin (PVL) toxin-producing Staphylococcus aureus. Isolate in single room and contact microbiologist, infectious disease, or respiratory consultant for advice (antimicrobials in Table)

Supportive

- Prescribe oxygen to maintain SpO_2 between 94–98% or, if patient at risk of CO_2 retention, 88–92% – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Ensure adequate fluid replacement to compensate for effects of pyrexia and tachypnoea coupled with inadequate intake – see **Maintenance** f**luid therapy** guideline
- Adequate analgesia for pleuritic pain – paracetamol alone is unlikely to be adequate
  - if well hydrated and eGFR ≥30 mL/min, ibuprofen 400 mg oral 8-hrly
  - in dehydrated patient or if eGFR <30 mL/min, to prevent renal damage, prefer morphine sulphate 10 mg oral 4-hrly – ibuprofen may be substituted once adequate fluid replacement achieved if eGFR ≥30 mL/min
  - if patient pregnant, prefer morphine sulphate 10 mg oral 4-hrly. Non-steroidal anti-inflammatory agents are contraindicated in pregnancy due to their nephrotoxicity
  - avoid NSAIDS, if patient taking ACE inhibitor
- Prophylactic low molecular weight heparin
- Treat any accompanying airflow obstruction or cardiac failure
- Physiotherapy **only** in patients with copious secretions
- Admit to a respiratory ward
- If patient meets the frail elderly criteria and has pneumonia as well as other diagnoses, consider admission to elderly care ward
- Several trials have been performed to evaluate adjunct use of steroids in pneumonia. While results are trending towards benefit its use is still controversial and still not recommended universally

Antimicrobial therapy

- Start as soon as diagnosis made – **give first dose within 1 hr of presentation** to hospital and **before leaving assessment area**
- therapy should **always** cover *Streptococcus pneumoniae*
- Route of administration depends whether patient able to swallow and absorb oral drugs, severity of illness and likely pathogens

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction. True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Severity of illness	First line	Alternative (penicillin allergy)
Statins contraindicated in combination with clarithromycin (see current BNF for other interactions)		
Patient discharged home or admitted for other reasons	Amoxicillin 500 mg oral 8-hrly	Clarithromycin 500 mg oral 12-hrly
Pneumonia of unknown aetiology **Requiring hospital treatment, not severe IV only needed if no NG/PEG and unable to swallow or absorb oral drugs. Convert to oral route as soon as available**	Amoxicillin 1 g oral 8-hrly **plus** clarithromycin 500 mg oral 12-hrly **If IV needed:** amoxicillin 1 g IV 8-hrly **plus** clarithromycin 500 mg IV by infusion into larger proximal vein 12-hrly	Clarithromycin 500 mg oral 12-hrly **If IV needed:** clarithromycin 500 mg IV by infusion into larger proximal vein 12-hrly **If not responding within 24–48 hr, treat as severe pneumonia**
Pneumonia of unknown aetiology **Requiring hospital treatment, severe and not tagged for ESBL in iPortal**[1]	Co-amoxiclav 1.2 g IV 8-hrly **plus** clarithromycin 500 mg IV by infusion into larger proximal vein 12-hrly	**Discuss with respiratory consultant or consultant microbiologist/infectious diseases** Levofloxacin 500 mg IV by infusion 12-hrly For patients admitted to critical care facility **add** vancomycin IV by infusion – see **Vancomycin** guideline **Oral stepdown:** levofloxacin 500 mg oral 12-hrly
Pneumonia of unknown aetiology and tagged for MRSA in iPortal[1]	Add vancomycin IV by infusion – see **Vancomycin** guideline	
Pneumonia of unknown aetiology, requiring hospital treatment, severe and tagged for ESBL in iPortal[1] Send rectum swab (and CSU if long-term catheter) for ESBL screen	Meropenem 1 g IV by infusion 8-hrly **If 'atypical' pneumonia suspected:** **Add** clarithromycin 500 mg IV by infusion 12-hrly to above regimen	

<table>
<tr><th>Severity of illness</th><th>First line</th><th>Alternative (penicillin allergy)</th></tr>
<tr><td>Pneumococcal pneumonia</td><td>Amoxicillin 1 g oral 8-hrly

If no NG/PEG tube and unable to swallow or absorb oral drugs:
Benzylpenicillin 1.2 g IV 4-hrly</td><td>If Pneumococcus sensitive:
Clarithromycin 500 mg oral 12-hrly

If no NG/PEG tube and unable to swallow or absorb oral drugs:
clarithromycin 500 mg IV by infusion 12-hrly
If not sensitive to clarithromycin, discuss with consultant in infectious diseases or microbiologist

For patients admitted to critical care facility: Add vancomycin IV by infusion – see Vancomycin guideline</td></tr>
<tr><td>Legionella pneumonia</td><td colspan="2">Not severe: Clarithromycin 500 mg oral 12-hrly

Severe: Levofloxacin 500 mg IV by infusion 12-hrly

IV should be transferred to oral as soon as clinical improvement occurs and the temperature has been normal for 24 hr, providing there is no contraindication to oral therapy
Not severe 14 days total (including IV treatment)
Severe 14–21 days total (including IV treatment)</td></tr>
<tr><td>Mycoplasma or chlamydia pneumonia</td><td colspan="2">Not severe: Clarithromycin 500 mg oral 12-hrly

Severe: Clarithromycin 500 mg IV by infusion 12-hrly

IV should be transferred to oral as soon as clinical improvement occurs and temperature has been normal for 24 hr, providing there is no contraindication to oral therapy</td></tr>
<tr><td rowspan="2">Staphylococcal pneumonia
(consider if ventilated or influenza suspected)</td><td>Flucloxacillin 2 g IV 6-hrly
If severe/necrotising pneumonia, see Necrotising pneumonia below</td><td>Vancomycin IV by infusion (see Vancomycin guideline)</td></tr>
<tr><td colspan="2">IV should be transferred to oral as soon as clinical improvement occurs and temperature has been normal for 24 hr, providing there is no contraindication to oral therapy and a suitable agent is available
Not severe: 14 days total (including IV treatment
Severe: 14–21 days total (including IV treatment)</td></tr>
<tr><td rowspan="2">Necrotising pneumonia
Thought to be caused by Panton-Valentine Leukocidin (PVL) toxin-producing Staphylococcus aureus

Isolate in single room and contact microbiologist, infectious diseases or respiratory consultant for advice</td><td>Clindamycin 1.2 g IV infusion 6-hrly plus
Rifampicin 600 mg IV infusion 12-hrly plus
Linezolid 600 mg IV infusion 12-hrly plus
Co-amoxiclav 1.2 g IV 8-hrly</td><td>Substitute co-amoxiclav with levofloxacin 500 mg IV by infusion 12-hrly</td></tr>
<tr><td colspan="2">Consider IVIG at an early stage and discuss with consultant microbiology or consultant in infectious diseases

Duration: 14 days minimum</td></tr>
</table>

[1] Check iPortal for IC alert under patient alerts. If unavailable, then check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL

Assessment of requirement for intensive care

- Indications for transfer to critical care include:
- severe pneumonia on CURB 65 score (4 or 5)
- arterial PaO_2 ≤8 kPa with inspired oxygen ≥60%
- severe acidosis – pH <7.25
- exhausted, drowsy or unconscious patient
- respiratory or cardiac arrest
- shock

MONITORING TREATMENT

- In severe pneumonia, clinical assessment, including mental state 12-hrly, until improving
- Pulse, BP, temperature, respiratory rate and SpO_2 with FiO_2 4-hrly until stable
- aim for SpO_2 ≥92%
- if type 2 respiratory failure – see **Respiratory failure** guideline
- Biochemical screen – repeat every 24–48 hr while significant abnormalities persist
- If patient not improving after 48 hr despite adequate therapy, repeat chest X-ray and CRP
- if CRP not falling, consider possibility of empyema, abscess or inappropriate antimicrobial regimen

SUBSEQUENT MANAGEMENT

- Nutritional support in prolonged illness
- If risk factors for HIV are present or recurrent pneumonia, test for HIV – see **HIV infection testing** guideline

Duration of antimicrobials

- If IV route used on admission, change to oral when clinical improvement occurs and temperature normal for 24 hr. Use oral antimicrobial to which microbe sensitive. If sensitivity not known, give co-amoxiclav 625 mg oral 8-hrly plus clarithromycin 500 mg oral 12-hrly. If allergic to penicillin, clarithromycin 500 mg oral 12-hrly
- In uncomplicated pneumonia non-severe, give 5–7 days treatment including IV treatment
- In patients with severe pneumonia, necrotising pneumonia, staphylococcal pneumonia, or legionella pneumonia, continue antimicrobials for at least 2 weeks including IV treatment

Failure to respond to therapy

- Request review by specialist in respiratory medicine/infectious disease and consider:
- incorrect diagnosis (e.g. pulmonary embolism, pulmonary oedema, pulmonary eosinophilia, Wegener's granulomatosis)
- resistant organism (e.g. amoxicillin-resistant/penicillin-resistant *S. pneumoniae,* haemophilus, mycoplasma, psittacosis, Q fever or staphylococcal pneumonia) – discuss with microbiologist
- unrecognised pulmonary tuberculosis
- unrecognised immunodeficiency (e.g. HIV infection leading to pneumocystis pneumonia)
- Complications:
- parapneumonia effusion or empyema – aspirate, culture and drain, and refer to respiratory physician – see **Pleural infection and empyema** guideline
- lung abscess – refer to respiratory physician
- bronchial obstruction – refer to respiratory physician
- pulmonary embolism – see **Pulmonary embolism** guidelines
- fever related to drug therapy – omit therapy for 48 hr

DISCHARGE AND FOLLOW-UP

- Check within 24 hr of planned discharge that patient does not have more than one of the following:
- temperature >37.8°C
- heart rate >100/min
- respiratory rate >24/min
- systolic blood pressure <90 mmHg
- oxygen saturation <90%
- inability to maintain oral intake
- abnormal mental status
- Clinical review by GP or in hospital clinic after approximately 6 weeks
- chest X-ray for all patients who have persistent symptoms or are at high risk of underlying malignancy (especially smokers and those aged >50 yr) whether or not they have been admitted. Convalescent serology can be obtained at this visit. **Request follow-up CXR before patient discharged**

HOSPITAL-ACQUIRED PNEUMONIA ● 1/4

DO NOT use this guideline for immunosuppressed patients.
Check on iPortal whether patient is positive for Extended-Spectrum Beta-Lactamase-producing Gram-negative bacilli (ESBL), Meticillin-Resistant Staphylococcus Aureus (MRSA), Multi-Resistant Gram-Negative Bacilli (MGNB) or Carbapenemase-producing Gram-negative bacilli (CARB). If unavailable, then check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL

RECOGNITION AND ASSESSMENT

Definition

Pneumonia at least 48 hr after hospitalisation and excluding any infection that is incubating at time of admission

Symptoms and signs

- Fever, rigors
- Confusion
- Cough, dyspnoea
- Pleuritic chest pain
- Tachycardia
- Tachypnoea
- Crackles
- Bronchial breathing
- Effusion
- Purulent tracheal secretions, and new and/or persistent infiltrate on chest X-ray otherwise unexplained
- Increased oxygen requirement

Investigations

- Chest X-ray (compare with previous chest X-ray if available)
- Arterial blood gases (ABG)
- FBC, CRP, biochemical screen
- Sputum: culture and sensitivity
- Urine antigen testing (UAT) for Legionella pneumophilia and pneumococcal antigen if <4 days following admission and if severe pneumonia (see below for definition)
- 2 sets of blood cultures from separate sites. Use aseptic technique – see **Collection of blood culture specimens** guideline
- Diagnostic thoracentesis if patient has parapneumonic effusion. See **Investigation of pleural effusion** guideline

Check on iPortal whether patient is positive for Extended-Spectrum Beta-Lactamase-producing Gram-negative bacilli (ESBL), Meticillin-Resistant Staphylococcus Aureus (MRSA), multi-resistant Gram-negative bacilli (MGNB) or Carbapenemase-producing Gram-negative bacilli (CARB). If unavailable, then check the previous 12 months of microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL

- If patient tagged for ESBL in iPortal, re-screen for carriage of multi-resistant Gram-negative bacilli with rectal swab, and CSU if urinary catheter *in situ*
- If patient tagged on iPortal for ESBL, MRSA, MGNB, CARB: isolate – refer to infection control guidelines

Differential diagnosis

- Congestive cardiac failure
- Pulmonary thromboembolism
- Drug reactions
- Pulmonary haemorrhage
- Adult respiratory distress syndrome
- Aspiration pneumonia

IMMEDIATE TREATMENT

If deteriorating, contact critical care early

Supportive

- Prescribe oxygen to maintain SpO_2 between 94–98% or, if patient at risk of CO_2 retention, 88–92% – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- check ABG and treat appropriately – see **Respiratory failure** guideline
- Ensure adequate fluid replacement to compensate for effects of pyrexia and tachypnoea coupled with inadequate intake – see **Maintenance fluid therapy** guideline
- Adequate analgesia for pleuritic pain – paracetamol alone is unlikely to be adequate
- if well hydrated and eGFR ≥30 mL/min, ibuprofen 400 mg oral 8-hrly
- in dehydrated patient or if eGFR <30 mL/min, to prevent renal damage, prefer morphine sulphate 10 mg oral 4-hrly – ibuprofen may be substituted once adequate fluid replacement achieved if eGFR ≥30 mL/min
- if patient pregnant, prefer morphine sulphate 10 mg oral 4-hrly. Non-steroidal anti-inflammatory agents (NSAIDs) are contraindicated in pregnancy due to their nephrotoxicity
- avoid NSAIDs, if patient taking ACE inhibitor
- Physiotherapy in patients with copious secretions

Antimicrobial therapy

- Start treatment as soon as clinical criteria for diagnosis are met, **do not await microbiological confirmation. If severely ill, administer antimicrobials within 1 hr of diagnosis**
- Modify Initial therapy once results of respiratory tract secretions or blood cultures become available
- Route of administration depends on severity of illness

For further advice on antimicrobial therapy, contact microbiologist

Severe hospital-acquired pneumonia

Presence of any of the following indicates a severe illness

- Respiratory failure (PaO_2 <8 kPa and/or $PaCO_2$ >6.4 kPa)
- Respiratory rate >25 breaths/min
- Rapid radiographic progression, multilobar pneumonia, or cavitation of lung infiltrate
- Diastolic BP <60 mmHg
- WBC low ($<4 \times 10^9$/L) or very high ($>20 \times 10^9$/L)
- Poor urine output or rising serum creatinine
- Metabolic acidosis
- Discuss with senior medical staff whether to refer to critical care

Antimicrobial regimens

Many patients with severe hospital-acquired pneumonia will have some renal impairment; seek advice when selecting antimicrobial dosage. Contact pharmacy medicines information

- If microbe known, follow advice of consultant microbiologist
- If pneumonia of unknown aetiology see below

Antimicrobial regimens

<4 days after admission

- Treat as community acquired pneumonia – see **Community acquired pneumonia** guideline if:
- <4 days after admission including patients admitted from nursing home/care home/residential home or community hospitals with pneumonia
- patients re-admitted with pneumonia after >4 days of discharge from acute hospitals

HOSPITAL-ACQUIRED PNEUMONIA ● 3/4

>4 days after admission

- >4 days after admission to Royal Stoke or County Hospital and patients being re-admitted with pneumonia up to 4 days after discharge from these 2 hospitals

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction. True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient is truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Severity of illness	First line	Alternative (penicillin allergy)
Statins contraindicated in combination with clarithromycin (see current BNF for other interactions)		
Non-severe pneumonia	Co-amoxiclav 625 mg oral 8-hrly	Clarithromycin 500 mg oral 12-hrly **or** Doxycycline 100 mg oral 12-hrly If IV needed: clarithromycin 500 mg IV by infusion 12-hrly
Severe pneumonia and not tagged for ESBL in iPortal	Co-amoxiclav 1.2 g IV 8-hrly If treating: • Ventilator associated pneumonia • Bronchiectasis/CF patients • Immunocompromised patient • Patient with previous respiratory samples growing in the previous 12 months: ◦ pseudomonas aeruginosa ◦ organisms resistant to co-amoxiclav Piperacillin/tazobactam 4.5 g IV 8-hrly	Levofloxacin 500 mg oral/IV 12-hrly
Pneumonia of unknown aetiology and tagged for MRSA in iPortal[1]	Add vancomycin IV by infusion – see **Vancomycin** guideline Provide cover for MRSA even if patient has had an MRSA screening investigation with MRSA not detected	
Severe pneumonia and tagged for ESBL in iPortal[1] Send rectum swab (and CSU if long-term catheter) for ESBL screen	Meropenem 1 g IV 8-hrly **If 'atypical' pneumonia suspected:** add clarithromycin 500 mg IV by infusion into larger proximal vein 12-hrly	
If ICU patient	As above. In addition: If proven MRSA pneumonia (usually ventilator-associated, infiltrates on chest X-ray, sputum culture yields MRSA **only**) does not respond to IV vancomycin as expected (within 48 hr), contact consultant microbiologist or consultant in infectious diseases	
Duration	**IV should be transferred to oral as soon as clinical improvement occurs and temperature has been normal for 24 hr, providing no contraindications to oral therapy** 5 days total (including IV treatment)	

[1] Check iPortal for IC alert under patient alerts. If unavailable, check the previous 12 months of Microbiology reports: if MRSA present then treat as tagged for MRSA; if ESBL present then treat as tagged for ESBL

MONITORING TREATMENT

- In hypoxaemic patients, repeat ABG 1 hr after change of inspired oxygen, then assess using pulse oximeter
- Pulse, BP and temperature hourly until patient stable
- Repeat biochemical screen every 24–48 hr while significant abnormalities persist
- If patient not improving despite therapy, repeat chest X-ray after 72 hr
- If no improvement, refer to critical care

SUBSEQUENT MANAGEMENT

Duration of antimicrobials

- IV should be transferred to oral as soon as clinical improvement occurs and temperature has been normal for 24 hr, providing no contraindication to oral therapy
- In uncomplicated pneumonia, continue antimicrobials for 5 days total (including IV treatment)
- In patients with staphylococcal pneumonia or legionella pneumonia, continue antimicrobials for at least 14 days total (including IV treatment)

Failure to respond to treatment

- Incorrect diagnosis (see **Differential diagnosis**)
- Re-evaluate and consider bronchoscopy to obtain protected specimens brushing and/or bronchoalveolar lavage specimens for quantitative cultures – refer to respiratory physician
- Complications: empyema, lung abscess – refer to respiratory physician and see **Pleural infection and empyema** guideline

Prevention of HAP and VAP

- Multiple studies show perioperative good oral hygiene significantly decreases the incidence of nosocomial infection and postoperative pneumonia in patients undergoing elective cardiac surgery
- Oral chlorhexidine has the best evidence for this and would be recommended based on the multiple studies showing benefit with a reduction in the risk for hospital-acquired and ventilator-associated pneumonia in high-risk patients

DISCHARGE AND FOLLOW-UP

- Follow up in clinic with chest X-ray about 6 weeks after discharge to ensure that resolution of radiological shadowing is occurring

RESPIRATORY FAILURE ● 1/3

RECOGNITION AND ASSESSMENT

Definition

Respiratory failure is present when lungs are unable to maintain normal gas exchange at rest, so that arterial PaO_2 <8.0 kPa and/or arterial $PaCO_2$ >6.0 kPa. It has many causes (see below), which must be identified and treated as part of overall management

Symptoms and signs

- Central cyanosis (difficult to detect in anaemic patients)
- Drowsiness
- Warm peripheries, bounding pulse, tachycardia, flapping tremor
- Papilloedema (in patients with hypercapnia)

Investigations

- Arterial blood gases (ABG) while breathing air
- if clinical condition does not allow ABG when breathing air, record fraction of inspired oxygen or oxygen flow and delivery device used
- Chest X-ray
- FBC
- U&E
- ECG

Consider whether:

- **Type 1 (oxygenation and gas exchange failure):** Low PaO_2, normal $PaCO_2$ owing to, for example, asthma, pneumonia, pneumothorax, pulmonary oedema and embolism or pulmonary fibrosis
- impairment of gas exchange if severe enough will affect $PaCO_2$
- **Type 2 (ventilatory failure):** Low PaO_2, high $PaCO_2$ owing to, for example, exacerbation of chronic obstructive pulmonary disease (COPD), neuromuscular disorders (acute e.g. Guillain-Barré and chronic e.g. motor neurone disease and muscular dystrophies) and thoracic skeletal abnormalities (e.g. scoliosis), encephalitis, or use of respiratory depressant drugs

IMMEDIATE TREATMENT – TYPE 1

- Treat underlying cause

Oxygen

- See **Oxygen therapy in acutely hypoxaemic patients** guideline
- Aim for SpO_2 94–98% (or PaO_2 >8 kPa) but if at risk of hypercapnia, aim for SpO_2 88–92% without increasing $PaCO_2$
- For patients not at risk of hypercapnic respiratory failure, commence oxygen via nasal cannulae 2–6 L/min (preferably) or simple face mask at 5–10 L/min or 24–60% Venturi mask. If SpO_2 <85%, commence treatment with reservoir mask at 10–15 L/min
- monitor SpO_2 continuously and titrate oxygen to keep SpO_2 within oxygen target range
- repeat ABG after 30–60 min in all patients at risk of type 2 respiratory failure

SUBSEQUENT MANAGEMENT – TYPE 1

If improving

- Continue oxygen, adjusting inspired oxygen concentration to achieve SpO_2 of 94–98% – see **Flowchart** for oxygen administration on general ward in **Oxygen therapy in acutely hypoxaemic patients** guideline
- Treat underlying disease

If not improving

- Consider mechanical ventilation

Mechanical ventilation

- If PaO_2 >8.0 kPa cannot be maintained despite high concentration oxygen therapy, especially in acute severe asthma with life-threatening features – see **Acute severe asthma in adults** guideline, contact critical care unit (CCU) and request transfer

IMMEDIATE TREATMENT – TYPE 2

- Treat underlying cause

Oxygen

- Start with 24–28% Venturi mask aiming to keep SpO_2 between 88–92%
- Follow **Flowchart** for **non-critical illness requiring moderate amounts of supplemental oxygen** in **Oxygen therapy in acutely hypoxaemic patients** guideline
- treat with lowest dose Venturi mask to maintain SpO_2 between 88–92%. Aim to raise PaO_2 ≥8 kPa or at least 6.7 kPa in selected patients
- if $PaCO_2$ rises by >1 kPa or pH falls below 7.35 (respiratory acidosis), seek immediate senior medical advice on non-invasive ventilation (NIV) Unit or CCU admission (see below)
- repeat ABG again after 30–60 min of each inspired oxygen increase

It may be necessary to accept only a modest increase in PaO_2; most patients will survive if PaO_2 >6.7 kPa

Non-invasive ventilation

- Patient with pH <7.35: Duty medical SpR or staff grade reviews patient against checklist below
- Patient must be:
- suffering from exacerbation of COPD
- on maximal medication – see **Exacerbation of chronic obstructive pulmonary disease** guideline
- Blood gas analysis should fit following criteria:
- pH <7.35
- $PaCO_2$ >6 kPa
- PaO_2 ≤8 kPa (aim PaO_2 7.3–8.0), breathing oxygen using a Venturi mask providing the lowest concentration of oxygen that achieves this target. Accept lower PaO_2 (but not lower than 6.7 kPa) in selected patients if CO_2 retention appears particularly oxygen sensitive. Call NIV unit to request admission
- Determine patient's cardiopulmonary resuscitation status

SUBSEQUENT MANAGEMENT – TYPE 2

If improving

- Continue adjusting inspired oxygen concentration to achieve PaO_2 7.3–8.0 kPa
- Consider changing to nasal spectacles to give oxygen

If not improving

- Consider mechanical ventilation

Intubation and ventilation

- Important to consider overall outlook. In general, ventilatory support is appropriate in a **previously active** patient with good quality of life over previous 6 months, or where history unclear. There is no point embarking on mechanical ventilation when patient has end-stage chronic respiratory failure with very poor quality of life and there is no cure for underlying disease

MONITORING TREATMENT

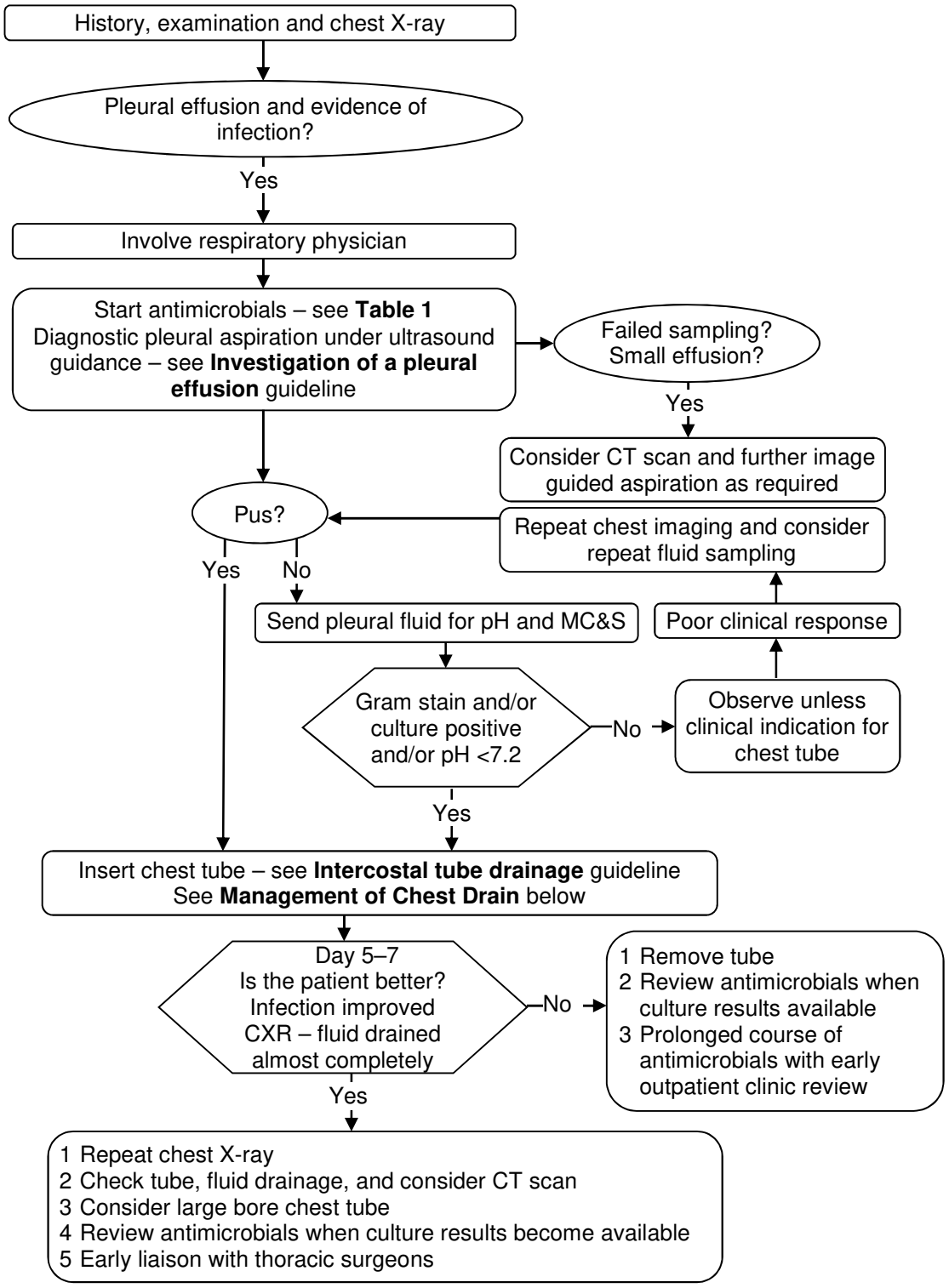
- **Type 1**
- for patients with Type 1 respiratory failure secondary to asthma – see **Acute severe asthma in adults** guideline
- regular ABG 6-hrly (at least) until patient stabilises
- **Type 2**
- remember that CO_2 narcosis can occur several hours after oxygen therapy started or FiO_2 increased. If in doubt, repeat ABG
- Ensure that underlying cause has been addressed:
- infection adequately treated
- collapsed lung in pneumothorax completely expanded – see **Spontaneous pneumothorax** guideline
- anticoagulation stabilised following pulmonary embolism – see **Pulmonary embolism** guidelines

DISCHARGE AND FOLLOW-UP

- Follow-up at discretion of supervising physician
- Advice on life-style appropriate to underlying disease that precipitated admission
- Refer all patients with type 1 or type 2 respiratory failure for follow up with respiratory physician
- Any patient with neuromuscular disease or kyphoscoliosis presenting with type 2 respiratory failure, regardless of underlying cause and even if resolved, must be referred to respiratory physician before discharge

PLEURAL INFECTION AND EMPYEMA • 1/3

Diagnostic algorithm for management of patients with pleural infection



IMMEDIATE TREATMENT

Management of chest drain

- Ensure chest tube is draining freely and the tube is swinging at all times.
- For small bore (12–18F) catheters, use the 3-way tap to flush with sodium chloride 0.9% 30 mL every 6 hr if not draining freely
- No flushing required for larger bore drains

Antimicrobials

Antimicrobials alone are not enough to treat an empyema. It is important to drain the infected pleural fluid. Unless absolutely impossible, send sample of fluid for culture before starting antimicrobial therapy. Start empirical therapy while awaiting results of culture

- If microbe known, follow advice of microbiologist or consultant in infectious diseases
- Before microbe known, use empirical treatment in **Table 1**

Check whether patient tagged for extended spectrum beta-lactamase-producing Gram-negative bacilli (ESBL), methicillin-resistant Staphylococcus aureus (MRSA), multi-resistant Gram-negative bacilli (MGNB) or Carbapenemase-producing Gram-negative bacilli (CARB)

Table 1: Antimicrobial regimens for empirical treatment of pleural infection

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction. True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission.
If any doubt about whether patient truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Type of infection	First line	Alternative (penicillin allergy)
Community or hospital acquired	Co-amoxiclav 1.2 g IV 8-hrly	Levofloxacin 500 mg IV by infusion 12-hrly **plus** metronidazole 500 mg IV by infusion/or 400 mg oral 8-hrly During inpatient stay challenge penicillin allergy
Tagged for MRSA[1]	**Add** vancomycin IV by infusion (see **Vancomycin** guideline)**,** to above regimens (if not already included). Vancomycin has poor lung tissue penetration. If MRSA proven (cultured in pleural fluid) **or** likely cause of empyema (e.g. recent relevant specimen other than pleural fluid positive for MRSA): Discuss use of additional antimicrobial (e.g. rifampicin) with consultant microbiologist/in infectious diseases Adjust treatment when relevant culture results become available	
Duration	**IV should be transferred to oral as soon as clinical improvement occurs and the temperature has been normal for 24 hr, providing there is no contra-indication to oral therapy and sensitivities allow. Use oral antimicrobial with good tissue penetration to which organism sensitive (discuss with consultant microbiologist/ID)** At least 3 weeks: continue antimicrobial therapy for a prolonged period of time (usually beyond when all the fluid has gone and drain removed) and the patient needs to be closely monitored for recurrence after stopping treatment	

[1] Check iPortal for IC alert under patient alerts: if MRSA present then treat as tagged for MRSA; if CARB present then discuss with microbiologist for empirical treatment

SUBSEQUENT MANAGEMENT

- Nutritional support in prolonged illness

Duration of antimicrobials

- Change to oral route **as soon as clinical improvement occurs and the temperature has been normal for 24 hr, providing there is no contra-indication to oral therapy and sensitivities allow**
- Use oral antimicrobial to which microbe sensitive with good tissue penetration. If not known or in doubt, discuss with microbiologist or consultant in infectious diseases
- At least 3 weeks: continue antimicrobial therapy for a prolonged period of time (usually at least until all fluid has gone and drain has been removed) and monitor patient closely for recurrence after stopping treatment

Failure to respond to therapy

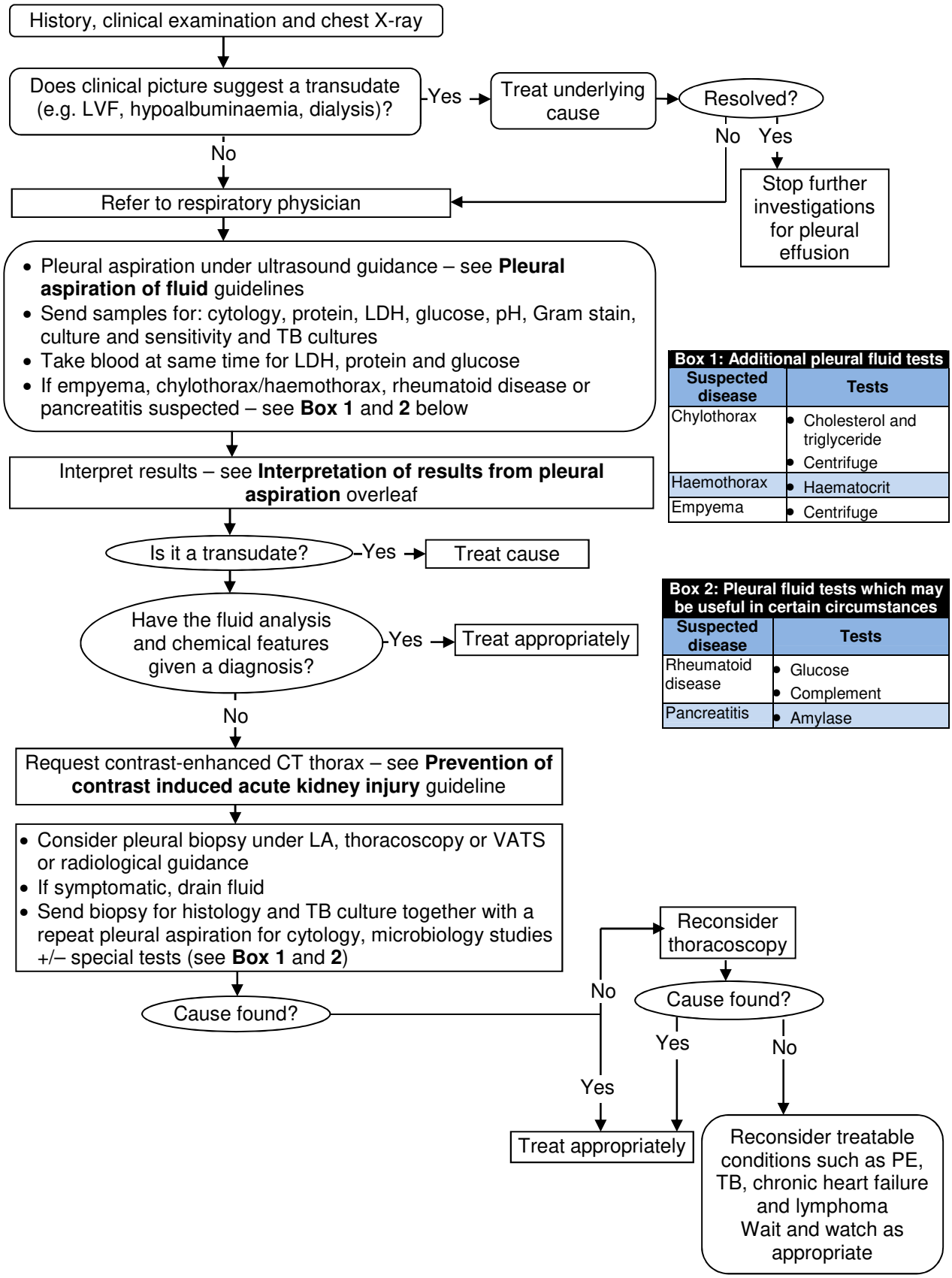
- Review by respiratory consultant/consultant in infectious diseases

DISCHARGE AND FOLLOW-UP

- Discharge when chest drains removed and clinical variables stable
- Continue antimicrobials for at least 3 weeks after initiation
- Follow up all patients up in respiratory clinic with chest X-ray about 3–4 weeks after discharge

INVESTIGATION OF A PLEURAL EFFUSION • 1/2

Diagnostic algorithm for investigation of a pleural effusion



Box 1: Additional pleural fluid tests

Suspected disease	Tests
Chylothorax	• Cholesterol and triglyceride • Centrifuge
Haemothorax	• Haematocrit
Empyema	• Centrifuge

Box 2: Pleural fluid tests which may be useful in certain circumstances

Suspected disease	Tests
Rheumatoid disease	• Glucose • Complement
Pancreatitis	• Amylase

INTERPRETATION OF RESULTS FROM PLEURAL ASPIRATION

Appearance

Appearance of pleural fluid	
Fluid	**Suspected disease**
Putrid odour	Anaerobic empyema
Food particles	Oesophageal rupture
Bile stained	Chylothorax (biliary fistula)
Milky	Chylothorax/pseudochylothorax

- If grossly bloody, consider malignancy, pulmonary infarction, trauma, benign asbestos effusion or post-cardiac injury syndrome
- if in doubt about haemothorax, request haematocrit on pleural fluid: if <1%, blood in pleural space is not significant

Biochemistry

- If serum protein is normal and:
- fluid protein >35 g/L, fluid is most likely exudate
- fluid protein <25 g/L, fluid is most likely transudate
- fluid protein between 25 and 35 g/L, use Light's criteria as below
- An exudative effusion is **defined** when one of the following is present (Light's criteria):
- pleural fluid protein/serum protein >0.5
- pleural fluid LDH/serum LDH >0.6
- pleural fluid LDH >2/3 × upper limit of normal serum LDH
- Pleural fluid pH
- >7.4 suggests transudative effusion, and virtually rules out tuberculous effusion
- <7.3 suggests exudative effusion
- <7.2 in parapneumonic effusion indicates thick empyema requiring tube drainage
- <7.1 in malignant pleural effusion is a bad prognostic sign (mean survival <6 weeks)
- Pleural fluid glucose <3.3 mmol/L is found in empyema, rheumatoid disease, SLE, tuberculosis, malignancy or oesophageal rupture
- Pleural fluid glucose <2 mmol/L or pleural fluid glucose/serum glucose <0.5 mmol/L
- in parapneumonic effusion indicates complicated pleural infection requiring tube drainage
- in malignant pleural effusion is a bad prognostic indicator
- If pleural fluid glucose >1.6 mmol/L or pleural fluid C4 complement >0.04 g/L, effusion unlikely to be caused by rheumatoid disease
- In acute rupture of oesophagus, pancreatitis, pancreatic pseudocyst, pregnancy or pleural malignancy, amylase is high (higher than upper limit for normal and pleural fluid/serum ratio >1)

Cytology

- Positive in only 60% of malignant effusions
- if first specimen negative, refer to respiratory physicians (consider pleural biopsy)
- Pleural lymphocytosis common in malignancy and TB, but not diagnostic
- Pleural eosinophilia not diagnostic

Microbiology and histology in case of possible TB effusion

- Smears for AAFB positive in 10–20% only; cultures positive in 25–50%
- addition of pleural biopsy for TB culture and histology raises diagnostic rate to 90%. Therefore, pleural biopsy with TB culture of tissue is essential to diagnose pleural TB

STATUS EPILEPTICUS ● 1/3

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Status epilepticus is defined as a state of seizure activity lasting for 30 min with no return to consciousness, however the majority of epileptologist now are using a more pragmatic operational definition of >5 min duration as a generalised seizure lasting longer than 5 min is highly unlikely to stop spontaneously

Refer urgently to on-call neurology SpR any patient with a seizure lasting >5–10 min

- Ask about:
- previous diagnosis of epilepsy
- previous history of status epilepticus
- recent withdrawal of anti-convulsant drug/missed medication
- respiratory tract or urinary tract infection
- vomiting/diarrhoea

Investigations

- Capillary blood glucose
- Venous blood glucose
- Bone and U&E
- If patient has history of seizures and is taking carbamazepine, phenobarbital or phenytoin, serum anticonvulsant concentration
- If new onset epilepsy, CT scan to exclude space-occupying lesion

Differential diagnosis

- Non-epileptic attack disorders (pseudo-seizures)

Important underlying causes

- Infection:
- meningitis
- encephalitis
- abscess
- Acute head injury
- Cerebral tumour
- Metabolic disorders:
- renal failure
- hypoglycaemia
- hypercalcaemia
- Drug overdosage:
- tricyclics
- phenothiazines
- theophylline
- isoniazid
- cocaine
- Acute cerebral infarction
- Alcohol intoxication/withdrawal
- Anoxic encephalopathy

IMMEDIATE TREATMENT

Generalised tonic-clonic status is potentially life-threatening – treat without delay

Do not attempt to put anything into patient's mouth during a seizure, even if tongue injured. Intubation, if necessary, requires special care

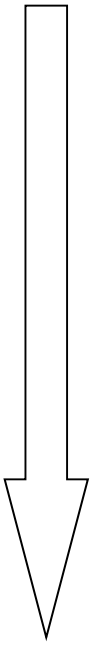
Avoid rolling patient during a seizure unless absolutely necessary as this can cause injury to shoulder/hip joints

STATUS EPILEPTICUS ● 2/3

Flowchart – Status epilepticus protocol

0–5 min

- Watch and assess (epileptic seizure, syncope, non-epileptic attack)
- Assess secondary metabolic factors (hypoglycaemia, electrolyte imbalance, lactic acidosis, dehydration, hyperpyrexia)
- Protect airway and support respiration if possible. If there is any period of relaxation, try carefully to insert an airway
- Oxygen (high flow mask) 10 L/min
- IV access
- blood test – glucose, U&E, calcium, FBC, serum anticonvulsant concentration (if patient taking anticonvulsant drug – see **Therapeutic drug monitoring** guideline)
- lorazepam 4 mg IV (diluted 1:1 with sodium chloride 0.9% or water for injection) as single slow bolus injection into large vein; if lorazepam unavailable, give diazepam (Diazemuls) 10 mg IV over 2 min. Monitor oxygen saturation carefully for evidence of respiratory depression
- if poor nutrition/alcoholism, give parenteral thiamine as Pabrinex IV High potency injection **two pairs** of ampoules (mixed) by IV infusion in sodium chloride 0.9% 100 mL over 30 min 8-hrly
- if hypoglycaemia suspected, give glucose 20% 50 mL IV over 5 min repeat if still unconscious after 15 min



Use caution when using Diazemuls because of prolonged sedative effect

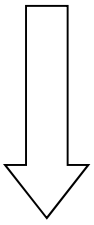
5–10 min

- Repeat lorazepam 4 mg IV if necessary (diluted 1:1 with sodium chloride 0.9% or water for injection); as a single bolus injection into a large vein. Do not exceed total dose of 8 mg of lorazepam
- if lorazepam unavailable, give diazepam (Diazemuls) 10 mg IV over 2 min repeated if necessary after a further 5 min. Do not exceed total dose of 30 mg of diazepam
- Monitor oxygen saturation carefully for evidence of respiratory depression

- If seizures continue after 10 min:
- if patient not already taking maintenance phenytoin therapy, give phenytoin (see **Phenytoin IV** guideline) with cardiac monitoring
- if already taking maintenance phenytoin therapy, contact neurology SpR to discuss reduced dose of IV phenytoin, or use of phenobarbital or alternative agents
- Check blood gases
- If, at any stage, respiratory depression or cardiac arrhythmia is apparent or pH <7.0, contact critical care

Call neurology SpR

10–40 min



- If satisfactory control still not established after 40 min, and neurology junior staff are in attendance, contact SpR or consultant for advice and arrange transfer to critical care
- further specialised management in critical care area

Reasons for failure to respond

- Incorrect diagnosis
- Underlying cause (e.g. metabolic abnormalities, not recognised and treated)
- Delay in intubation and anaesthesia
- Inappropriate use of drugs/dosage
- Delay in initiating maintenance anticonvulsant therapy

SUBSEQUENT MANAGEMENT

All patients should now be under the care of the neurology team

- **If not improving:**
- reconsider underlying causes
- if patient transferred to critical care and anaesthetised, arrange EEG as soon as possible after intubation to establish state of cerebral ictal activity
- if continued sedation necessary, repeat EEG 24-hrly

EEG can be arranged: Monday–Friday 0830–1700 hr via EEG department, out-of-hours contact on-call technician via call centre. Out-of-hours EEGs may not be reported until next working day, discuss with technician

- If improving:
- once seizure activity has ceased, place patient in recovery position
- in patients with previously diagnosed epilepsy, recommence previous AED therapy
- in newly diagnosed patients, neurologist to introduce appropriate therapy before discharge
- If on recovery, continued oxygen is required – see **Oxygen therapy in acutely hypoxaemic patients** guideline

DISCHARGE AND FOLLOW-UP

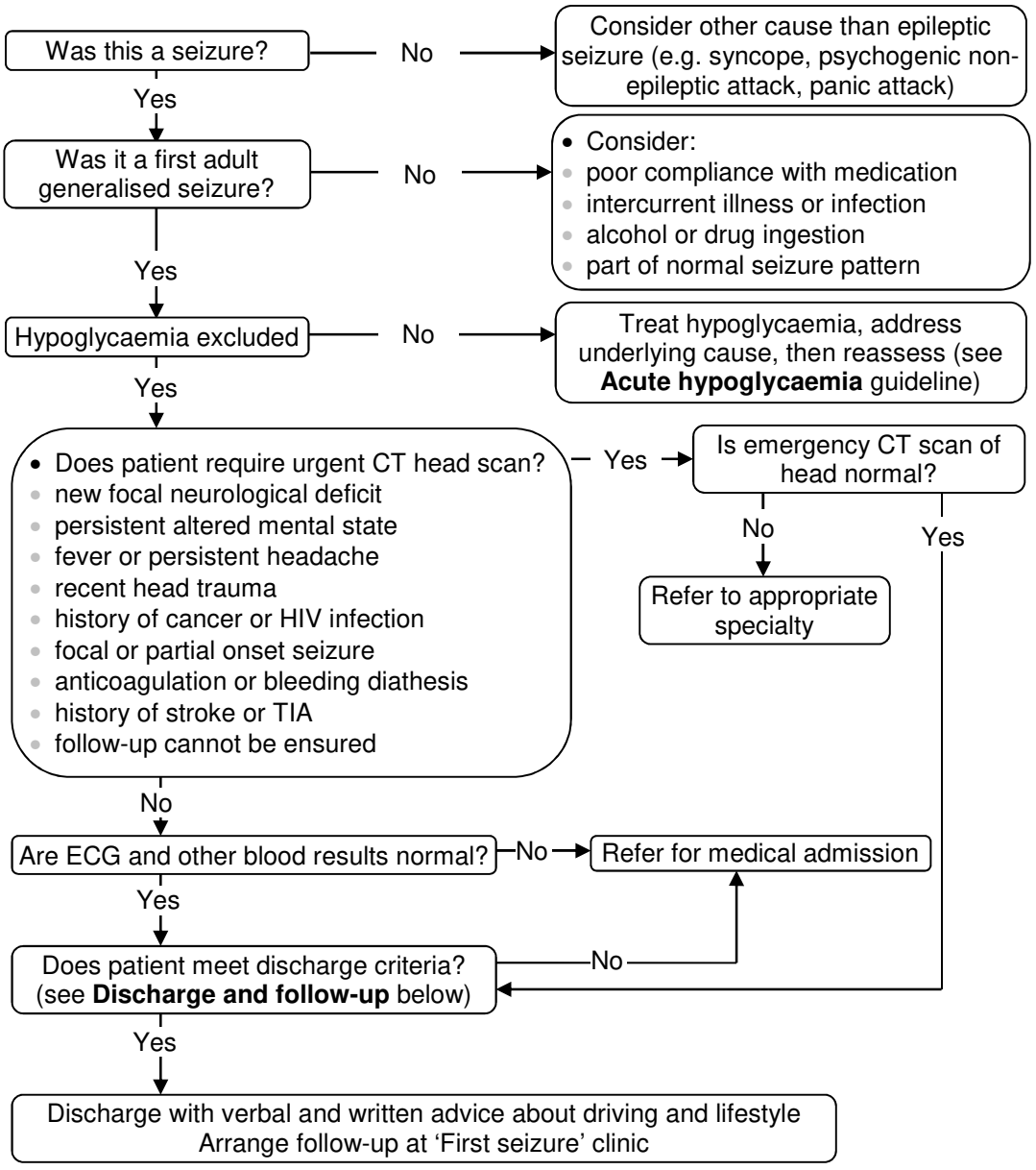
- Discharge when patient seizure-free for 48 hr and fit to leave hospital, and anti-convulsant drug therapy established
- Review existing follow-up appointments for patients with a previous history of epilepsy
- Ensure patients with no previous history have review appointment arranged
- Refer all cases to clinical nurse specialist before discharge if not already seen during admission (page via call centre)

FIRST SEIZURE ● 1/3

Approximately 5% of the population will experience at least 1 non-febrile seizure during their lifetime

- **Do not use this guideline for patients presenting with:**
  - known epilepsy
  - seizures related to head trauma
  - seizures related to eclampsia
  - status epilepticus – see **Status epilepticus** guideline

FLOWCHART SUMMARY – for detail, see guideline



RECOGNITION AND ASSESSMENT

Symptoms and signs

Before

- Provoking factors include:
  - sleep deprivation
  - acute alcohol or substance intoxication
  - alcohol withdrawal
- Prodromal symptoms of seizures often bizarre and hard for patients to describe

During

- Several conditions can mimic an epileptic seizure – see **Differential diagnosis**. Where possible, obtain eyewitness accounts
- Symptoms/signs that may be present:
  - myoclonic jerking
  - tonic-clonic movements
  - **lateral** tongue biting (biting tip of the tongue or the cheek is not suggestive of a generalised seizure)
  - incontinence (not specific and can occur in any type of collapse in patient with full bladder)

After

- Generalised epileptiform seizures usually followed by a period of at least 10 min (often more), when patient truly confused (post-ictal state). They almost always have amnesia for this period
- Other symptoms (e.g. headache and aching limbs) are more suggestive of seizure than syncope

Differential diagnosis

Differential diagnosis	Symptoms

Vasovagal episode	• Loss of consciousness, usually provoked (e.g. pain)
	• Presyncopal symptoms include:
	  ◦ dizziness
	  ◦ nausea
	  ◦ clamminess
	  ◦ 'feeling faint'
	• Rapid recovery of awareness

Electrolyte abnormalities	• Hypoglycaemia • Hyponatraemia • Hypo- or hypercalcaemia • Uraemia

Cardiac syncope	• Causes include:
	  ◦ ischaemia
	  ◦ Wolff–Parkinson–White (WPW) syndrome
	  ◦ long-QT syndrome
	  ◦ bradycardia
	  ◦ tachycardia
	  ◦ structural heart disease (e.g. aortic stenosis)
	• Syncope can occur with or without cardiac symptoms
	• A Stokes–Adams attack is classically associated with pallor followed on recovery by flushing

Carotid sinus hypersensitivity	• Rare • Usually in an elderly patient • Precipitated by head turning or pressure on neck (e.g. shaving)
Hyperventilation	• Anxiety • Paraesthesia of perioral region or extremities • Palpitations • Chest pain
Postural hypotension	• Within 3 min of standing, systolic BP falls to <90 mmHg or falls by >20 mmHg

Examination

- Look for any injury sustained, including evidence of lateral tongue biting
- Full neurological examination
- Auscultation of heart for murmurs
- Stigmata of other conditions associated with seizures (e.g. chronic liver disease/alcoholism, café-au-lait spots suggesting neurofibromatosis)

Investigations

- Blood glucose
- U&E
- Serum corrected calcium
- FBC
- If alcoholism suspected, LFT
- ECG
- CT scan of head if:
  - new focal neurological deficit
  - persistent altered mental status
  - fever or persistent headache
  - recent head trauma
  - history of cancer or HIV infection
  - focal or partial onset seizure
  - anticoagulation or bleeding diathesis
  - history of stroke or TIA
  - follow-up cannot be ensured

IMMEDIATE TREATMENT

- None required
- Inappropriate use of diazepam can result in unnecessary admission if seizure had already resolved spontaneously, and can cause respiratory depression
- Do not start anticonvulsant therapy before seeking advice from neurology SpR or consultant

If focal neurological abnormalities found or CT scan abnormal, contact on-call neurology SpR while patient in A&E for advice about further action to be taken

DISCHARGE AND FOLLOW-UP

See flowchart

- Admission necessary only if:
  - patient remains drowsy or comatose
  - neurological examination abnormal
  - investigation results abnormal
  - patient at high risk of further seizures (e.g. alcohol withdrawal)
  - patient cannot be supervised by a responsible adult
- Refer to clinical nurse specialist in epilepsy for further assessment at neurology outpatient 'First seizure' clinic

Advice to patients

- Advise patient to stop driving and to inform DVLA. Record this advice explicitly on casualty card
  - following first and single epileptic seizure, Group 1 entitlement drivers (motor cars and motorcycles) may restart driving after 6 months if agreed by appropriate specialist and no abnormality found (e.g. EEG and brain scan normal)
  - if any pathology exists, refrain from driving for 1 yr before subsequent medical review
- Patients should inform their employer that they have had a seizure in order to fulfill the requirements of Health and Safety at Work legislation
- Advise patient to return to A&E if a further episode occurs
- Issue contact number for clinical nurse specialist to obtain further advice or to query outpatient appointment at 'First seizure' clinic

CLUSTER SEIZURES AND COMPLEX PARTIAL AND NON-CONVULSIVE STATUS ● 1/1

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Repeated seizures that fluctuate in severity and may last for hours or days
- Most common in patients with temporal or frontal lobe epilepsy, or where epilepsy is associated with a learning disability
- Most patients already have an established diagnosis of epilepsy and are taking treatment
- Ask about:
- previous history of cluster seizures or non-convulsive status
- fluctuating conscious level without loss of consciousness
- Look for:
- confusion, agitation or aggressive behaviour
- drowsiness
- ataxia

Many of these features are similar to those of drug toxicity or behavioural problems

Important underlying causes

- Consider:
- recent changes in anti-epileptic drug therapy, dose or brand prescribed
- underlying infection

Investigations

- FBC
- U&E
- Glucose
- If taking carbamazepine, phenobarbital or phenytoin, serum anticonvulsant concentrations

IMMEDIATE TREATMENT

- Contact on-call neurology SpR for advice about need for urgent EEG, admission and management
- Avoid alteration in drug treatment before seeking advice
- Admission, if indicated, should be under care of consultant neurologist, if possible
- If patient admitted to general medical ward, notify clinical nurse specialist in epilepsy or consultant neurologist already concerned with patient's care, as soon as possible

DISCHARGE AND FOLLOW-UP

- If patient not admitted, send A&E card to clinical nurse specialist in epilepsy for urgent out-patient review
- If patient admitted, arrange out-patient review with neurology service

ACUTE STROKE ● 1/8

DEFINITION

- Stroke is a neurological deficit of sudden onset:
- with focal rather than global dysfunction
- with symptoms still present (if <24 hr) **or** lasting >24 hr, **or** resulting in death before 24 hr
- in which, after adequate investigation, symptoms are presumed to be of a non-traumatic vascular origin

RECOGNITION AND ASSESSMENT

Treat all patients with symptoms at time of assessment as a stroke, even if minor or improving. Diagnose TIA only if symptoms have completely resolved

Causes of stroke

- **Ischaemic**: large-artery atherosclerosis, small vessel atherosclerosis, cardioembolism, carotid/vertebral dissection and rarer causes: consider especially in younger patients: drugs, vasculitis, infection, sickle cell disease, polycythaemia, haematological condition, sarcoidosis, metabolic disorder – homocystinuria
- **Haemorrhagic**: intracranial, subdural, and subarachnoid haemorrhage

STROKE SYNDROMES

Infarct subtypes[1] (infarcted territory)	Symptoms and signs
Total anterior circulation syndrome (TACS) [involving both deep and superficial middle cerebral artery (MCA) territory]	• New higher cerebral dysfunction (e.g. dysphasia, dyscalculia, visiospatial disorder)[2] **and** • Homonymous visual field defect[2] **and** • Hemiparesis/hemisensory loss affecting at least 2 body areas (2 out of face, arm and leg)
Partial anterior circulation syndrome (PACS) [more restricted cortical infarcts in the MCA territory, including isolated infarctions in the anterior cerebral artery (ACA) territory and striatocapsular infarctions]	• Patients presenting with only 2 of the 3 components of the TACS **or** • Motor/sensory deficit restricted to face or arm or leg
Lacunar syndrome (LACS) (small lacunar infarcts in the basal ganglia or pons)	• Pure motor, pure sensory or sensori-motor deficit **or** • Ataxic hemiparesis (with at least faciobrachial or brachiocrural involvement)[3]
Posterior circulation syndrome (POCS) (infarcts in brainstem, cerebellum and/or occipital lobes)	• Ipsilateral cranial nerve palsy with contralateral motor and/or sensory deficit • Bilateral motor and/or sensory deficit • Disorder of conjugate eye movement • Cerebellar dysfunction without ipsilateral hemiparesis • Isolated homonymous visual field defect

[1] As defined by Oxfordshire community stroke project
[2] Assume a deficit present if consciousness is impaired and higher cerebral functions or visual fields cannot be tested formally
[3] Acute focal movement disorders should probably also be included in this group

Differential diagnosis

- Acute medical problem exacerbating effects of an older established stroke
- Arterial dissection (look out for Horner's syndrome, neck and face pains, whiplash injury, neck trauma)
- Seizures/Todd's paralysis
- Migraine
- Functional
- Subarachnoid haemorrhage, extradural haemorrhage, subdural haemorrhage
- Space-occupying lesion
- Meningitis/encephalitis
- Metabolic (e.g. hypoglycaemia, hyponatraemia)
- Toxic (e.g. overdose)
- Anoxic encephalopathy (e.g. shock, arrhythmia)
- Trauma

ACUTE STROKE CARE PATHWAY

- The ambulance service should pre-alert the stroke team with key patient details (name, date of birth, onset time, expected time of arrival, and contact number of ambulance crew)
- Commence Stroke pathway (yellow forms in A&E or download directly from http://www.thrombolysis.info)
- Take a detailed history (use telephone if necessary) to accurately ascertain onset time to stroke to determine appropriate hyper-acute treatments e.g. thrombolysis
- If an inpatient develops symptoms or signs raising strong suspicion of an acute stroke, arrange immediate CT head scan (plain) via OrderComms and inform radiology SpR. Inform stroke team immediately via bleep 74734

Urgent investigations

- **Immediate CT head scan** – **do not delay –** it is paramount that CT scan is done quickly
- if fit and independent, no contraindications to contrast, significant neurological deficit (NIHSS >7) and within <8 hr of onset and no haemorrhage, order CT angiogram (arch to Circle of Willis) together with plain CT scan to be performed if no signs of established infarction found on CT head scan
- If occlusion of a major intracerebral or extra cerebral artery identified, discuss immediately with stroke consultant of the day
- Consider ENCHANTED, study within 4.5 hr of onset and ECASS-4/Wake-up to 9 hr
- Glucose, U&E, FBC, INR, random cholesterol, LFT, CRP
- if patient on warfarin obtain INR urgently (use point of care device for immediate results)
- ECG

IMMEDIATE TREATMENT

Ischaemic stroke

Patient eligible for thrombolysis within 4.5 hr of presentation

- **Start thrombolysis** immediately if indicated, use care pathway (pink forms in A&E or download directly from http://www.thrombolysis.info)
- **In patients with contraindications to IV thrombolysis** (e.g. post-operative, postpartum), or with severe stroke i.e. proximal MCA thrombus or basilar thrombus, **consider thrombectomy** (arrange CT angiogram – see thrombolysis pathway) – working hours bleep via call centre/out-of-hours call stroke consultant of the day via call centre
- In previously fit and independent patients with occlusions the CCA, ICA, M1, M2, ACA, basilar artery, or PCA – consider mechanical thrombectomy if within 4.5 hr of symptom onset. Alert stroke nurse (74734). Call consultant of the day, anaesthstetist and consultant radiologist. Do not delay thrombolysis, this can be arranged once treatment has been started. **For patients too late for thrombolysis** (4.5–8 hr) ECASS-4 or Wake-up stroke trial
- Bleep research nurse (74739) within hours and bleep 15998 after hours/weekends. If no response or out-of-hours, call 74734 or stroke consultant of the day
- In patients who have been thrombolysed, do not give antiplatelets for 24 hr

Patients not eligible for thrombolysis/too late at presentation beyond 8 hr

- Give antiplatelet, aspirin 300 mg oral, rectal or via nasogastric tube immediately once CT head scan excludes haemorrhage
- Transfer patient to acute stroke unit (ASU) as soon as possible within 4 hr of arrival. Bleep 74734 or ring extension 76232 immediately to assist with this
- If urgent senior advice is required, call stroke physician of the day via call centre

Intracranial haemorrhage

- **For patients with** intracerebral, subdural, subarachnoid haemorrhage, carry out point-of-care INR, check full clotting screen and reverse immediately (even with prosthetic valves)
- Consider for TICH-2 trial for intracerebral haemorrhage
- Reverse anticoagulation with FXa inhibitors (rivaroxaban, apixaban, edoxaban, betrixaban) with adexanet alfa (stock kept in A&E) and enrol into ANNEXA-4 study
- Reverse anticoagulation with dabigatran with idarucizumab (stock kept in A&E)
- Only refer to neurosurgeons if haemorrhage is subdural, cortical, or subarachnoid

Patients on warfarin

- In **intracranial haemorrhage**, reverse anticoagulation immediately (within 3 hr or less), aiming for INR of 1.0 (**even in patients with mechanical heart valves**)
- give Vitamin K_1 (phytomenadione) 5 mg IV immediately as slow bolus
- Contact on-call consultant haematologist to order dried prothrombin complex (e.g. Octaplex or Beriplex) and correct INR as soon as possible within 3 hr (including patients with prosthetic valves)
- In patients with prosthetic valves and disabling cerebral infarct, stop warfarin for 1 week and replace with aspirin 300 mg once daily

General measures

Hypoxia

- **Check and clear airway.** If oxygen saturation falls to <95% in spite of this, give supplemental oxygen. See **Oxygen therapy in acutely hypoxaemic patients** guideline

Fluids

- **Do not catheterise** unless patient in urinary retention
- In patients who are nil-by-mouth, dehydrated or at risk of dehydration, give sodium chloride 0.9% (unless contraindicated) within the first 48 hr, then follow **Fluid maintenance** guideline

Pyrexia (temperature >37.2°C)

- Look for source of infection and treat as indicated

Hyperglycaemia

- Maintain blood glucose between 4–11 mmol/L. See **Control of hyperglycaemia in the ill patient** guideline

Blood pressure

- Correct hypotension and try to prevent BP from falling
- **Do not** lower BP acutely unless >220/120 mmHg
- **In intracranial hemorrhage, use GTN infusions and/or labetalol IV to lower blood pressure rapidly (within 1 hr) to ≤140/80 and maintain this level for 7 days**

Statin

- **If on statin** before stroke, continue
- Immediate initiation of statin treatment not recommended in acute stroke, delay start by 48 hr
- Use atorvastatin 20 mg/day. Consider switching patients on simvastatin to atorvastatin, as this has less risks of adverse interactions. Simvastatin is contraindicated in combination with clarithromycin and restricted to ≤20 mg in patients taking amlodipine. Refer to BNF for all other interactions

Prevention of deep venous thrombosis/pulmonary embolism

- Mobilise (out of bed) on day of admission
- Adequate hydration
- Start antiplatelet therapy as soon as CT head scan has excluded intracerebral haemorrhage
- For all patients not able to mobilise to the toilet independently apply intermittent pneumatic compression stockings (e.g. Kendall SCD™ express sequential compression system, Covidien, MA, USA) day and night for first 30 days, until mobile, or until discharged from acute care (whichever comes first)
- stockings may be removed temporarily during therapy, when mobilising, and while out of the ward for diagnostic tests
- Do not use compression stockings
- Do not use heparin/dalteparin routinely (e.g. for age and stroke related immobility or infections alone)
- Consider heparin if patient has non-stroke related increased risk of thromboembolism (e.g. cancer, thrombophilia, past history of thromboembolism, post-operative stroke) since with increasing stroke severity both risk of thromboembolism and haemorrhagic complications increases and there is no evidence of an overall benefit on mortality and recovery

Oral health

- For patients who are nil-by-mouth, use chlorhexidine gluconate 1% dental gel or toothpaste for oral hygiene 8-hrly
- Keep dentures in during the day in all patients (unless very loose and safety risk)

Fracture prevention

- If stroke patient likely to remain housebound, or discharged to an institution, prescribe calcium and vitamin D

Specific syndromes

Acute venous stroke (cerebral sinus venous thrombosis)

- In patients with cerebral sinus venous thrombosis (including those with secondary cerebral haemorrhage) start full dose anticoagulation (initially unfractionated heparin, then warfarin aiming for target INR 2–3) unless contraindicated by other concurrent conditions

Stroke secondary to acute arterial dissection

- Use either anticoagulants or antiplatelet agents

Advice

- Ask for senior/specialist advice about:
  - patients in whom unusual cause for stroke suspected (call stroke consultant of the day)
  - intracerebral haematoma (do not refer automatically, discuss with stroke consultant whether neurosurgical referral is needed)
  - hydrocephalus (bleep neurosurgical team)
- Research related queries: during working hours (including Saturday and Sunday), call 74739 or pager 15998, and via switchboard after hours

CAUSES OF DETERIORATION

Malignant MCA syndrome

- If deterioration of consciousness within first 48 hr National Institute of Health Stroke Scale (NIHSS) item 1a ≥1 (e.g. drowsy patient) in patients with large MCA territory infarcts (NIHSS score >15), consider malignant MCA syndrome
- Arrange urgent CT head scan and discuss with stroke consultant of the day (contact via call centre in working hours) or on-call stroke thrombolysis consultant via call centre after hours
  - signs on CT of an infarct of at least 50% of the middle cerebral artery territory with/without additional infarction in the territory of the anterior or posterior cerebral artery on the same side, or an infarct volume of >145 cm^3 on diffusion-weighted MR scan of brain confirm the diagnosis
- Untreated malignant MCA syndrome has 80% mortality but hemicraniectomy within first 48 hr has been shown to reduce mortality significantly – consider urgent referral to neurosurgery (within 24 hr) to allow surgery within 48 hr. Refer early, **do not wait** for midline shift on head CT scan or abnormal pupillary responses
- In patients who are potential candidates for hemicraniectomy, avoid mannitol or hypertonic saline. This may mask signs of deterioration and delay surgery inappropriately

Other brain causes

- Stroke progression/further stroke – highest risk in minor strokes/TIAs: make sure secondary prevention is in place from day 1
- Brain oedema (especially in large parietal strokes)
- Progression of intracerebral haemorrhage – if deterioration in neurological signs/level of consciousness after admission, re-scan immediately and refer to neurosurgeons for advice (unless there are good reasons not to consider surgery). Recheck INR and correct, if necessary
- Haemorrhagic conversion (especially in large infarcts or in thrombolysed patients)
- Cerebral emboli, or vasculitis
- Hydrocephalus (especially in cerebellar strokes or in patients with intracerebral haemorrhage, refer previously fit patients to neurosurgery)

Action

- Treat as emergency
- Confirm by repeating NIHSS score (in yellow pathway). An increase of ≥4 points indicates clinically significant deterioration. Repeat head CT scan and seek senior advice
- Review differential diagnosis
- Consider: MR, EEG (for possible encephalitis or epilepsy), lumbar puncture

Non-brain causes

- Complications – see **COMPLICATIONS**
- Coincident medical condition (e.g. hypoxia, hypoglycaemia, hyperglycaemia, pyrexia, infection, heart failure, fluid/electrolyte disturbance) – see relevant guidelines

SUBSEQUENT MANAGEMENT

Ensure stroke team aware of all patients with stroke not admitted to stroke unit. Members of stroke team will assess patient and arrange transfer to stroke unit, if other concurrent conditions allow

General

- Allow patient to sit up as tolerated (bed/chair) as soon as possible
- Mobilise conscious patients from day 1
- If no haemorrhage on CT, give aspirin 300 mg oral, rectal or via nasogastric tube for 2 weeks unless contraindicated. In patients with previous dyspepsia, add proton pump inhibitor. In patients genuinely allergic to, or intolerant of aspirin, use clopidogrel 300 mg stat followed by 75 mg once daily. After 2 weeks, or when considering discharge, change to clopidogrel 75 mg/day (or warfarin for patients in AF) indefinitely
- Ensure patients who are nil-by-mouth receive all necessary medication (use rectal, IV or nasogastric tube)
- Treat pyrexia (temperature >37.5°C) with paracetamol 1 g oral or rectal 6-hrly
- Avoid sedatives (e.g. temazepam, chlorpromazine, haloperidol)
- Young patients with intracerebral haemorrhage may have an operable vascular abnormality. Request neurosurgical assessment

Further investigations

General

- If random glucose >7.5 mmol/L, request fasting glucose
- Lipid status (<48 hr after stroke or after 6 weeks)
- Chest X-ray

For specific indications

- In patients with cardiac murmurs and/or history of rheumatic fever, and/or no risk factors for atheroma, consider echocardiography to exclude a cardiac source of embolism
- Request bubble contrast echocardiogram in young patients (age <55 yr) with stroke and no vascular risk factors and no cardiac or arterial sources of embolism to exclude atrial septal defect (ASD)/patent foramen ovale (PFO)
- if positive for ASD/PFO, no other cause for the stroke identified (cryptogenic), and aged <55 yr refer to cardiology for consideration of closure
- In patients with no risk factors for atheroma, screen for arteritis (CRP, ANA, ANCA, Rh Factor)
- In young patients with stroke and no atherosclerosis/risk factors, investigate for thrombophilia
- FBC: exclude polycythaemia, thrombocytosis, sickle cell disease (where indicated), lupus anticoagulant, anticardiolipin antibodies, JAK-2 mutation studies: to exclude myeloproliferative disorders, fasting homocysteine levels
- Only in cases with a PFO or patient has a venous thrombosis (concurrent PE, cerebral sinus thrombosis), check protein C, protein S, Factor V Leiden and PT gene mutation. Send sample which will be frozen and stored in the lab (for 6 months). If necessary, stroke team will liaise with Dr Deepak Chandra on a case by case basis
- In younger stroke patients (age <55 yr) and those without vascular risk factors, consider CT or MR angiography to exclude dissection
- In patients without vascular risk factors where the diagnosis is in doubt, consider MR (DWI) scan of brain with ADC mapping to confirm an infarct/show potential alternative pathology, or demonstrate normality. Discuss with neuro-radiologists for protocol (working hours only)
- If several repeated scans considered necessary to exclude recurrent silent ischaemic events, consider MR scan in preference to CT, to reduce radiation exposure

Fluid and nutrition management

Assess swallowing at bedside

- Check patient is:
  - alert and co-operative
  - able to sit up for feeding
  - able to cough on demand
  - not drooling excessively
- Sit patient up, listen to voice and give 5 mL of water on a spoon
- Watch and feel swallow with fingers on larynx
- Observe for 2 min, looking for:
  - choking or impaired breathing
  - delayed swallow
  - cough
  - change of voice
- If 5 mL swallowed without difficulty, give 50 mL of water before giving soft diet
- If there is any doubt about swallowing, recommend nil-by-mouth, give fluid (2 L/24 hr) IV/SC and ask speech therapist or stroke team to assess swallowing – see **Fluid maintenance** guideline

Tube feeding

- In patients with severe strokes and dysphagia, start nasogastric feeding within 24 hr (unless expected to die within hours)
- Prescribe metoclopramide 10 mg 8-hrly (5 mg if <50 kg body weight) via nasogastric tube for 3 weeks or until nasogastric feeding no longer required (whichever occurs earlier)
- In mild strokes, where normal swallow expected to return, review after 48 hr and, if dysphagia still present, pass nasogastric tube
- Where a standard nasogastric tube cannot be kept in place safely and reliably, consider a nasal bridle
- Refer patients with persistent dysphagia after 3 days for dietary advice and consider further investigation (e.g. video fluoroscopy)
- If NG tube not tolerated and patient unable to take sufficient nasogastric/oral diet for 3 or more days, refer urgently for PEG (percutaneous endoscopic gastrostomy)
- If nasogastric feeding successful but no significant recovery of swallowing occurs, consider referral for PEG within 4 weeks
- If there is some recovery of swallowing and nasogastric feeding successful, PEG referral may not be necessary, continue nasogastric feeding until patient able to eat normally

Rehabilitation

- Admit all stroke patients to acute stroke unit and start active rehabilitation on day 1
  - unless consciousness impaired, sit out and mobilise from day 1
- Full multidisciplinary assessment; include nurses, occupational therapist, physiotherapist, doctors, speech and language therapist and clinical psychologist to identify rehabilitation goals. Involve dietitian, social worker, pharmacist, other medical or surgical specialties, at a later date, as necessary

Quick recovery

- If patient recovers rapidly and is left with no significant residual disability after a few days, arrange for urgent carotid Doppler (within 1 working day) and make sure secondary prevention (see below) is in place (12% of patients with minor strokes will extend or have a further stroke within one week)

Secondary prevention

Manage patients with antiphospholipid syndrome who have an acute ischaemic stroke in the same way as patients with acute ischaemic stroke without antiphospholipid syndrome

General

- Advise to stop smoking
- Give dietary advice
- Advise to exercise regularly
- Identify and treat diabetes. Keep HbA_{1c} below 7%

Antiplatelet treatment or anticoagulation

- Aspirin: once haemorrhage excluded by CT, unless contraindicated, 300 mg/day for 2 weeks or until discharge. In patients with history of dyspepsia, add proton pump inhibitor – refer to hospital formulary for choice of PPI. After 2 weeks, or at discharge, change to clopidogrel 75 mg/day indefinitely
- in patients allergic to, or genuinely intolerant of aspirin, use clopidogrel 300 mg stat followed by 75 mg once daily. If allergic to both aspirin and clopidogrel, give dipyridamole MR 200 mg 12-hrly
- Warfarin: for all patients with atrial fibrillation/flutter (AF) who have no contraindications
- 2 weeks after stroke, start slow induction dose of warfarin (no need to achieve rapid anticoagulation). **For stable patients in good health,** see **Warfarin initiation** guideline**: Slow anticoagulation.** For frail, malnourished, multimorbid patients or those on multiple other medications, discuss warfarin starting regimen with stroke consultant since lower doses may be required. Use **OATES regimen** – see **Warfarin initiation** guideline
- once INR >2, stop aspirin, clopidogrel and dipyridamole
- In mild non-disabling stroke, start warfarin between day 2 and day 14. In severe disabling stroke, delay start of anticoagulation to 14 days or longer
- In patients who have recurrent strokes/TIAs on warfarin, who are unable to comply with warfarin, or where INR is out of therapeutic range for >60% of the time consider changing to newer anticoagulants (e.g. dabigatran, rivaroxaban, apixaban)

Other medication

- If non-HDL cholesterol >4.0 mmol/L, give atorvastatin 20 mg/day at night starting 48 hr or later after stroke. Check levels after 3 months and adjust dose to reduce level by 40%. Review annually
- Aim for a non-HDL cholesterol of <4 mmol/L. Patients with atrial fibrillation and a Chads score ≥1, and contraindications to warfarin and to the newer non-vitamin K antagonist anticoagulants should be referred to cardiology for consideration of atrial appendage closure
- Stop contraceptive pill/hormone replacement therapy [unless there is an important reason to continue (e.g. premature ovarian failure)]. In premenopausal women, provide advice on alternative methods of contraception
- Reduce blood pressure to a target of ≤130/80 mmHg starting within 24 hr of minor stroke/TIA and within 2 weeks of moderate to severe stroke
- start treatment slowly – use indapamide 1.5 mg MR [for patients with dysphagia, use 2.5 mg plain tablets, as they can be crushed (unlicensed)] daily in morning and ACE inhibitor or a calcium channel blocker

COMPLICATIONS

Pneumonia after starting oral fluids

- Reassess swallowing, treat as **Hospital-acquired pneumonia** unless diagnosed on admission

Urinary retention

- Relieve by in and out catheter, record drained volume
- Monitor bladder volume by bladder scan, intermittent catheterisation as needed
- Check for faecal impaction and treat
- If retention recurrent, start tamsulosin MR 400 microgram/day. For patients with nasogastric tube *in situ,* doxazosin tablets may be crushed (unlicensed). **Do not use in patients where the blood pressure lowering effect could be a problem**
- Avoid indwelling catheter

Deep venous thrombosis/pulmonary embolism

- If CT head scan has excluded haemorrhage, treat in usual way – see **Deep venous thrombosis** and **Pulmonary embolism** guidelines
- In patients with haemorrhagic stroke and symptomatic DVT/PE, discuss anticoagulation or placement of a caval filter to prevent (further) pulmonary embolism with consultant

Shoulder pain

- Prevent by not pulling on the affected arm and always supporting its weight
- Maintain correct position and adequate support, consult physiotherapist, consider paracetamol
- For subluxation, consider functional electrical stimulation
- If pain persists, consider addition of NSAIDs, supraspinal nerve block, TENS or intra-articular corticosteroids

Depression

- Treat conventionally

Seizures

- Treat conventionally

Pressure sores

- Treat diarrhoea effectively, prevent hypotension, ensure adequate nutrition, check that pressure relief adequate. Involve tissue viability team

DISCHARGE

Acute stroke unit provides information packs for patients and carers, and will assist in discharge planning and arrangements for continued outpatient rehabilitation. They will also contact stroke family support worker where needed

- Use multidisciplinary stroke checklist to ensure all secondary prevention measures are in place and follow-up arranged
- Consider referral to the early supported discharge team
- Consider and record whether a joint care plan with social services is required
- Discharge summary must contain:
  - diagnosis including OCSP class and NIHSS score at admission and on discharge
  - thrombolysed/not thrombolysed
  - details of any clinical trial patient taking part in
  - advice for secondary prevention
  - driving advice
  - NIHSS on discharge, level of dependence, mobility
- Give patient a copy of the discharge summary

Patient and relatives

- Check for hemianopia and hemi-inattention in all drivers. This is not always obvious to patient and disqualifies from driving until resolved
- Give driving instructions verbally and in writing
  - do not drive for 1 month and inform insurance of stroke
  - if back to normal within 1 month and no recurrence, patient may drive again
  - if persistent deficit or recurrence, patient must inform DVLA and await assessment by a doctor
- Ensure patient and relatives are aware of diagnosis, discharge date, follow-up arrangements and secondary prevention measures

FOLLOW-UP

- Follow-up at 6 weeks, 6 months, and annually
  - first follow-up in a specialist hospital clinic. Further follow-ups can be carried out by stroke-trained teams in the community (if available)
- Assess functional status (Rankin), continence, pain, mood, cognition, and barriers to return to work, leisure activities and driving in clinic and refer as appropriate
- Include risk factor assessment and instructions for secondary prevention (refer to stroke check list) in discharge documentation

TRANSIENT ISCHAEMIC ATTACK (TIA) ● 1/4

DEFINITION

- **TIA:** a clinical syndrome characterised by an acute loss of focal cerebral or ocular function with symptoms lasting <24 hr
- **Crescendo TIAs** are >1 TIA within 1 week. Treat as high risk, even if ABCD2 score <4 (see below)
- **Frequent TIAs** are those occurring at least once per week

Consider all patients with TIA who are in atrial fibrillation (AF) as high risk TIA irrespective of whatever the ABCD2 score is

RECOGNITION

- Consider any patient presenting acutely with focal neurological signs to have had a stroke until signs have completely resolved – see **Acute stroke** guideline
- Diagnose a TIA only once symptoms have resolved
- TIA is more difficult to diagnose than stroke:
- try to obtain a witness account
- syncope is unlikely to be a TIA
- vertigo alone is unlikely to be a TIA

Syndromes

Anterior circulation

- Dysphasia
- Dysarthria
- Visuospatial neglect
- Usually hemiparesis (face, arm and leg)
- Usually hemisensory (face, arm and leg)

Posterior circulation (ischaemia in brainstem, cerebellum and/or occipital lobes)

- Nausea and vomiting
- Vertigo
- Diplopia
- Ataxia
- Crossed syndromes (weakness or numbness on side of face and in contralateral limbs)
- Coma
- Visual field defect (Homonymous hemianopia)

Treat patient who still has symptoms at time of assessment as stroke and consider for thrombolysis (see Acute stroke guideline) if within <4 hr of symptom onset. TIA can only be diagnosed once all symptoms have resolved

ASSESSMENT OF STROKE RISK

- Use ABCD2 score to classify chance of stroke within 7 days as 'low' or 'high'

		Score
A	Age >60 yr	**1**
B	BP >140 mmHg systolic or >90 mmHg diastolic	**1**
C	Clinical hemiparesis **or** Speech problem without hemiparesis	**2** **1**
D	Duration ≥60 min **or** 10–59 min	**2** **1**

ABCD2 score ≥4 or crescendo TIAs 'high risk'

- Treat immediately, initiate referral to TIA service immediately using rapid access TIA referral form from Trust intranet>Clinicians>Clinical services>Neurology>Referral forms>TIA. Specialist appointment target is within 24 hr for high risk TIA, carotid endarterectomy (if indicated) within 7 days
- Complete referral form:
- high risk TIA 24 hr/7 days: bleep 101 or call 74734 to arrange appointment at TIA clinic and fax referral to 08442 448261
- advise patient not to drive or fly until seen in clinic

ABCD2 score <4 'low risk'

- Treat immediately, initiate referral to TIA service immediately using rapid access TIA referral form from Trust intranet>Clinicians>Clinical services>Neurology>Referral forms>TIA. Specialist appointment target is within 1 week for low risk TIA, carotid endarterectomy (if indicated) within 3 weeks of TIA
- low risk TIA Mon–Fri (0900–1700 hr) bleep 101 or call 74734 to arrange appointment and fax referral to 08442 448261
- advise patient not to drive or fly until seen in clinic

IMMEDIATE INVESTIGATIONS

- FBC, clotting, ESR
- Random blood glucose
- U&E
- Random cholesterol
- ECG
- Carotid Doppler
- CT brain plain
- If symptomatic stenosis of >50% by NASCET criteria (RCP **Stroke** Guideline 2012) and considered appropriate for carotid intervention (after checking renal function), CT angiogram from arch to Circle of Willis

For high risk TIA

- On weekdays, request a CT scan of head and carotid Doppler to be carried out on same day (bleep101 or call 74734 if unsure)
- On weekends and bank holidays, request a CT brain scan and CT angiogram (arch to circle of Willis) instead of a carotid Doppler
- Where vascular territory or pathology is uncertain, request a diffusion weighted MRI scan

IMMEDIATE MANAGEMENT

When

- Begin antiplatelet and other therapy immediately **unless** you **STRONGLY** suspect a haemorrhagic stroke (severe headache, loss of consciousness) or BP very high (>180/100)

What

- **Atorvastatin 20 mg straightaway** and then each night regardless of the cholesterol value – non HDL <40% if intolerant to statin ezetimibe 10 mg daily
- **Clopidogrel 300 mg or aspirin 300 mg as loading dose and** then 75 mg oral daily indefinitely
- If dyspepsia experienced with Clopidogrel/aspirin, consider adding proton pump inhibitor. Try to avoid omeprazole, esomeprazole as they reduce the efficacy of Clopidogrel
- If patient's blood pressure in the TIA clinic is >130/80, start antihypertensive treatment. Do not wait for repeated measurements by the GP (2012 Royal College of Physicians **Stroke** guideline)

Summary

- Clopidogrel 75 mg daily monotherapy is first line (unlicensed)
- If patient not able to tolerate clopidogrel, give aspirin 300 mg stat followed by aspirin 75 mg/day and dipyridamole 200 mg MR twice daily
- If both clopidogrel and dipyridamole contraindicated, offer aspirin 300 mg stat followed by aspirin 75 mg once daily
- If both clopidogrel and aspirin contraindicated or not tolerated, offer dipyridamole 200 mg MR twice daily
- Combination of clopidogrel and aspirin is not recommended for long-term prevention after stroke or TIA, unless there is another indication e.g. acute coronary syndrome or recent coronary stent procedure

Patient in AF

- If in AF, discuss anticoagulation options. Discuss options for both warfarin (vitamin K antagonist) and non-vitamin K antagonist oral anticoagulation (DOAC). Base choice on clinical features, patient preferences and use CHADS-VASc to assess stroke risk and HAS-BLED to assess bleeding risk. Refer to **Atrial fibrillation** guideline to assess risk vs benefit

- Choices of anticoagulation include: warfarin, apixaban, dabigatran etexilate, edoxaban and rivaroxaban
- **DOAC initiation:** Screen patient – U&Es, LFTs, FBC, BP, renal function. Always check calculated creatinine clearance and follow prescribing guidelines for each DOAC
- For review and follow-up below, refer to the atrial fibrillation stoke prevention team to carry out follow-up:
- 1 month – review to check adherence, tolerance and side effects
- 6 months – recheck above and assess renal/hepatic function if poor when initiated
- ongoing monitoring – if stable consider 6 month review of the above – at least once a year or more frequently if impaired renal/hepatic function. Continue to check creatinine clearance and refer to prescribing guideline for each DOAC
- Creatinine clearance must be checked on review using tool http://www.nuh.nhs.uk/healthcare-professionals/antibiotics/antibiotics-calculators/creatinine-clearance-calculator
- **Warfarin Initiation** guideline: **Slow anticoagulation** (unless there are contraindications), aiming for an INR of 2–3, and **stop** antiplatelet agents once target INR achieved. Warfarin will be commenced by TIA specialist in the Rapid Access TIA clinic after assessing risk stratification, hence patient can be treated on the same day with a low molecular weight heparin (LMWH) and warfarin combination. Once INR >2, LMWH can be stopped
- Discuss a clear treatment plan with patient and teach them how to administer LMWH (dosage guidance as per treatment dose in **Dalteparin for VTE** guideline). Patient should receive treatment dose of LMWH **not** a prophylactic dose
- Refer all patients who commenced warfarin to the anticoagulation clinic for long-term follow-up
- If patient is on warfarin and developed a TIA with sub-therapeutic INR (<2), give treatment dose LMWH until INR >2
- If patient is already on warfarin with sub-therapeutic INR and time in therapeutic range (TTR) <65%, consider switching to NOAC if compliance and adherence is not an issue
- Contact anticoagulation hub to investigate TTR
- Refer to the "At a Glance Guide for the Prevention of Stroke and Systemic Embolism in Patients with Non-valvular Atrial Fibrillation" http://uhns/media/575342/150212%20At_a_glance_AF_anticoagulation_guide_FINAL_v1.0_Jan2015.pdf
- Note: poor adherence with any oral anticoagulant agent will reduce benefits but may increase risk associated with use
- To discuss anticoagulation – contact stroke prevention team on 79449

Patient advice

- If smoking – advise to stop
- Advise patient not to drive until symptom-free for 1 month and to inform insurance company
- Advise all patients with definite clinical symptoms of TIA who are otherwise fit to dial 999 if they experience any new TIAs lasting more than a few minutes
- Advise patient on healthy lifestyle advice

Patients with TIA who have symptomatic carotid stenosis of 50–99% according to NASECT criteria should:

- Be assessed and referred for carotid endarterectomy to be performed within 1 week of onset of symptoms
- Carotid endarterectomy should be the treatment of choice for patients with symptomatic carotid stenosis, particularly those aged ≥70 yr
- Receive best medical treatment (control of blood pressure, antiplatelet agents, diabetic management, cholesterol lowering through diet and drugs, and lifestyle advice, including smoking cessation)
- Advise all patients with definite clinical symptoms of TIA who are otherwise fit to dial 999 if they experience any new TIAs lasting more than a few minutes
- Use the following link to calculate the 1 yr and 5 yr stroke risk and discuss all cases with vascular surgeon of the week http://www.stroke.ox.ac.uk/model/model.htm
- Following risk assessment, discuss case in the vascular MDT. Discuss management plan with patient (carotid endarterectomy vs medical management)

Patients with TIA who have symptomatic carotid stenosis of <50% according to NASECT criteria should:

- Not undergo surgery
- Receive medical treatment (control of blood pressure, antiplatelet agents, diabetic management, cholesterol lowering through diet and drugs, and lifestyle advice including smoking cessation)

Where patients have repeated attacks of transient neurological symptoms despite best medical treatment, and an embolic source has been excluded, consider an alternative neurological diagnosis

DISCHARGE AND FOLLOW-UP

- For patients with crescendo TIA, frequent TIA, BP uncontrolled or if symptoms unresolved when assessment completed, seek advice from stroke consultant of the day (bleep via call centre working hours) or call 74734
- provide patient with drugs sufficient until appointment time and letter to GP

LONG-TERM RISK FACTOR MANAGEMENT (AT FOLLOW-UP)

- In addition to the factors addressed in **Immediate management**, address the following at follow-up:
- smoking cessation advice
- hypertension – aim for a target BP <130/80 mmHg but do not reduce abruptly
- diabetes mellitus – aim for HbA_{1c} <53 mmol/mol
- oral contraceptive pill or hormone replacement therapy contraindicated
- lifestyle and diet advice
- aim for total cholesterol <4 mmol/L and low-density lipoprotein (LDL) <2 mmol/L

RESEARCH

- Consider enrolment in a research study (e.g. TARDIS if no AF or CROMIS-2 for AF). Contact research team via call centre during working hours for details

SUBARACHNOID HAEMORRHAGE ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Severe headache of sudden onset (becoming severe within seconds and no longer than one minute) implies subarachnoid haemorrhage (SAH) until proved otherwise. It may be associated with vomiting and loss of consciousness, with subsequent photophobia and neck stiffness

Symptoms can sometimes resolve within a few hours but should still be investigated with CT scan of head. Thirty percent of patients with SAH may have 'minor' leaks hours or days before the major haemorrhage, which are often misdiagnosed as simple headaches or migraine

- Unexplained coma or seizures with subsequent persistent severe headache can indicate acute SAH

Investigations

- CT scan of head – within 24 hr of admission, if possible
- If initial CT normal (especially if performed more than 24–72 hr after initial headache onset) and clinical suspicion for SAH high, based on appropriate history, exclude SAH completely by analysis of CSF at least **12 hr** after symptom onset (see **Lumbar puncture** guideline), measuring:
- opening pressure
- xanthochromia
- MC&S, glucose and protein
- Send blood for glucose, protein and bilirubin with CSF sample
- Record time from headache onset in hours/days on CSF xanthochromia request card (to allow best assessment)

When lumbar puncture performed, send sample to clinical biochemistry immediately for centrifugation to allow CSF spectrophotometry for xanthochromia. This is especially important if tap was traumatic. You must protect sample from light and warn clinical biochemistry before you send sample. Do not use air tube to transport sample

Differential diagnosis

- Meningitis
- Encephalitis
- Cerebral venous sinus thrombosis (with raised opening pressure)

IMMEDIATE TREATMENT

- If consciousness impaired, check airway and maintain it
- Codeine phosphate 60 mg oral (or IM) 4-hrly as required up to maximum 240 mg in 24 hr
- Observe respiratory effort and monitor ECG
- If SAH confirmed, bleep on-call neurosurgical SpR, and request transfer to neurosciences

SUBSEQUENT MANAGEMENT

(After discussion with neurosciences team)

- Nimodipine 60 mg oral 4-hrly including throughout night. Commence within 4 hr of SAH or as soon as diagnosis confirmed. If unconscious, crush tablets and give as soon as possible via nasogastric tube
- Manage blood pressure – see **Acute stroke** guideline **– Immediate treatment, *Blood pressure***
- If no contraindication, give sodium chloride 0.9% at least 3 L by IV infusion every 24 hr
- Arrange for nursing staff to measure patient's legs and fit TED stockings

If improving and stable

- In confirmed SAH, consider CT angiography at earliest opportunity

If not improving or deteriorating

- Think about:
  - metabolic cause (diabetes insipidus, hyponatraemia, hypoxia)
  - hydrocephalus
  - acute rebleed
- Consider further CT scan of head

MONITORING TREATMENT

- Until headache has subsided and patient stable, monitor 4-hrly:
  - Glasgow coma score
  - neurological observations
  - pulse
  - BP
  - temperature
- When stable, monitor BP twice daily in patients taking nimodipine

DISCHARGE AND FOLLOW-UP

- As a rule, CT angiography is carried out with a view to operative treatment. If no operative intervention planned, continue oral nimodipine for a total of 21 days. Discharge after 2–4 weeks and review in outpatient clinic
- If patient hypertensive, treat BP according to national guidelines e.g. British Hypertension Society http://www.bhsoc.org

MANAGEMENT OF PARKINSON'S DISEASE IN ACUTE ADMISSIONS ● 1/3

INTRODUCTION

- Parkinson's Disease (PD) is characterised by: tremors, rigidity, akinesia, postural instability, and a range of non-motor complications (e.g. psychiatric and sleep disorders)
- It is imperative that patients continue their individualised PD treatment to prevent adverse effects of sub-optimal treatment including: rigidity, decline in swallowing function, and neuroleptic malignant syndrome. These may lead to poor patient outcomes, prolonged hospital stay, and can prove fatal
- This guidance aims to provide emergency advice on the best management of patients suffering from PD, where optimal management may not be achievable, until specialist review is possible

ON ADMISSION

- Take an accurate drug history – know precisely how PD is usually managed by patient
- Consider all sources of information, including:
  - patient – usually well informed on their precise treatment
  - Summary Care Records/GP fax/GP phone call/previous TTO
  - carer(s)/next of kin
  - transferring hospital/nursing home/residential home prescription charts
  - patient's own drugs (PODs)/repeat prescriptions
  - iPortal letters and notes: PD team may already be aware of the patient and medications
- Confirm if the patient has been taking their normal doses within the days immediately before admission – e.g. have they been too unwell to take their medicines as normal. Discuss with a specialist whether dose adjustments may be required on admission

Useful contacts

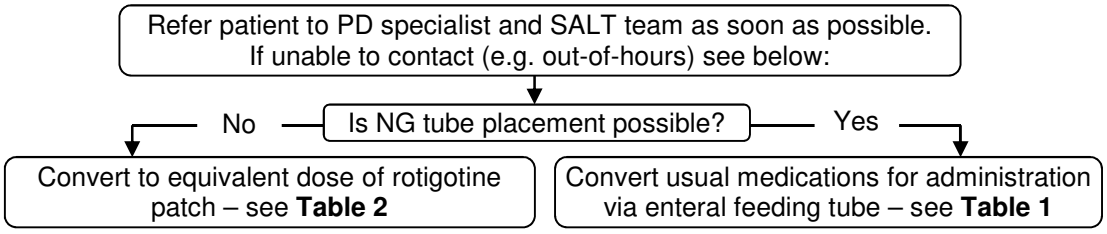
- PD nurses – RSUH: 01782 679463 County: 01785 230245
- Email: ParkinsonsDiseaseNurses@uhnm.nhs.uk
- PD nurse referral forms available at http://uhns/clinicians/clinical-services/neurosciences/

Drugs

- Ensure patients receive the right medicines at the right time whilst they are inpatients
  - prescribe all PD medications onto prescription chart, specifying exact timings as necessary (e.g. co-beneldopa 12.5/50 mg 6-hrly; 0600, 1000, 1400, 1800)
  - ensure supply of required PD medications are available
- Do not stop or miss doses of levodopa or dopamine agonists. Complete a Datix for any missed doses
  - UHNM currently has no self-medication policy, POD blister packs should not be used. All critical medicines are available within the Trust 24/7 (see http://uhnm/clinicians/support-services/pharmacy/obtaining-critical-medicines/)
- Ensure COMT inhibitors (e.g. entacapone) are prescribed and given at the same time as levodopa-containing medicines
- **Avoid medicines which may worsen PD, these include:**
  - antipsychotics (haloperidol) – if necessary, consider a benzodiazepine
  - anti-emetics (metoclopramide and prochlorperazine) – if necessary consider domperidone – think ECG QTc prolongation if nausea not transient

Nil-by-mouth or compromised swallow

- Refer to SALT for urgent swallowing assessment and advice
- If appropriate, consider placing tablets on a teaspoon with thickened fluids/soft foods (e.g. yoghurt), or dispersible/liquid preparations where available
- Check for underlying cause and treat accordingly
- **Priority:** maintenance of dopaminergic medication(s). If patient not able to take next oral dose:



COMT inhibitors and MAOB inhibitors can be safely omitted temporarily

MANAGEMENT OF PARKINSON'S DISEASE IN ACUTE ADMISSIONS ● 2/3

Table 1: Administration of dopaminergic medicines via enteral feeding tube or when swallowing difficulties

Normal prescription	Method of administration/alternative
Co-beneldopa (Madopar®)	• Use equal dose dispersible co-beneldopa • For CR doses multiply total daily levodopa CR dose by 0.7 and round to the nearest available dispersible preparation – e.g. Madopar® CR 50/200 mg at night → 200 mg x 0.7 → 140 mg → nearest dispersible co-beneldopa = 3 x 12.5/50 mg tablets at night. Monitor patient closely, dose frequency may need to be altered accordingly
Co-careldopa (Sinemet®)	• Use equivalent dose dispersible co-beneldopa (i.e. 12.5/50 mg Sinemet® = 12.5/50 mg Madopar®) • For CR doses see co-beneldopa above. If dispersible co-beneldopa tablets not available – as 2nd line co-careldopa tablets may be dispersed in water
Co-careldopa and entacapone (Stalevo®)	• Treat co-careldopa constituent of Stalevo® as above • Entacapone tablets can be dispersed in water. Flush well after administration (drug may stain orange) • If unavailable entacapone may be safely omitted temporarily
Ropinirole/ pramipexole	• Tablets can be crushed and mixed with water • For MR preparations, split total daily dose to 8-hrly dosing of normal release and administer as above (e.g. ropinirole MR 6 mg daily → ropinirole normal release 2 mg 8-hrly)
Bromocriptine/ pergolide	• Disperse in water and give immediately. Flush well after administration
Cabergoline	• Crush tablets and mix with water

Apomorphine

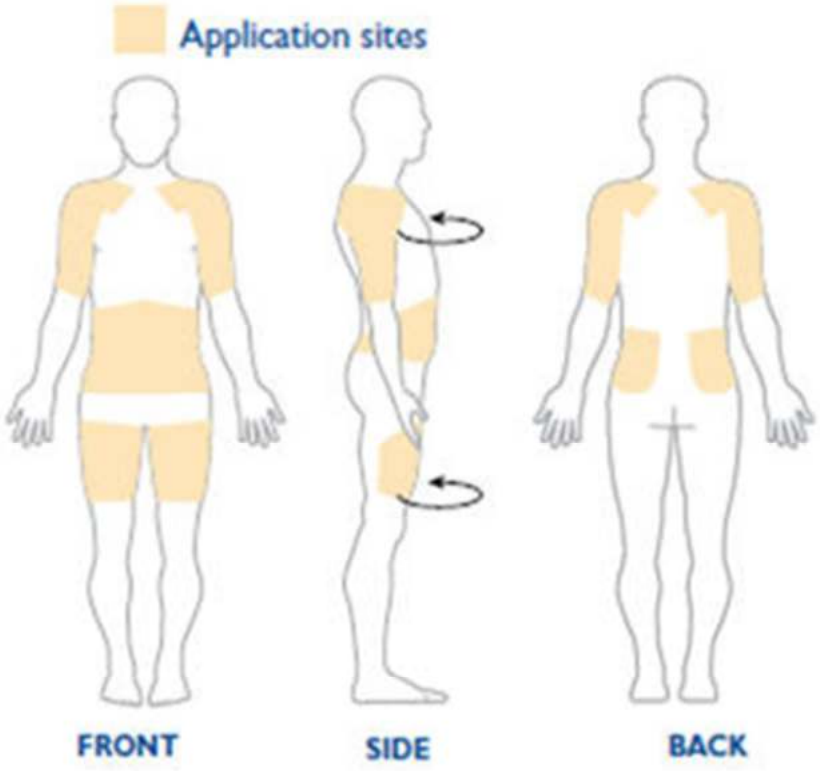
- If already using apomorphine continue current regimen
- **Do not** initiate apomorphine without involvement from a PD specialist
- APO-go (apomorphine) 24 hr helpline – 0844 8801327 (www.apo-go.co.uk)

Table 2: Estimating equivalent levodopa dosages and administration for rotigotine patches

	Calculate adjusted levodopa equivalent daily dose (LEDD): (A + B) ÷ 80 = _____ mg	
1	**A = Total adjusted daily levodopa dose** = Total daily levodopa dose in mg (excluding benserazide or carbidopa) x 0.7 per dose if MR/CR preparation **or** x 1.3 per dose if on COMT inhibitor at same time **or** x 0.91 per dose if MR/CR preparation and COMT inhibitor at same time E.g. Madopar 100/25 mg 6-hrly and madopar 100/25 MR at night = (4 x 100) + (100 x 0.7) = 470 mg/24 hr	**B = Total adjusted daily dopamine agonist estimate levodopa equivalent dose** = Total daily dopamine agonist in mg (listed below): x 100 if pramipexole/cabergoline/pergolide x 20 if ropinirole x 10 if bromocriptine E.g. Ropinirole MR 6 mg once daily = 6 x 20 = 120 mg/24 hr NB If patient already on rotigotine patch add the daily dose of this patch to the LEDD calculated dose
2	• Round up to nearest 2 mg (maximum 16 mg) as only 2 mg patches are licensed for PD (1 mg patches are licensed only for RLS) In the examples above the LEDD = (470 + 120) ÷ 80 = 7.375 which should be rounded up to 8 mg • Prescribe final dose as 24 hr patch – available on AMU, FEAU, 231, and County EDC	
3	**Monitor patient** • 4-hrly observations including ◦ sedation ◦ respiratory rate ◦ application site ◦ response • If increased stiffness/slowness, increase dose and review daily • If increased confusion/hallucinations, decreased dose and review daily	
4	**Rotigotine patch administration** • Apply patches once a day. Press firmly on back of patch for a minimum of 30 seconds onto skin to activate adhesive – see **Figure 1** • Apply patch at approximately the same time each day • Rotate application site daily to reduce risk of skin irritation (do not use same area of skin again for 14 days). See **Figure 2** for suggested application sites	
5	Contact PD nurses for urgent advice on continued management of PD medication	

Figure 1: Applying rotigotine patch

Figure 2: Suggestion application sites for rotigotine patches



ACUTE SPINAL CORD COMPRESSION ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Acute (usually symmetrical) weakness of arms or legs or both (weakness of the arms only is rare but apparently normal strength in the legs does not rule out spinal cord compression, especially note central cord syndrome usually in elderly and arteriopaths)
- Sensory level (may be absent or at least difficult to pick up in high cervical spine compression)
- Hyperreflexia and extensor plantar responses (note that because of spinal shock these may not be present at outset)
- Bowel/bladder dysfunction
- Erectile dysfunction in males
- Local spinal pain and/or tenderness +/- radicular pain
- In patient with diagnosed cancer certain symptoms strongly suggest spinal metastases:
- cervical or thoracic pain
- progressive or unremitting severe lumbar pain
- nocturnal spinal pain preventing sleep

Early diagnosis is imperative, high index of suspicion necessary in patients with mild weakness and urinary hesitancy especially if history of cancer

Investigations

Acute spinal cord compression is an emergency – refer such patients IMMEDIATELY to a spinal specialist. Do not delay referral; it is better that the spinal specialist organises emergency MRI scan than referral be delayed until a scan has been done

- If spinal cord compression suspected, request immediate MRI scan of whole spine and give history in request
- If MRI scan required out-of-hours – see **Accessing imaging: inpatients and emergencies** guideline
- FBC, U&E, LFT, ESR, CRP and blood cultures if infection suspected – see **Collection of blood culture specimens** guideline
- Chest X-ray
- If malignant cause of cord compression suspected from MRI scan:
- CT head/chest/abdomen/pelvis

Differential diagnosis (if spinal cord compression excluded)

- Transverse myelitis
- Cord ischaemia
- Guillain-Barré syndrome
- Intrinsic spinal cord lesion such as intramedullary tumour
- Intracranial lesion

Examination

- Full neurological examination with clear documentation on ASIA chart
- Upper and lower limb strength and reflexes
- Sensory examination of upper and lower limbs and perineum

IMMEDIATE TREATMENT

- If malignancy suspected or proven, refer immediately to MSCC co-ordinator (out-of-hours orthopaedic SpR)
- Optimise spinal cord perfusion by treating hypovolaemic or neurogenic shock, ideally keeping MAP ≥75–80 mmHg
- Both because of potential for spinal instability, and to optimise cord perfusion, ensure patient is nursed flat, with turns side-to-side for pressure area care
- Catheterise the bladder – see **Urethral catheterisation** guideline
- If symptoms and signs suggest high cervical spinal cord compression, be aware of potential for respiratory failure

- Once MRI scan performed and infective cause excluded, and after discussion with on-call spinal surgery team, give dexamethasone sodium phosphate 6.6 mg (Hameln brand) IV immediately, then 8 mg oral twice daily at breakfast and lunchtime for at least 48 hr, with a review in all cases at 48 hr, and with concomitant administration of a PPI (e.g. omeprazole or lansoprazole – refer to joint formulary) for prophylaxis of peptic ulcer disease. If oral route for dexamethasone inappropriate, continue 6.6 mg IV twice daily at the same times
- If patient requires surgery +/- radiotherapy, review dose. If surgery not indicated, and patient has cancer, refer immediately to oncology team. In all cases, treatment decisions should be shared with oncology, but this need not delay urgent surgery

SUBSEQUENT MANAGEMENT, DISCHARGE AND FOLLOW-UP

- These will be decided by spinal team or oncology team, as patients may receive radiotherapy after or as an alternative to surgery

CAUDA EQUINA SYNDROME ● 1/2

DEFINITION

Cauda equina syndrome (CES) is the collection of symptoms and signs that accompany compression of the cauda equina. Compression is most often the result of massive lumbar disc prolapse, but can also be the result of tumour, trauma, epidural haematoma or abscess, or occasionally the result of progressive lumbar spinal stenosis. If there is pre-existing spinal stenosis, a relatively small disc prolapse can cause symptomatic CES. It is the equivalent of spinal cord compression, but occurring below L1/2 (termination of the spinal cord). It is a surgical emergency. It is nevertheless still frequently missed, and a high index of suspicion is mandatory

RECOGNITION AND ASSESSMENT

History

- Mechanism of injury (if any)
- Pain:
  - site
  - onset and duration
  - character
  - radiation
- Associated symptoms:
  - saddle anaesthesia
  - recent onset bladder dysfunction (e.g. painless urinary retention, overflow incontinence)
  - recent onset faecal incontinence
  - recent onset altered sexual function
  - progressive neurological deficit

Note that it is not uncommon for patients to present time after time with symptoms suggestive of CES, only for it to be disproved by MRI. It is still necessary to take these presentations seriously – several such patients have eventually been found to have CES

Investigations

- Blood tests for FBC, U&E, LFT, bone profile, clotting screen
- Urinalysis
- Myeloma screen
- Spinal plain film imaging may have a place, but usually unnecessary in addition to MRI
- CT scan – suspected unstable fracture
- MRI scan is the definitive test for cauda equina compression, which correlates closely with symptomatic CES

Differential diagnosis

- Spinal cord compression
  - (examine upper limbs as well and examine for sensory level (see **Acute spinal cord compression** guideline)
- Neurological disorder such as demyelination, transverse myelitis, Guillain-Barré syndrome
- Bladder/bowel problem
- Effect of pain/analgesia/anxiety

Examination

- Full neurological examination with clear documentation on ASIA chart
- Lower limb strength and reflexes
- Sensory examination of lower limbs and perineum
- Presence or absence of perianal pin-prick sensibility, documented bilaterally
- Presence or absence of voluntary anal contraction (note that anal tone is an unreliable sign)
- Presence or absence of ‘anal wink’ reflex (absent in profound lower motor neurone i.e. cauda equina as opposed to spinal cord lesion)
  - test the anal wink reflex by looking for contraction of the anal sphincter whilst testing perianal skin for pinprick sensibility. If there is reflex contraction, lower motor neurones are intact and spinal shock has worn off, even if there is spinal cord injury preventing voluntary contraction
- Unless patient to be catheterised anyway (see below), assess post-void residual urine with bladder scanner

CAUDA EQUINA SYNDROME ● 2/2

IMMEDIATE TREATMENT

- Analgesia may be required
- Catheter if CES strongly suspected – see **Urethral catheterisation** guideline
- ask patient to void bladder before catheterisation and document residual urine – a residual over 100 mL is abnormal and may correlate with CES
- Immediate spinal (orthopaedic or neurosurgical) referral
- MRI scan unless contraindicated, in which case discuss with orthopaedic spinal or neurosurgical consultant with regard to possibility of CT myelogram
- where possible, send patient for MRI scan from Emergency Department before admission to ward
- Remember to keep patient nil-by-mouth until surgical decision has been made

ACUTE KIDNEY INJURY (acute renal failure) ● 1/4

PREVENTION

- Ensure patients at risk have a fluid balance chart initiated at admission to hospital
- Ensure adequate pre-operative hydration
- encourage patients who are nil-by-mouth for planned anaesthesia to drink clear fluids until 2 hr before anaesthesia
- If pre-operative U&E required in patient undergoing major surgical procedures, repeat 24 hr post-operatively
- Once identified as at risk or AKI has developed, start **NEWS scoring** to detect further deterioration at early point. Write appropriate monitoring plan in notes and inform nursing staff in line with NICE CG50
- Do not overlook simple interventions (e.g. adequate fluid replacement and stopping potentially nephrotoxic drugs in at-risk individuals)
- Minimise risk of acute kidney injury associated with radiographic contrast media – see **Prevention of contrast induced acute kidney injury** guideline
- When prescribing diuretics and NSAIDs/ACE inhibitors/angiotensin-II receptor antagonists remember to inform patients about AKI risks. Patient leaflet 'My medication: What Should I Do When I Am Poorly?' available: http://uhnstrust/Central%20Functions/PatientInfo/Documents/Guidance%20for%20Sick%20days.pdf

RECOGNITION

- Acute kidney injury (AKI) is defined as an abrupt reduction in kidney function determined by an absolute increase in serum creatinine of either ≥26.4 µmol/L within 48 hr or ≥50% (1.5 x baseline) within 7 days, or a reduction in urine output documented as oliguria <0.5 mL/kg/hr for >6 hr

AKI stage	Clearance	Urine output
1	Increase in creatinine ≥26.4 µmol/L within 48 hr or 1.5–2 fold increase from baseline within 7 days	<0.5 mL/kg/hr for >6 hr
2	Increase in creatinine >2–3 fold from baseline	<0.5 mL/kg/hr for >12 hr
3	Increase in creatinine >3 fold or serum creatinine >350 µmol/L with an acute rise of 1.5 fold within 7 days	<0.3 mL/kg/hr for 24 hr or anuria for 12 hr

- **E-Alert for AKI stages above automatically generated by pathology systems and sent to iPortal. Note may only trigger if baseline U&E available in past 12 months dependent on severity. Complete AKI Prevention tool at medical admission portals**

Groups at higher risk

- Pre-existing chronic kidney disease
- Previous episode of AKI
- Age >65 yr
- Neurological or cognitive impairment or disability causing reliance on carer and possible limited access to fluids
- Sepsis
- Cardiac failure
- Atherosclerotic peripheral vascular disease
- Diabetes/cirrhosis/cancer

Risk factors in patients requiring surgery

- Emergency surgery, especially when associated with sepsis or hypovolaemia
- Intraperitoneal surgery
- Major joint surgery
- Assess baseline renal function in any at-risk group

Think STOP AKI

STOP AKI	Response
Sepsis **Identified as qSOFA score >2 with suspected or confirmed infection** • RR >22 breaths/min • Systolic BP <100 mmHg • GCS ≤13	• Complete formal SOFA score • **Sepsis six care bundle:** ◦ blood cultures ◦ urine output – hourly **(urea and electrolytes)** ◦ fluids – IV ◦ antimicrobials – IV ◦ lactate and haemoglobin ◦ oxygen – high flow • **Identify and treat source of sepsis**
Toxins – review risk	• **Stop/avoid potential nephrotoxins:** ◦ gentamicin ◦ NSAIDs ◦ iodinated contrast
Optimise BP	• **Volume status assessment:** ◦ IV fluids • **Hold BP-lowering medication** • **Consider vasopressors**
Prevent harm	• **Treat complications** • **Identify the cause and investigate management** • **Review:** ◦ all medications ◦ fluid management plan

Causes

- Pre-renal (perfusion)
  - volume depletion
  - hypotension, pump failure
  - sepsis
- Renal (organ)
  - established acute tubular necrosis – ischaemic or toxic
  - glomerulonephritis/vasculitis
  - tubulointerstitial nephritis
- Post-renal (obstructive)

Hospital-acquired renal failure is often multifactorial, with contributions from hypotension, sepsis and drugs. Risk of ARF resulting from obstruction or renovascular disease is greater if patient has single kidney

ASSESSMENT

Full set of physiological observations

- MEWS triggers to be applied according to local protocol
- Follow NICE CG50 guidelines ('Management of the Acutely Ill Patient')

ABCDE examination to include

- Any evidence of sepsis – qSOFA >2 with suspected or confirmed infection
  - start Sepsis Six Care Bundle
- Haemodynamic (including volume) assessment
- Signs of shock/hypoperfusion
- **Reagent strip urinalysis – documented in medical notes**
  - presence of haematuria/proteinuria may indicate acute glomerulonephritis/vasculitis
- Palpation for enlarged bladder
- Evidence of vascular disease
- Signs suggestive of a less common cause (e.g. vasculitis)

Relevant clinical history including:

- Obtain previous U&E for evidence of pre-existing renal dysfunction
- Possible precipitants and risk factors also requiring full medication history (prescribed and non-prescribed drugs; iodinated contrast investigations)
- History of urinary tract symptoms **or** renal stone disease
- History suggestive of sepsis
- History of vascular disease or recent vascular intervention (is cholesterol embolisation possible?)
- Systemic symptoms suggestive of a less common cause of AKI (e.g. vasculitis)

Assessment for complications of AKI including

- Pulmonary oedema
- Hyperkalaemia – see **Hyperkalaemia** guideline
- Tachypnoea (suggesting fluid overload and/or acidosis)
- Pericardial/pleural rub
- Neurological manifestations of uraemia, e.g. encephalopathy (having excluded other causes of confusion/delirium)

Look for evidence of multiple organ failure

- Hypotension [mean arterial pressure (MAP) <65 mmHg] despite initial fluid resuscitation up to 30 mL/kg, or inotrope or vasopressor dependency
- Impaired gas transfer: hypoxaemia (PaO_2 <10 kPa) despite 40% oxygen
- Metabolic acidosis – compensated as well as uncompensated
- Pulmonary shadowing/oedema on chest X-ray
- Patient looks severely ill/exhausted/obtunded

Identify patients with developing or established multiple organ failure early and refer to critical care for further investigation and management

Ultrasound

- If cause not identified, urgent renal ultrasound scan to assess renal size/exclude obstruction within 24 hr of AKI recognition
- When pyonephrosis [infected and obstructed kidney(s)] suspected in adults or children with acute kidney injury, offer immediate ultrasound of the urinary tract (to be performed within 6 hr of assessment)

REFERRAL TO RENAL TEAM

- Discuss with renal team or AKI specialist nurse (pager 07623974027) any patient with:
- **creatinine >350 µmol/L or >3 fold rise in creatinine from known baseline (AKI Stage 3)**
- CKD stage 5 or renal transplant
- AKI without obvious cause (e.g. volume depletion, sepsis)
- AKI with haematuria/proteinuria
- AKI with complications (see above)
- Patients referred in normal working hours will be seen within 24 hr
- Call on-call renal SpR between 2300–0700 hr only if:
- urgent dialysis required for life-threatening complications of AKI
- problem is sufficient to require specialist renal input **after assessment by patient's own team's SpR or consultant**

IMMEDIATE TREATMENT

Fluid balance

- Careful assessment of volume status including calculation of any fluid deficit
- Accurately chart fluid input and urine output (urinary catheter may be required)
- Fluid resuscitation with crystalloids to achieve appropriate physiological targets e.g. systolic blood pressure >100 mmHg or MAP >65 (higher if normally hypertensive) and/or resolution of tachycardia and/or restoration of adequate urine output as per **Fluid resuscitation** guideline. In patients who remain oliguric, carry out careful reassessment to ensure fluid overload does not occur
- use crystalloid solutions and avoid colloids (gelatins and starch-based solutions)
- insert CVP line if necessary (it will be possible to manage most patients without a CVP line), and maintain CVP pressure 10–14 cm H_2O
- **do not use dopamine or mannitol**
- Once rehydrated, continue IV crystalloid to match urine output + 30 mL/hr plus continuing fluid losses
- If patient is fluid overloaded (i.e. pulmonary oedema with oliguria), give furosemide 250 mg in 25 mL by IV infusion over 2 hr using infusion pump or syringe driver. **Do not use furosemide unless evidence of fluid overload**
- If no response, contact renal team urgently
- Recheck U&E daily to assess changes in renal function

Urinary tract obstruction

- When nephrostomy or stenting is used to treat upper tract urological obstruction in adults or children with acute kidney injury, undertake as soon as possible and within 12 hr of diagnosis

Drugs

- Discontinue/avoid nephrotoxins (e.g. NSAIDs/ACE inhibitors/angiotensin-II receptor antagonists)
- Stop metformin/sulphonylurea drugs as these may accumulate if any evidence of acute kidney injury. Consider need to adjust dosage of any drugs given in renal failure – consult BNF or renal drug handbook
- Consider appropriateness of restarting drugs following resolution of AKI

Tumour lysis syndrome

- Discuss patients with suspected tumour lysis syndrome (massively increased serum uric acid) urgently with renal team or oncology

Patients whose renal function continues to decline (even if creatinine <300 µmol/L) despite initial resuscitation – refer to renal team within 48 hr of diagnosing AKI

Other significant clinical features

Clinical and laboratory features suggesting a rare diagnosis symptom	Possible diagnoses
Fever, arthralgias, rashes	Small vessel vasculitis (e.g. granulomatosis with polyangiitis, microscopic polyangiitis), SLE, anti-glomerular basement membrane antibody disease
Haemoptysis	Small vessel vasculitis, anti-glomerular basement membrane antibody disease
Haemolysis, thrombocytopenia	Haemolytic–uraemic syndrome
Hypercalcaemia, hyperuricaemia, bone pain, lytic lesions	Multiple myeloma
Recent vascular intervention ± livedo reticularis, hypocomplementaemia	Cholesterol emboli syndrome
Raised serum creatinine, creatine kinase >10,000 U/L, prolonged severe immobility, crush injuries	Rhabdomyolysis

RENAL REPLACEMENT THERAPY

- Refer to renal team for possible intermittent haemodialysis or continuous renal replacement therapy if evidence of:
- fluid overload with oliguria
- potassium >6.5 mmol/L – see **Hyperkalaemia** guideline
- uraemia
- severe acidosis

SUBSEQUENT MANAGEMENT

- Discuss with renal team

MONITORING TREATMENT

- Daily weight and fluid balance
- Daily U&E
- Monitoring of underlying cause

DISCHARGE AND FOLLOW-UP

- If renal function remains abnormal despite treatment and eGFR <30 mL/min, arrange outpatient review by renal team
- Any discharged patient with AKI – U&E check in community within 6 weeks with GP team or, if eGFR <30, within 2 weeks
- Patient medication advice leaflet available for patients with CKD, hypertension and cardiac failure. Document title 'My medication: What Should I Do When I Am Poorly?' – see intranet http://uhnstrust/Central%20Functions/PatientInfo/Documents/Guidance%20for%20Sick%20days.pdf

ACCELERATED (MALIGNANT) HYPERTENSION ● 1/3

RECOGNITION

Hypertensive emergencies are acute, life-threatening, and usually associated with marked increases in blood pressure (BP), generally systolic ≥180 and diastolic ≥120 mmHg. There are 2 major clinical syndromes induced by severe hypertension:

Accelerated (malignant) hypertension

- Marked hypertension with grade III/IV retinopathy. There may be renal involvement (malignant nephrosclerosis). The presence of papilloedema does not affect prognosis or treatment

Hypertensive encephalopathy

- Symptoms and signs of cerebral oedema

Recognition of a hypertensive emergency is essential for effective triage and treatment
If accelerated hypertension suspected examine fundi thoroughly

Symptoms and signs

- Neurological symptoms due to intracerebral or subarachnoid bleeding, lacunar infarcts
- Hypertensive encephalopathy is characterised by the **insidious** onset of headache, nausea, and vomiting, followed by non-localising neurological symptoms (e.g. restlessness, confusion, and, if hypertension not treated, seizures and coma)
- Dyspnoea [left ventricular (LV) failure]
- Retinal haemorrhages and exudates (representing both ischemic damage and leakage of blood and plasma from affected vessels) and papilloedema
- Haematuria (usually non-visible) and proteinuria suggests acute kidney injury due to malignant nephrosclerosis

IMMEDIATE INVESTIGATIONS

- Complete history with particular attention to pre-existing hypertension and target-organ damage
- Fundoscopy
- FBC, U&E
- Urinalysis
- ECG +/- echocardiogram
- Chest X-ray
- Ultrasound scan of the renal tract
- If neurological symptoms present, obtain MRI scan to exclude ischemic stroke or haemorrhage (not usually treated with aggressive BP reduction)
- MRI may reveal oedema of parieto-occipital regions white matter (reversible posterior leukoencephalopathy syndrome)

TREATMENT

Goal of therapy

- Initial aim of treatment is to steadily lower diastolic BP to approximately 100–105 mmHg within 6 hr, but fall in BP must not exceed 25% of diastolic BP on presentation. Oral agents may be tried as first line therapy in the absence of hypertensive encephalopathy and/or grade III/IV retinopathy or when there is no rapid access to parenteral therapy

If there is any doubt about the need for treatment, seek advice from a SpR or consultant in renal medicine

- Sustained hypertension ≥180/120 mmHg requires treatment
- BP ≥180/120 mmHg and grade III/IV retinopathy requires **urgent** assessment

Sustained high BP alters cerebral autoregulation; sudden reduction of BP will reduce cerebral perfusion and can be dangerous. Aim to reduce blood pressure by no more than 25% in first 24–48 hr

ACCELERATED (MALIGNANT) HYPERTENSION ● 2/3

ANTIHYPERTENSIVE DRUGS

Parenteral therapy

If parenteral therapy indicated, contact on-call renal SpR and request transfer to care of renal team

- If no evidence of pulmonary oedema, or other contraindications (e.g. bronchospasm, heart block), prefer labetalol see **Labetalol** guideline, particularly when there is associated aortic dissection
- **Do not use** beta blockers or labetalol (which has predominantly beta-blocking effects) in patients with hyperadrenergic states (e.g. pheochromocytoma, cocaine overdose and methamphetamine overdose) in the acute setting. As blockade of vasodilatory peripheral beta-adrenergic receptors with unopposed alpha-adrenergic receptor stimulation can lead to a further elevation in blood pressure. Sodium nitroprusside may be used instead (see **Sodium nitroprusside** guideline)
- In patients with acute pulmonary oedema or acute coronary syndrome, prefer glyceryl trinitrate see **Glyceryl trinitrate** guideline
- In most other hypertensive emergencies, use sodium nitroprusside see **Sodium nitroprusside** guideline
- In the first instance, do not reduce diastolic BP below 100–105 mmHg or 25% of presenting value whichever is higher, with 2 exceptions:
- patient has aortic dissection – see **Aortic dissection guideline**, reduce systolic BP to <100 mmHg and maintain
- patient has pulmonary oedema, reduce BP until clinical improvement occurs but not <90/60 mmHg

Oral agents

- Slower onset of action and inability to control degree of BP reduction limits use in hypertensive crises but should be used when there is no rapid access to parenteral medications

First line

The following may be used:

- Labetalol 50–800 mg twice daily (in 3–4 divided doses in high doses). Maximum 2.4 g daily
- Nifedipine SR 10–40 mg 12-hrly
- Amlodipine 5–10 mg daily
- Doxazosin 1–16 mg daily
- Hydralazine 25–50 mg twice daily

Sublingual nifedipine and captopril can substantially lower BP within 10–30 min. A more rapid response is seen when liquid nifedipine is swallowed. Ischemic symptoms (e.g, angina pectoris, myocardial infarction, or stroke) are a major risk due to an excessive and uncontrolled hypotensive response.
Avoid their use in the treatment of hypertensive crises

HYPONATRAEMIC HYPERTENSIVE SYNDROME

- Severe hypertension related to renal ischemia, most commonly due to severe atherosclerotic renovascular disorder
- Excessive stimulation of renin-angiotensin-aldosterone system is responsible for heavy polyuria, renal electrolyte loss and proteinuria
- Neurological manifestations of hyponatraemia and/or hypertensive encephalopathy are the main presenting symptoms, and may disproportionate to degree of hyponatraemia and/or hypertension
- Treat underlying hypertensive disease, but ensure the correction of hyponatraemic dehydration and safe decrease of BP takes place in the emergency phase

If this condition is suspected, refer to the renal team urgently

SUBSEQUENT MANAGEMENT

If improving

- In patients treated with parenteral agents, start oral treatment before parenteral agent withdrawn
- Continue maintenance oral treatment as per current NICE Hypertension guidelines
- Assess kidneys in more detail e.g. renal ultrasound Doppler scan, urine PCR
- Aim to reduce BP gradually over 7–10 days to a target of:
- patients <80 yr: 140/90 mmHg
- patients >80 yr: 150/90mm Hg
- Carefully assess all patients for secondary causes of hypertension
- **If not improving, seek advice from renal team**

MONITORING TREATMENT

- During parenteral therapy, measure BP every 15 min
- Once maintenance therapy has started, measure BP 4-hrly
- Monitor urine output and serum U&E daily

DISCHARGE AND FOLLOW-UP

- Address other risk factors for cardiovascular disease (smoking, cholesterol, obesity) and advise
- Discharge home when BP ≤160/90 mmHg and condition stable
- Refer to hypertension clinic for follow-up as outpatient
- Following discharge, provide close follow-up care and advise weekly BP and U&E monitoring by GP

DELIRIUM (ACUTE CONFUSIONAL STATE) IN OLDER PEOPLE ● 1/5

RECOGNITION AND ASSESSMENT

Recognition

- Patients with the following conditions are at high risk:
- dementia
- visual impairment
- physical frailty
- any severe illness
- infection
- dehydration
- renal impairment
- recent surgery (e.g. fractured neck of femur)
- alcohol excess
- polypharmacy

Identify these patients on admission and incorporate prevention strategies into their care plan (see **Immediate treatment**)

Assessment

Assess mental status of **all** elderly patients on admission. Repeat whenever there are subsequent changes in mental function

- **Assessment must include**:
- history taken from patient **and** a relative
- 4AT assessment test for delirium and cognitive impairment
- the six item cognitive impairment test (6 CIT) – see below and also Proud to care booklet
- a full clinical examination, including a neurological and rectal examination (where possible)
- basic investigations as below

4 'A's Test: screening instrument for delirium and cognitive impairment*

[1] Alertness	This includes patients who may be markedly drowsy (e.g. difficult to rouse and/or obviously sleepy during assessment) or agitated/hyperactive. Observe patient. If asleep, attempt to wake with speech or gentle touch on shoulder. Ask patient to state their name and address to assist rating.	Normal (fully alert, but not agitated, throughout assessment)	**0**
		Mild sleepiness for <10 sec after waking, then normal	**0**
		Clearly abnormal	**4**
[2] AMT4	Age, date of birth, place (name of hospital or building), current year.	No mistakes	**0**
		1 mistake	**1**
		2 or more mistakes/untestable	**2**
[3] Attention	Ask patient: "Please tell me the months of the year in backwards order, starting at December." To assist initial understanding one prompt of "what is the month before December?" is permitted.	Months of the year backwards	
		Achieves 7 months or more correctly	**0**
		Starts but scores <7 months/ refuses to start	**1**
		Untestable (cannot start because unwell, drowsy, inattentive)	**2**
[4] Acute change or fluctuating course	Evidence of significant change or fluctuation in: alertness, cognition, other mental function (e.g. paranoia, hallucinations) arising over the last 2 weeks and still evident in last 24hr	No	**0**
		Yes	**4**
4 or above: possible delirium +/- cognitive impairment **1–3:** possible cognitive impairment **0:** delirium or severe cognitive impairment unlikely (but delirium still possible if [4] information incomplete)		**4AT SCORE**	

www.the4AT.com

* Available in A and E paperwork (p18) and Elderly care wards (separate green sheet)

DELIRIUM (ACUTE CONFUSIONAL STATE) IN OLDER PEOPLE ● 2/5

Six item Cognitive Impairment Test (6 CIT) – see **Proud to Care** booklet

			Score
1	**What year is it?**	Correct	0
		Wrong	4
2	**What month is it?**	Correct	0
		Wrong	3
3a*	***Memorise this address and repeat back to me** 'John/Brown/42/West Street/Bedford'	No score* see below	
4	**What is the time now?**	Correct (within 60 min)	0
		Wrong	3
5	**Count backwards from 20 to 1**	Correct	0
		1 error	2
		≥2 errors	4
6	**Say the months of the year backwards, starting from December**	Correct	0
		1 error	2
		≥2 errors	4
3b* Repeat the address back to me The address is broken into 5 segments and is scored for each error made in remembering it up to a score of 5		All correct	0
		1 part wrong	2
		2 parts wrong	4
		3 parts wrong	6
		4 parts wrong	8
		All wrong	10

- Add up the scores for the 6 items (range 0–28)
- 0–7: probably normal
- 8–9: minimal cognitive impairment
- 10–28: likely dementia refer to Mental Health Liaison team

Differential diagnosis

- Confusion is a symptom, not a diagnosis. Establish in every case whether you are dealing with:
- delirium (acute confusional state) – acute confusion in a previously well patient, which develops over a short period (hours to days), is always associated with clouding of consciousness and is usually precipitated by an acute medical or surgical problem
- dementia – continuing confusion relatively unchanged for a month or more
- delirium superimposed on dementia – acute confusion in a patient with previous cognitive impairment who has become suddenly much worse
- acute functional psychosis – such as schizophrenia, paraphrenia (a variant of schizophrenia commencing in patients aged >60 yr) or severe depression
- any combination of the above. See **Table 1** for distinguishing features

Investigations

- FBC, U&E, glucose, LFT, CRP, and bone biochemistry
- Blood glucose
- Thyroid function tests
- Blood cultures
- Urinalysis
- Chest X-ray
- ECG
- Pulse oximetry
- Consider need for: lumbar puncture, blood gases, EEG, B_{12}, folate
- Consider CT scan of head **only** where a brain lesion suspected (fall, head injury, focal neurological signs, evidence of raised intracranial pressure)

Table 1: Clinical features of delirium, dementia and acute functional psychosis

Characteristics	Delirium	Dementia	Acute functional psychosis
Onset	**Sudden**	**Insidious**	**Sudden**
Course over 24 hr	Fluctuating, worse at night	Usually stable	Stable
Consciousness	Reduced	Clear	Clear
Attention	Globally disordered	Usually normal	May be disordered
Orientation	Usually impaired	Variable	May be impaired
Hallucinations	Common	Often absent	Predominantly auditory
Memory	Recent and immediate memory impaired	Recent and remote memory impaired	Variable
Involuntary movements	Often asterixis or coarse tremor	Often absent	Usually absent except for side effects of drugs
Physical illness or drug toxicity (see **Table 2**)	Always present	Often absent	Usually absent

Table 2: Underlying conditions commonly associated with delirium

Infection	Metabolic	Drugs/alcohol	CNS	Miscellaneous
• Chest • Urinary tract	• Hypoxia • Fluid, electrolyte or acid-base disturbances • Hypo- or hyperglycaemia • Uraemia • Endocrinopathies (hepatic failure)	Therapeutic use, abuse of, or withdrawal from: • Alcohol • Hypnotics • Tranquillizers • Sedatives • Antidepressants • Anticholinergics • Anticonvulsants • Antiparkinsonian agents • Oral hypoglycaemics • Digoxin • Cimetidine • NSAIDs	• Post-ictal • Head trauma • Multiple cerebral infarcts • Intracerebral neoplasm • Meningitis	**Sensory overload** • New environment • Constipation • Faecal impaction • Pain • Urinary retention **Sensory deprivation** • Visual impairment • Auditory impairment **Miscellaneous** • Myocardial infarction • Pyrexia • Hypothermia

IMMEDIATE TREATMENT

Delirium

Environment

- Nurse in quiet environment (light in the day, dark at night) and in a side room if possible. Ensure:
  - you ascertain what is worrying the patient. There is often a simple cause which can be addressed
  - appropriate lighting for time of day
  - regular and repeated cues to improve personal orientation (at least 3 times daily)
  - clocks and calendars to improve orientation
  - hearing aids and glasses available and in good working order
  - continuity of care from nursing staff
  - encouragement of mobility
  - patient approached and handled gently
  - elimination of unexpected irritating noise (e.g. pump alarms)
- **Avoid:**
  - physical restraints including, bed rails if at all possible as, in some cases, these have not been shown to prevent falls and can increase risk of injury. It may be preferable to nurse patient on a low bed. If this is not feasible, use a mattress or protective mat on the floor. Nursing staff will carry out a risk assessment to assess whether bed rails should or should not be used
  - inter- and intra-ward transfers

Relatives and friends

- Family and friends, who may be able to calm patient, are encouraged to visit. Ensure nursing staff and family know that patient requires open visiting for his/her own safety (would still apply even if ward is closed due to an infection outbreak)

- Ask family to complete a THIS IS ABOUT ME form (available on Trust intranet> clinicians>medical-and-nursing>nursing-essentials>safeguarding-adultsmcadols>Dementia) to provide background information about the patient
- Explanation of cause of confusion to relatives; encourage them to bring in familiar objects and pictures and to participate in rehabilitation (e.g. to help with feeding and drinking)

Clinical treatment

- Treat or remove underlying causes (e.g. treat infection, stop all non-essential medication, correct hypoglycaemia/hypoxia/hypothermia)
- Correct and/or maintain fluid and electrolyte balance, nutrition and vitamin supply (especially B complex) in patients with alcohol dependence or malnutrition – see **Alcohol withdrawal** guideline
- For alcohol withdrawal delirium – see **Alcohol withdrawal** guideline
- In malnourished patients or those with a history of ethanol abuse, in whom vitamin B deficiency is likely, give Pabrinex ampoules 1 & 2, two pairs as IV infusion 8-hrly for 3 days
- Regular analgesia given when needed (e.g. paracetamol)
- Adequate fluid intake to avoid dehydration
- Good diet, fluid intake, and mobility to avoid constipation
- Good sleep pattern (milky drinks at night, exercise during day)
- **Avoid** catheters and constipation

If patient severely disturbed and a danger to self or others – see recommendations for assessment and non-medical management in* Aggressive and violent patients *guideline

Drug treatment

Do not use anti-psychotic medication (e.g. haloperidol, risperidone, olanzepine) or sedatives for insomnia, restlessness, wandering or disruptive behaviour

- Keep use of sedatives to a minimum
- If absolutely necessary, consider sedation with:
- lorazepam 500 microgram–1 mg (15 microgram/kg) 6-hrly (**maximum of 2 mg in 24 hr**). Give orally (preferably) or by slow IV injection into a large vein. **Only use IM route in the same doses as IV if oral or IV routes are not possible**

or

- haloperidol 0.5–1 mg 8-hrly, reducing to 500 microgram oral/IM 8-hrly to a maximum dose of 3 mg in 24 hr for a maximum duration of 1 week. Do not use haloperidol in patients:
  - with heart disease, dementia or Parkinson's disease
  - known to have a prolonged QT interval or on other drugs that prolong the QT interval. Normal range for QTc interval is up to 440 milliseconds. QTc prolongation defined as >450 milliseconds for men and >470 milliseconds for women
- Use one drug only, starting at lowest possible dose
- **Ensure one-to-one nursing while dose of psychotropic medication is titrated upward** in a controlled and safe manner
- Do not use atypical anti-psychotics (risperidone, olanzapine) in patients with dementia or cerebrovascular disease because of increased risk of stroke
- If extrapyramidal symptoms and pyrexia occur, consider neuroleptic malignant syndrome
- If underlying cause of confusion has been treated, no further anti-psychotic treatment may be necessary
- If maintenance treatment required, consider haloperidol 500 microgram oral daily or 12-hrly. Review all medication at least every 24 hr. Stop after 1 week. No long-term treatment should be required in patients with delirium

SUBSEQUENT MANAGEMENT

Delirium

- **Further investigation:**
- if confusion slow to resolve, consider vitamin B_{12} and folate assays, syphilis and HIV serology, and review diagnosis (**Table 2**)
- **Reconditioning of patient:**
- encourage good food, adequate fluids, bowel regulation, pain control, sufficient sleep, avoidance of sedation and attention to appearance (clothes, shoes, teeth, spectacles, hearing aids, hair and shaving)

- Repeat 6 CIT score to check whether it has reduced following treatment of the condition that induced the delirium
- **Rehabilitation:**
- start early **and be comprehensive** to avoid permanent immobility, pressure sores, infections and thromboembolic disease. Always liaise with physiotherapist, occupational therapist and nursing staff. Where rehabilitation likely to be prolonged, refer to department of geriatric medicine where all the resources of the multidisciplinary team are available

Dementia

- For insomnia, restlessness, wandering or difficult behaviour, avoid medication. Check for sources of pain or discomfort, and treat effectively. Use behavioural techniques to manage patient. If necessary, refer to Mental health liaison team – see below
- If above does not resolve problem, give paracetamol 1 g 8-hrly (max 6-hrly, but reduce dose if weight <50 kg)
- if not effective after 24 hr, review and consider limited trial of stepped-up pain relief
- Review every 24 hr and stop if behaviour no better
- Typical and atypical anti-psychotic medications (haloperidol, olanzepine) are not licensed for use in dementia. Long-term use doubles the risk of death
- Use of risperidone increases the risk of stroke and death, but has a product licence for short-term use in **persistent** aggression in patients with Alzheimer's disease, where behavioural problems cannot be modified using behavioural techniques
- starting dose: 250 microgram 12-hrly, increasing in increments of 250 microgram on alternate days up to a maximum of 500 microgram 12-hrly
- Review medication weekly and stop at earliest opportunity
- Maximum treatment is 6 weeks
- If patient discharged before 6 week course of treatment completed, notify GP or community hospital doctor of stop date so that treatment can be completed if necessary

As risperidone is only indicated for persistent aggression, it must only be prescribed by a consultant geriatrician or psycho-geriatrician. It should never be prescribed by junior staff to treat acute episodes out-of-hours

MONITORING

- If change occurs, repeat assessment of mental status (see **Recognition and assessment)**
- If sedation given, monitor respiratory rate, pulse and blood pressure

DISCHARGE AND FOLLOW-UP

- Many elderly patients will make a full recovery and can be discharged without referral to another agency
- Offer reassurance and support – delirium is very unpleasant and can leave patients with unpleasant half recollections of events and delusions
- Refer to social services if community care package required or full community care assessment needed
- Consider referral to Mental health liaison team (pager 15845) who will provide advice and refer on or discuss with a psycho-geriatrician if necessary
- In patients with **delirium**, stop all sedatives/anti-psychotics within a week or before discharge whatever comes earlier
- Long-term anti-psychotic medication is not indicated for management of difficult behaviour or aggression (unless patient has a psychotic illness such as schizophrenia or mania). Such use is unlicensed and increases mortality in patients with dementia. If treatment with haloperidol or atypical anti-psychotic agents is continued past discharge, patient and their relatives must be informed of the unlicensed use of the drug and risk of death and stroke
- A clear plan for reducing and eventually stopping the drug must be communicated to GP, patient and family
- For patients with **established dementia**, give relatives or carers contact numbers of North Staffordshire Carers' Association (01782 793100 Mon–Thurs: 0800–1700 hr, Fri: 0800–1630 hr), North Staffordshire Alzheimer's Carers' Support Group (01782 541521) and Alzheimer's Society (020 7423 3500) for support and leaflets and 0300 222 1122 for the helpline
- For patients with a 6 CIT >7, but not previously known to have dementia, advise GP in the summary that patient requires review after discharge to confirm or exclude a diagnosis of dementia; if a dementing illness is then suspected, advise GP to refer to a memory clinic; if Mental health liaison team have already referred patient to a memory clinic, notify GP in the discharge summary

HYPOTHERMIA IN OLDER PEOPLE ● 1/3

RECOGNITION AND ASSESSMENT

An older person's ability to recognise and to respond both physiologically and practically to cold may be impaired. Hypothermia (core temperature: mild 35–32°C; moderate 31.9–30°C; severe <29.9°C) usually occurs in the presence of other acute or chronic illness, which can obscure its diagnosis. A high level of suspicion of an underlying illness is required. Although much more common in winter, hypothermia can occur at any time of year

Symptoms and signs

In mild cases, patient may complain of being cold but this is not reliable

- Symptoms of a precipitating condition (see **Causative conditions**)
- Shivering may be present in mild cases but is usually absent in severe cases
- Skin (abdomen, inner thigh, axilla) cold, mottled and feels like marble
- Face may appear puffy and myxoedematous
- Muscle rigidity, absent deep reflexes and extensor plantars may be found
- Depressed respiration
- Bradycardia with underlying sinus rhythm or atrial fibrillation
- Hypotension
- Confusional state (delirium)
- Apathy
- Coma when temperature <32°C

Investigations

- Measure core body temperature with tympanic thermometer

Blood

- FBC, U&E, INR
- Troponin I
- **NB**: venous blood pools and may give erroneous results for the above laboratory measurements
- Blood glucose (may be high but falls during rewarming – see **Monitoring**)
- Thyroid function tests
- Blood culture – see **Collection of blood culture specimens** guideline
- Arterial blood gases – remember to enter core temperature into analyser

Other

- Urinalysis
- ECG (may show characteristic J wave on the down stroke of the R wave, best seen in leads II and V6, or QT_c prolongation)
- Chest X-ray (looking for pneumonia, aspiration, pulmonary oedema)

Consider associated/causative conditions

- Hypothyroidism
- Hypopituitarism
- Hypoadrenalism
- Stroke
- Epilepsy
- Parkinson's disease
- Fractures
- Drug overdose
- Dementia
- Pneumonia
- Myocardial infarction
- Over-sedation
- Drug-induced (alcohol, barbiturates, phenothiazines, lithium, tricyclics, opioids)
- Heart failure
- Head injury

IMMEDIATE TREATMENT

Supportive treatment

- Special mattress (to prevent pressure sores)
- If hypoxaemic, give controlled oxygen therapy – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- If pneumonia suspected – see **Community-acquired pneumonia** guideline

Warming

- Nurse at room temperature of 25–30°C
- Warm with blankets (remember to cover head and neck); if available, use Bair Hugger™ (forced air re-warming) blanket

Critical care unit (CCU)

- Transfer to CCU may not be appropriate for some older people with hypothermia unless there are other clinical indications for this, as outcome may not be affected

SUBSEQUENT MANAGEMENT

- Most patients will improve spontaneously without further active treatment
- Avoid unnecessary interventions and movement (these can precipitate cardiac arrhythmia)
- Identify and treat other predisposing factors

Prognosis poor if patient fails to warm. High risk of death if temperature <30°C

- If re-warming fails in moderate-severe hypothermia (<32°C), consultant to consider use of warm IV fluids – IV fluid warmer in A&E, or given via a heated infusion pump. **Never warm IV fluids in microwave.** Observe temperature, pulse, BP every 15 min and with continuous cardiac monitoring

Hypothermia protects against cerebral hypoxia so continue cardiac arrest procedures for longer than usual, if necessary until core temperature reaches 37°C

Multidisciplinary team assessment

- Once re-warming started in A&E, ensure patient admitted straight to an elderly care bed for assessment by full multidisciplinary team

MONITORING TREATMENT

Hourly (if patient requires active re-warming, every 15 min)

- Core temperature with tympanic thermometer. Aim to raise by 0.5–1°C/hr, for mild hypothermia
- For moderate to severe hypothermia aim to re-warm at 1°C/hr
- pyrexia after re-warming does not necessarily indicate infection
- If temperature rises by >1°C/hr, cool by removing blankets to maintain peripheral vasoconstriction
- Heart rate and rhythm (continuous cardiac monitoring)
- bradycardia and AV block can occur and may require temporary pacing
- ventricular ectopics are suppressed by cold and may appear during warming
- BP
- Respiration
- Glucose
- treat hypoglycaemia with glucose infusion – see **Acute hypoglycaemia** guideline
- do not treat hyperglycaemia with insulin unless blood glucose persistently >30 mmol/L – insulin is ineffective in the hypothermic state and should not be used unless re-warming is very slow

2-hrly

- pH (until core temperature >35°C)
- If hypoxaemic or acidotic, $PaCO_2$

COMPLICATIONS

- Paralytic ileus
- Gastric dilatation
- Respiratory failure
- Cardiovascular collapse
- Oliguria
- Gastric ulceration
- Pancreatitis
- Aspiration pneumonia

DISCHARGE AND FOLLOW-UP

- Assess cognitive state immediately before discharge by doing a 6 CIT score – if cognitive impairment is noted, consider referral to mental health liaison team while patient still in hospital or advise GP in the discharge summary to refer to memory clinic
- If patient lives alone, ensure they can summon help by telephone or Care Line
- Ensure home is adequately heated. Beat the Cold, a local voluntary agency who may be able to help with replacement heating etc. can be contacted on 01782 683813/08003892258
- Ensure patient and family are aware of risks of hypothermia

MANAGEMENT OF CONSTIPATION IN HOSPITALISED ELDERLY PATIENTS ● 1/3

RECOGNITION AND ASSESSMENT

- Enquire about usual bowel habit
- If patient from nursing/residential home and unable to provide information, ensure detailed information is obtained by requesting the Home-to-Hospital form (4 page document)
- Enquire about laxatives prescribed by GP or bought over the counter
- Enquire about adverse effects from laxatives in the past

Risk factors

- Constipation likely in patients who are:
  - immobile/less mobile than usual
  - drinking less fluid than usual
  - eating less cereal, fruit and vegetables than usual
  - taking prescribed codeine and/or iron or post-operatively (e.g. orthopaedic patients)
- Patients taking opioid analgesics should have laxatives prescribed routinely

IMMEDIATE MANAGEMENT

Routine nursing care

- Complete bowels section on nursing sheets daily
- Encourage fluids (≥1 L/day)
- If patient usually takes prescribed laxatives, ensure these are prescribed in hospital

Toileting

- Ensure toileting facilities provided safeguard privacy and dignity
- Transfer to toilet, if possible
- Avoid commode
- Prevent inhibition
- Ensure privacy
- Control noise (try to locate toilets in quieter part of ward)
- Ensure patient can easily summon help
  - make bell or button accessible and respond promptly
- Control odours (use air freshener if necessary)

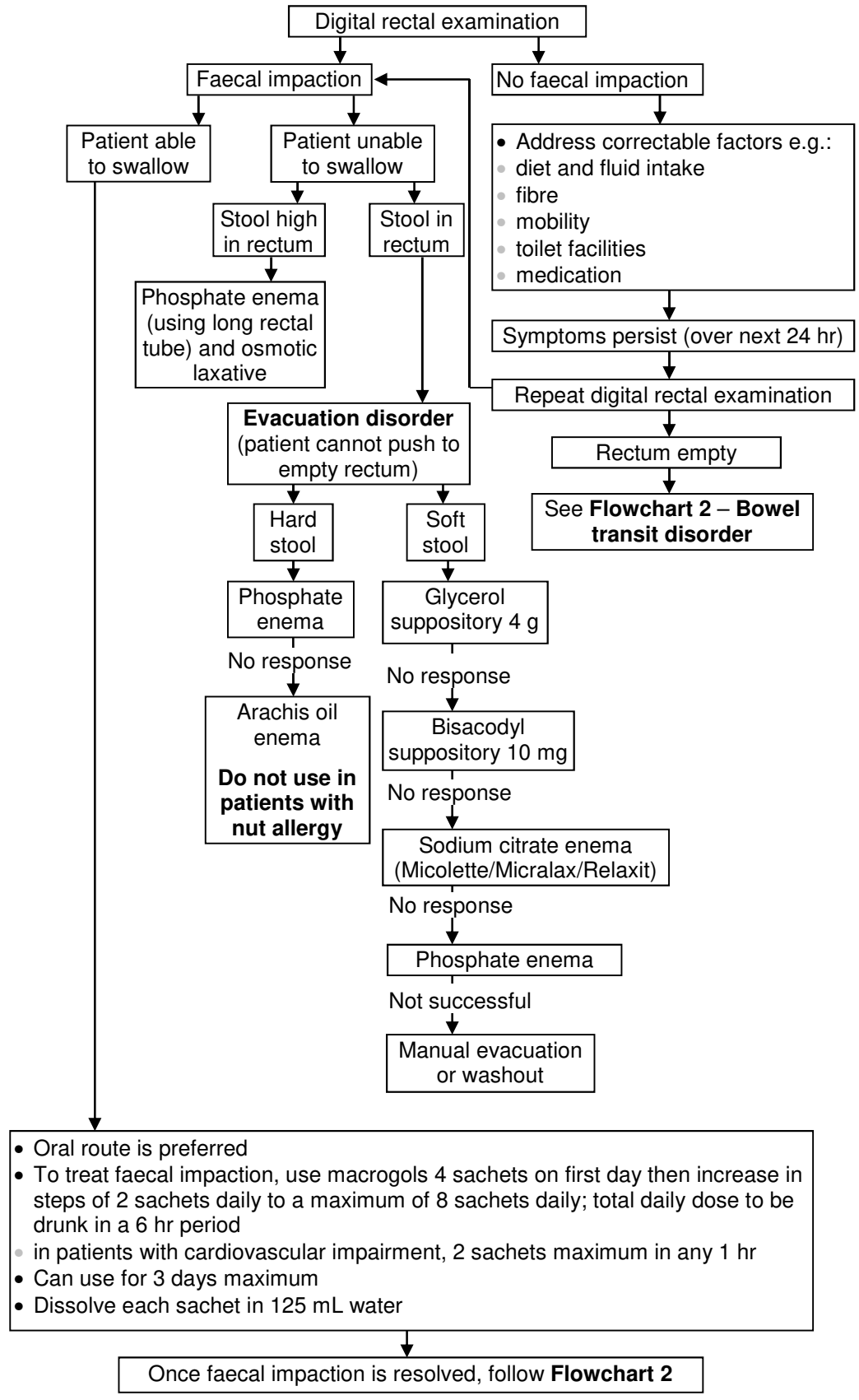
Bowels not open (BNO)

- If bowels not opened for >3 days, perform digital rectal examination to determine whether faecal impaction present. Document findings, then follow **Flowchart 1,** which provides guidance for all patients initially

Before prescribing laxatives, carry out digital rectal examination in all patients and document findings. Take care when using laxatives of any kind in patients with suspected intestinal obstruction (ask for senior advice in these patients)
If haemorrhoids or anal fissure, avoid rectal preparations. In patients with inflammatory bowel disease, colitis or Crohn's disease, avoid macrogols

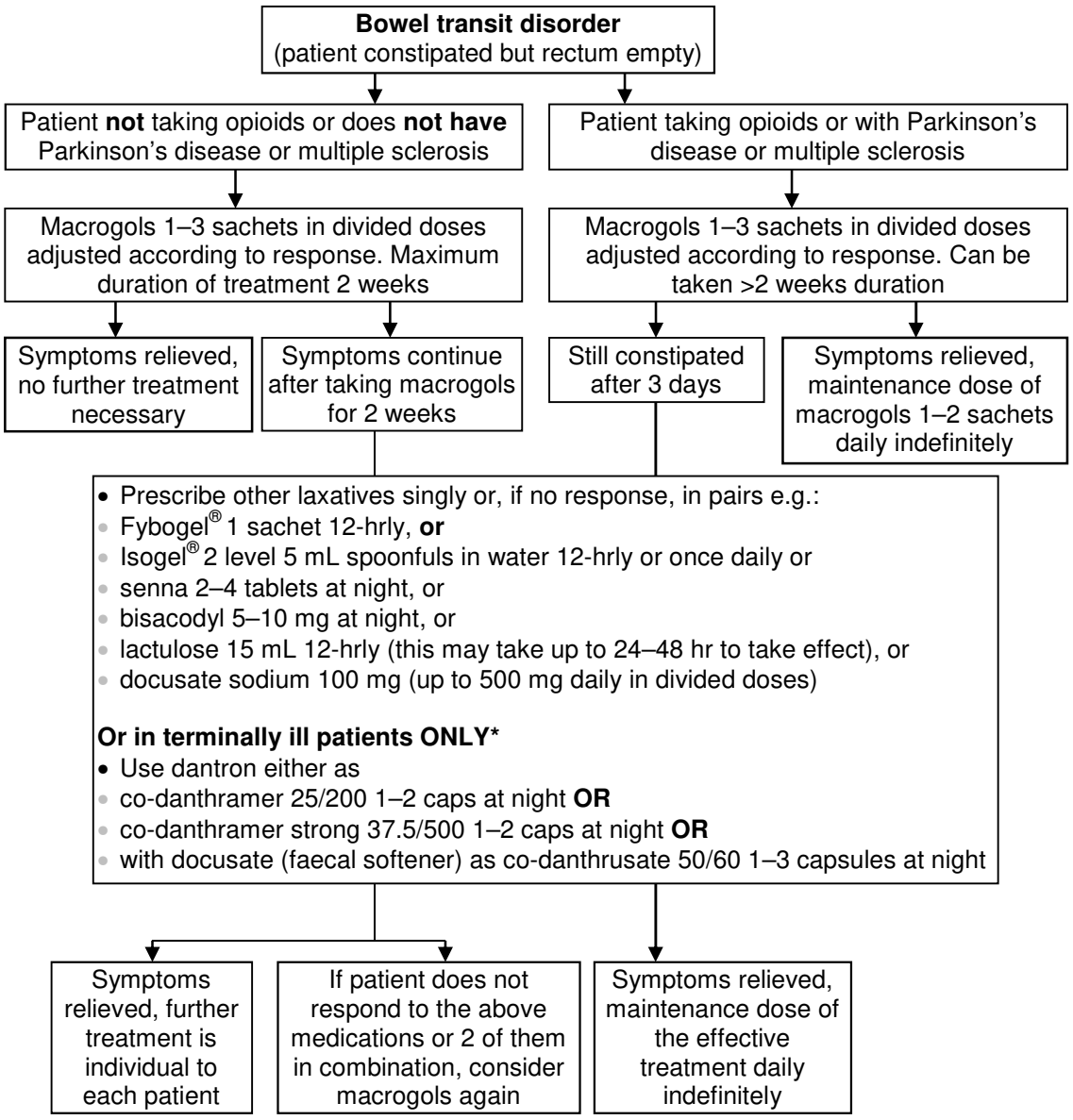
MANAGEMENT OF CONSTIPATION IN HOSPITALISED ELDERLY PATIENTS ● 2/3

Flowchart 1: Bowels not opened for 3 days



MANAGEMENT OF CONSTIPATION IN HOSPITALISED ELDERLY PATIENTS ● 3/3

Flowchart 2: Bowel transit disorder



***To be used only in a palliative care setting**

For patients with severe opioid-induced constipation, consider naloxegol 25 mg daily orally as it may be more effective than repeating macrogols; can only be prescribed on advice from the palliative care team

MANAGEMENT OF FALLS IN A&E AND WARDS ● 1/3

RECOGNITION AND ASSESSMENT

- Falls are common in the elderly and may be the presenting symptom of an acute illness
- Causes are generally multifactorial with a considerable overlap between falls and syncope
- It is difficult to rule out syncope because patient may have no memory of the event and there may be no eye witness accounts – see **Transient loss of consciousness (blackout/syncope)** guideline

Risk factors

- Gait and balance impairment
- Reduced muscle strength
- Reduced visual acuity
- Cognitive impairment
- Drugs – polypharmacy, sedatives/hypnotics, antidepressants, neuroleptics, diuretics, class 1 anti-arrhythmics, alcohol, anti-cholinergics
- falls are more likely to occur in patients taking any of these agents alone, in combination, or because of interactions with other drugs
- Predisposing conditions – Alzheimer's disease, stroke, Parkinsonism, peripheral neuropathy, arthropathy, depression, visual impairment, cardiac failure
- Environmental hazards – poor lighting, loose carpets, lack of safety equipment, poorly fitting shoes or clothes

History

Circumstances of fall

- Obtain an eye witness account if possible
- Ask for information that may suggest:
- syncope
- vertigo
- dizziness
- unsteadiness
- seizures

Consequences of the fall

- Time spent on floor
- Injuries sustained

Document any risk factors

- Medications that can precipitate postural hypotension (see **Risk factors** above)
- History of falls, including previous fractures
- Impaired mobility
- Fear of falling
- Poor vision
- Incontinent of urine
- Confirmed dementia

Social history

- Carer support
- ? Lives alone
- Environmental hazards

Examination

Cardiovascular

- Check for postural drop (after standing for 3 min) of 20 mmHg in systolic BP or 10 mmHg in diastolic BP. If drop confirmed, review diuretic therapy, antihypertensive medications and major tranquillizers
- Presence of arrhythmias
- Structural heart disease
- Heart failure

Neurological

- Evidence of head injury
- Glasgow Coma Score
- Vision
- Muscle strength
- Tone
- Lower extremity peripheral nerves

- Proprioception
- Extrapyramidal and cerebellar function

Cognitive assessment

- **Six item cognitive impairment test (6 CIT) –** see **Delirium (acute confusional state) in older people** guideline

Locomotor

- Evidence of hip fracture or other bony injury
- Presence of muscle wasting
- Leg ulcers
- Deformities

INVESTIGATIONS

- FBC, U&E
- ECG
- Urinalysis
- Imaging – to identify injuries or acute illness

RISK ASSESSMENT

- In A&E nursing staff will complete Adults Falls Risk assessment

IMMEDIATE TREATMENT (IN A&E)

- Treat injuries

Acute medical problems

- Commence treatment and refer to appropriate medical team (e.g. cardiology for acute MI or stroke team for new stroke)
- If patient meets North Midlands Frailty criteria for frail elderly and requires admission, request elderly care bed

North Midlands Frailty criteria
• Aged >65 yr and 1 of the following: ◦ confusion/dementia/delirium ◦ residential home/nursing home resident ◦ falls with low trauma fracture, not requiring surgery ◦ Parkinson's disease ◦ more than 3 falls in 3 months
• Aged >85 yr with an illness that is not better served by a single organ specialism

- If syncope suspected, see **Transient loss of consciousness (blackout/syncope)** guideline
- If no acute medical problem and patient not independently ambulant, refer to physiotherapy. Consider referral to intermediate care team for supervision at home or, if necessary, in an intermediate care bed
- For A&E patients being discharged home who are at **high** risk of falls, if there is a YES answer to any of the 4 falls risk screening questions, explain this in the A&E summary letter
- If medical team feel further outpatient investigation or attendance at a Falls programme required, refer patient to SSOTP Falls service based at Longton health centre, Drayton Road, Longton If medical team feel further outpatient investigation or attendance at a Falls programme required, refer patient to SSOTP Falls service based at Longton Health Centre, (telephone: 0300 123 0995 extension 4422/4277, fax: 01782 828570)
  - complete a falls service referral form available on Trust intranet>Elderly care>Falls section and fax to number above
  - include relevant medical history
  - reason for referral and information about recent falls and falls-related injuries
  - details of known contributing factors (medical history etc.)

SUBSEQUENT MANAGEMENT AFTER ADMISSION

- Ward nursing staff to complete Adults Falls Risk Assessment in Proud to Care booklet, for all patients. They then proceed to determine a falls prevention care plan; this includes a list of interventions
- Item 6 on this list includes a medication review, which needs to be completed by medical or pharmacy staff; doctors to review treatment and assess if any drugs should be stopped or reduced e.g. antidepressants, night sedation, antipsychotics, and antihypertensives

Investigations

Cardiovascular

- If aortic stenosis or hypertrophic obstructive cardiomyopathy (HOCM) suspected, echocardiogram
- 24 hr tape if:
  - bradycardia
  - first degree atrioventricular block
  - right bundle branch block (RBBB) and left axis deviation
  - second or third degree atrioventricular block
  - recurrent episode of loss of consciousness, with no features of epilepsy
- If inpatient echo and 24 hr tape have been requested, it is the responsibility of the doctor who ordered the test to forward the results to the GP, when they become available, even if this is after discharge
  - if abnormalities on 24 hr tape, cardiology referral may be needed
- If an EEG has been done and is suggestive of epilepsy, refer to First seizure clinic (see **First seizure** guideline)

Osteoporosis assessment

- History of fragility fractures or frequent falls:
  - bone biochemistry
  - TFT
  - if serum corrected calcium low or high, plasma parathyroid hormone (PTH)
  - if osteomalacia suspected, check serum vitamin D_3
- Women ≥75 yr and men of any age with suspected osteoporosis but no history of fragility fracture:
  - DEXA (bone density) scan

Perform full multifactorial assessment

Drugs

- Use RCP guidance re medications that may cause falls – available on Trust intranet>elderly care>falls
- Polypharmacy, especially if patient taking one or more of the following:
  - cardiovascular drugs
  - insulin or oral hypoglycaemic agents
  - hypnotics
  - psychotropic drugs
- Alcohol can increase risk of falls in elderly patients

Environment

- Refer to occupational therapy

Neurovascular problems

- Gait and balance – refer to physiotherapy

Living arrangements

- Social work referral

Specialist referral

- Depending on clinical findings, refer to appropriate specialist

Recurrent falls

- Unless patient has moderate-severe dementia, refer to Falls service

When a patient falls in hospital

- Complete a post falls proforma to document that the patient has had an appropriate review after the fall. Copies are available on all wards
  - ward nurse to complete top section of form
  - bottom section requires completion by a doctor or advanced nurse practitioner to ensure all interventions required have taken place

TRANSIENT LOSS OF CONSCIOUSNESS (BLACKOUT/SYNCOPE) ● 1/3

RECOGNITION AND ASSESSMENT

Definition

- Transient self-limiting loss of consciousness
- Usually of rapid onset and with spontaneous, complete and prompt recovery
- Underlying pathology is global hypoperfusion
- May be preceded by a feeling of faintness, light-headedness or muscular weakness (presyncope); evaluate presyncope in the same way as true syncope

Aim of assessment

- Majority of patients will have made a full recovery at point of assessment with low risk of serious adverse outcomes. Aim to identify the small proportion with a significant underlying cause at risk of serious outcome

Principal causes

Reflex (neurally mediated) syncope

- Vasovagal (simple faint) – suggested by the presence of **3 P's** (provocation, prodromal and positional elements)
- Situational: micturition, cough, defecation, pain, swallowing
- Carotid sinus syndrome

Syncope resulting from orthostatic hypotension (>20 mmHg fall in systolic BP after 3 min standing)

- Autonomic failure
- Drug-induced
- Volume depletion (e.g. haemorrhage, diarrhoea, vomiting)

Cardiac syncope

- Arrhythmias: bradycardia, tachycardia, implanted device failure
- Structural cardiac or cardiopulmonary disease (e.g. valvular heart disease, LV systolic dysfunction, LV outflow obstruction, cardiac tamponade, pulmonary embolism)
- Syncope during (rather than after) exercise

Differential diagnosis

Disorders with impairment or loss of consciousness

- Epilepsy
- Metabolic (hypoglycaemia, hypoxia, hyperventilation with hypocarbia)
- Intoxication
- TIAs of vertebrobasilar origin. See **Transient ischaemic attack** guideline

Disorders resembling syncope without loss of consciousness

- Falls: See **Management of falls in A&E and wards** guideline
- Cataplexy
- Functional: pseudosyncope, somatisation disorders
- TIAs of carotid origin. See **Transient ischaemic attack** guideline

History

Circumstances

- Before episode (position, activity, predisposing factors or precipitating events)
- Symptoms at onset of episode (nausea, aura, visual, feeling warm/hot, cardiac symptoms)
- Details of episode (eye-witness account, collateral history from paramedics): skin colour, duration of loss of consciousness, breathing pattern, movements, tongue biting, etc
- End of episode: confusion, muscle aches, skin colour, injury, incontinence

Brief non-specific symptoms/signs (e.g. nausea, and diaphoresis) and brief myoclonic jerking are common in syncope
Syncope may present as true seizure, owing to cerebral hypoperfusion

Risk factors

- Previous presyncopal or syncopal episodes
- Previous cardiac and medical history, family history (e.g. sudden cardiac death, epilepsy)
- Medication
- Occupation and driving status

Physical examination

- Clinical assessment to identify serious underlying conditions (e.g. abdominal aortic aneurysm, gastrointestinal bleed)
- Vital signs at rest
- Evidence of orthostatic hypotension (lying and standing BP)
- Evidence of injury

MANAGEMENT IN A&E

Screening investigations

- 12-lead ECG
- If patient has an implanted cardiac monitor ('Reveal' device) *in situ*, request interrogation of the device before discharge
- Blood tests useful only if clinically indicated (e.g. haemoglobin for suspected haemorrhage)
- Blood glucose
- Pregnancy test in women of childbearing age (consider ectopic pregnancy)

'Red flag' signs or symptoms

'Red flag' signs or symptoms indicate patient may be at high risk of a serious adverse event and should have an urgent specialist assessment within 24 hr

- Signs or symptoms include:
- an electrocardiogram (ECG) abnormality: e.g. evidence of ischaemia (pathological Qs, ST or T wave abnormal), conduction defects [LBBB, RBBB, WPW, Brugada, any heart block, sinus pause >3 sec, prolonged QT interval (abnormal: males >450 milliseconds, females >470 milliseconds)], marked bradycardia if not on beta-blockers
- heart failure (history or physical signs)
- transient loss of consciousness during exertion
- family history of sudden cardiac death in people aged <40 yr and/or an inherited cardiac condition
- new or unexplained breathlessness or persistently abnormal vital signs (e.g. hypotension, hypoxia)
- a heart murmur

DISCHARGE AND FOLLOW-UP

- Advise patient to:
- avoid precipitating situations
- maintain hydration
- avoid becoming overheated
- take avoiding action if warning symptoms occur
- Adjust cardiovascular medication, especially in elderly patients experiencing giddy spells with postural change and occasional syncope. Discuss with senior clinician and ensure patient and GP receive written instructions of any adjustments
- **Health and Safety:** Advise all patents of the implications of their episode for health and safety at work and any actions they must take to ensure safety
- If underlying cause identified, discharge as indicated in **Table** below
- If patient not admitted, refer to appropriate clinic or back to GP (enclose copies of ECGs)
- **Provide patient with advice on driving restrictions as per DVLA guidelines** – see **www.gov.uk/guidance/neurological-disorders-assessing-fitness-to-drive** for current guidance

TRANSIENT LOSS OF CONSCIOUSNESS (BLACKOUT/SYNCOPE) ● 3/3

Identified cause	Discharge and follow-up
Simple faint (vasovagal episode) Definite **P**rovocational factors with associated **P**rodromal symptoms unlikely to occur whilst sitting or lying (**P**osition). Benign in nature	If social circumstances favourable, discharge
Loss of consciousness/loss or altered awareness likely to be unexplained syncope **Low risk of recurrence:** No relevant abnormality on CVS and neurological examination and normal ECG **High risk of recurrence:** • Abnormal ECG • Clinical evidence of structural heart disease, sudden syncope occurring whilst driving, sitting, lying, on exertion or resulting in injury >1 episode in previous 6 months • Family history of sudden cardiac death in people aged <40 yr and/or inherited cardiac condition	• If social circumstances favourable, discharge • If events frequent and patient sustained injuries, consider referral to falls clinic or programme: • Refer to MPFT Falls service based at Longton Health Centre (telephone: 0300 123 0995 extension 4422; 0800–1600 hr) giving: ◦ relevant medical history ◦ reason for referral and information about recent falls and falls-related injuries ◦ details of known contributing factors • If high risk clinical features present, admit • If patient meets frail elderly criteria, request elderly care bed • If cardiac cause suspected, discuss with cardiologist/CAN team
Unwitnessed (presumed) loss of consciousness/loss or altered awareness with seizure markers: • Strong clinical suspicion of epilepsy but no definite evidence (see **First seizure** guideline)	• Refer to first seizure clinic (complete referral form and arrange imaging as indicated) and, if social circumstances favourable, discharge

PAIN CONTROL IN PALLIATIVE CARE ● 1/3

PAIN

- Pain is common in patients with life-limiting illness
- Physical, psychological, social and spiritual factors can influence the experience of pain
- Pain can be well controlled in the majority of patients

Types of pain

- Visceral/soft tissue pain
  - likely to be opioid sensitive
- Bone pain
  - often partially opioid sensitive
  - may respond to NSAIDs, radiotherapy and bisphosphonates
- Nerve pain
  - partially opioid sensitive
  - may respond well to adjuvant analgesics

Pain assessment

- Take a pain history using SOCRATES
  - S – Site
  - O – Onset
  - C – Character
  - R – Radiation
  - A – Associated symptoms
  - T – Timing
  - E – Exacerbating and relieving factors
  - S – Severity
- Use a pain scale
  - 0–10
  - visual analogue scale
- Analgesic history
  - current analgesia
  - previously tried analgesia
  - effectiveness of treatment
  - side effects of treatment

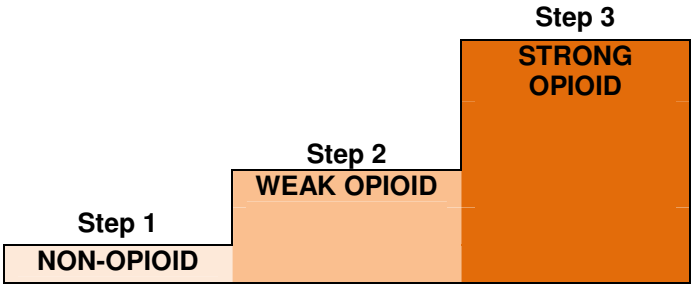
PAIN MANAGEMENT

Principles

- Identify and treat cause of pain if possible
- Select treatment appropriate for the pain and patient's needs
- Keep it simple and use oral medication whenever possible

Pain relief should be by the mouth (oral), by the clock (regular) and by the ladder

WHO analgesic ladder



Adjuvant analgesics (e.g. NSAID/anticonvulsant/antidepressant/antispasmodic) can be added with any step. See West Midlands guidelines for the use of drugs in symptom control www.wmcares.org.uk/wmpcp/guide

PAIN CONTROL IN PALLIATIVE CARE ● 2/3

STEP 1 – NON-OPIOID

Paracetamol

- Analgesic and antipyretic
- Dose: 500 mg–1 g 4–6 hrly (maximum dose 4 g in 24 hr)

Non-steroidal anti-inflammatories – NSAIDs

- Anti-inflammatory, anti-pyretic and analgesic
- 1st line NSAID – ibuprofen
- 1.2–2.4 g daily in 3–4 divided doses

Caution

- See BNF for cautions and contraindications before starting NSAID
- History of gastroduodenal ulceration – prescribe gastroprotective drug (e.g. PPI)
- Concomitant corticosteroids or anticoagulant – prescribe gastroprotective drug (e.g. PPI)

STEP 2 – WEAK OPIOID

- Useful for moderate pain
- Seldom useful to change from one preparation to another
- If regular doses do not provide adequate analgesia, move up ladder to **Step 3**
- Prescribe regular laxative to prevent constipation

Drugs

- Codeine 30–60 mg 4-hrly (maximum dose 240 mg in 24 hr)
- Co-codamol available as:
- 8/500 (codeine 8 mg with paracetamol 500 mg)
- 30/500 (codeine 30 mg with paracetamol 500 mg)
- Dose: 2 tablets 4–6 hrly (maximum 8 in 24 hr)

STEP 3 – STRONG OPIOID

- If regular weak opioid not controlling pain, initiate modified release morphine (e.g. Zomorph®, MST®) usual starting dose 10–15 mg oral 12-hrly. Remember 60 mg codeine 6-hrly is equivalent to 24 mg oral morphine in 24 hr
- Also prescribe as required immediate release morphine (e.g. morphine sulphate solution) for breakthrough pain. Prescribe one-sixth of the total daily dose of regular morphine (2.5–5 mg)

Communication

- It is common for patients to have concerns and misconceptions about starting strong opioids. Ask about and discuss any concerns
- Provide verbal and written information on the use of strong opioids, how to take them, side effects, safe storage, how pain will be reviewed and who to contact if any problems
- Give patient leaflet 'Taking strong opioids to treat pain in advanced, progressive disease' (Trust intranet>Clinicians>Support services>Palliative care>Leaflets)
- If patient wishes to continue to drive, give verbal and written advice on the law on driving when taking opioid medications
- Give patient leaflet 'New law on driving having taken certain drugs' (Trust intranet>Clinicians>Support services>Palliative care>Leaflets)
- Prescribe regular laxative to prevent constipation

Review and titration

- Nursing assessment of pain at least 4-hrly (e.g. drug rounds, observations)
- Medical review of pain control 24–48 hr after starting regular strong opioids
- if patient still experiencing pain and pain is opioid sensitive, consider increasing regular dose. Add up total amount of morphine given in last 24 hr including modified release and immediate release morphine. Divide by 2 and prescribe 12-hrly (rounded to the nearest 5 mg)
- ensure dose of as-required immediate release morphine is adjusted when the dose of modified release morphine changed. It should be one sixth of the total daily dose of regular morphine – see **Example** below

Example:
Patient started taking **modified release morphine 15 mg 12-hrly** 2 days ago
Over last 24 hr, patient has required **6** extra doses of morphine sulphate solution **5 mg** for breakthrough pain
Total morphine dose in 24 hr **= 30 mg** (15 mg + 15 mg) modified release morphine + **30 mg** (6 x 5 mg) morphine sulphate solution **= 60 mg**

New dose of modified release morphine is **60 mg** divided by **2 = 30 mg 12-hrly**
New dose of morphine sulphate solution is **60 mg** divided by **6 = 10 mg as required**

Side effects

- Constipation can occur with all opioids
- prescribe regular laxatives when prescribing regular strong opioids
- it may be necessary to increase the dose of laxatives as the dose of morphine increases
- Nausea may occur when strong opioids started or dose increased but this is likely to be transient
- if nausea develops, use regular haloperidol 1.5 mg oral or SC at night
- consider stopping after 5 days
- Drowsiness or impaired concentration may occur when strong opioids started or at dose increase. If persistent or severe:
- if pain controlled, reduce dose
- if pain not controlled, consider switching to alternative opioid (see **Alternative opioids** below)
- if side effects persist or considering alternative opioids, refer to hospital palliative care team

Alternative opioids

- May be used to improve side effect profile
- Oxycodone is the preferred second line opioid
- **Do not use** fentanyl patches to manage **uncontrolled** pain due to long half-life
- Relative potency tables for converting to a different opioid are available on Trust intranet>Clinicians>Support services>Pharmacy>NS&SoT approved guidelines and documents>Approved prescribing guidelines

If considering alternative opioid preparations, seek advice from hospital palliative care team (74029) 7 days a week 0900–1700 hr or out-of-hours from Douglas Macmillan Hospice (01782 344300)

Opioids by continuous subcutaneous infusion

- See **Continuous subcutaneous infusion (CSCI) in palliative care** guideline

Opioids via continuous subcutaneous infusion will not provide better analgesia than oral route unless there is a problem with absorption or administration

CONTINUOUS SUBCUTANEOUS INFUSIONS (CSCI) IN PALLIATIVE CARE ● 1/2

DESCRIPTION

The administration of medication by continuous infusion into the subcutaneous tissue via a pump, commonly used in palliative care to achieve symptom control

WHEN TO USE

- Use oral route as long as practical and effective
- Consider CSCI in palliative patients who require regular medication to control symptoms but are unable to take or absorb oral medications because they:
  - are semi-conscious, unconscious or fatigued
  - are vomiting or nauseated
  - have dysphagia
  - have abdominal pathology likely to reduce absorption e.g. bowel perforation or obstruction
  - are in last hours or days of life when it is anticipated patient will deteriorate and be unable to take oral medications

WHAT TO USE

Drugs commonly administered by CSCI

Analgesics	Anti-emetics	Anxiolytics	Antisecretory
Morphine	Metoclopramide	Midazolam	Hyoscine butylbromide
Oxycodone	Cyclizine		
Alfentanil	Haloperidol		Hyoscine hydrobromide
	Levomepromazine		

Drugs NOT suitable for CSCI

- Diazepam
- Antimicrobials
- Chlorpromazine
- Prochlorperazine

Guidance

- For detailed guidance on which drugs can be given by CSCI and which drugs can be combined in a single infusion – see BNF section on prescribing in palliative care or
  - contact medicines information (74537/74358 0900–1700 hr)
  - contact hospital palliative care team (74029 0900–1700 hr)
  - Douglas Macmillan Hospice (01782 344300 after 1700 hr)

Starting and converting opioids to CSCI

- **Remember** – equivalent SC doses may differ from the oral dose for opioid analgesics. If needed see BNF section on palliative care or, seek advice on converting to SC from:
  - medicines information (74537/74358 0900–1700 hr)
  - hospital palliative care team (74029 0900–1700 hr)
  - Douglas Macmillan Hospice (01782 344300 after 1700 hr)

Patients who are not currently on opioids

- Patients who have not previously been on opioids (e.g. opioid naïve), a suitable starting dose would be morphine 5–10 mg over 24 hr

Patients already on regular opioids

- See **Opioid equivalence tables** on Trust intranet>Clinicians>Support services>Pharmacy >NS&SoT approved guidelines and documents>Approved prescribing guidelines
- When converting from oral morphine to subcutaneous morphine a 2:1 ratio is a useful guide e.g. 2 mg oral morphine = 1 mg subcutaneous morphine – see **Example 1**

Example 1: Patient on modified release morphine (e.g. Zomorph®) 15 mg 12-hrly, total daily dose = 30 mg
Subcutaneous morphine dose = 30 ÷ 2 = 15 mg/24 hr

Always add up total of the regular and breakthrough doses of morphine over a 24 hr period – see Example 2

Example 2: Patient on modified release morphine (e.g. Zomorph®) 30 mg 12-hrly and has had 3 x 10 mg breakthrough doses of morphine sulphate solution in last 24 hr
Total daily dose = 90 mg
Subcutaneous morphine dose = 90 ÷ 2 = 45 mg/24 hr

CONTINUOUS SUBCUTANEOUS INFUSIONS (CSCI) IN PALLIATIVE CARE ● 2/2

Patients already on fentanyl patch

- If patient already on fentanyl patch and requiring CSCI:
- if pain controlled, continue fentanyl patch to maintain pain control
- if pain not controlled, refer to hospital palliative care team for advice and **do not discontinue** patch

HOW TO USE

Types of pump/driver

Pump/driver	Description	Use	Training
McKinley T34 syringe pump	Battery powered, portable	CSCI	Book training via intranet
Alaris GS or GH syringe pump	Mains electricity powered, non-portable	CSCI	Book training via intranet

Prescribing CSCI on infusion recording sheet

Specify	Pump type	Example
List of drugs to be added and doses	All	Morphine 10 mg and metoclopramide 30 mg
Diluent – unless instructed otherwise by hospital palliative care team, use water for injection	All	Made up with water for injection
Volume to be made up to, rate of administration and pump to be used	McKinley T34 Alaris	Make up to 17 mL and infuse over 24 hr Make up to 24 mL and infuse at 1 mL/hr or Make up to 48 mL and infuse at 2 mL/hr
Route	All	SC

Setting up CSCI and troubleshooting

- Guidance on setting up, monitoring and discharging patients with McKinley T34 pump available on Trust intranet>Clinicians>Support services>Palliative care>McKinley T34 pump

Checking

- Monitor and check CSCI, line and site as a minimum 4-hrly

DISCHARGING AND TRANSFERRING PATIENTS ON CSCI

- Continue infusion during transfer
- Replenish pump before transfer
- Staff nurse responsible completes “Checklist for discharging a patient with a McKinley T34 Syringe Pump”
- a copy should be sent with the patient, a copy retained in the notes and a copy emailed to clin.tech@uhnm.nhs.uk
- Contact receiving nurse
- discharging home – district nurse
- discharging to nursing home, hospice or community hospital – nurse on duty
- ensure the name of person spoken to is documented on the form
- The receiving nurse should be instructed to:
- change to a community pump on 1st visit (within 24 hr of discharge)
- complete bottom section of “Checklist for discharging a patient with a McKinley T34 Syringe Pump” and contact clinical technology to arrange collection of the T34 syringe pump
- If patient going home, ensure CSCI prescribed on district nurse authorisation document
- Ensure adequate supply of medication to replenish pump sent home with patient especially before a weekend or bank holiday
- When booking transport, inform transport co-ordinator McKinley T34 pump is in use
- If patient being transferred to a location outside North Staffordshire or Stoke-on-Trent, remove lock box (receiving nurse may not have a key) and press-and-hold ‘info’ button on keypad to lock it
- Discharge letter should inform GP that patient is on a CSCI and specify name and dose of all medications in the infusion

END OF LIFE CARE ● 1/2

INTRODUCTION

- All patients have a right to high quality end of life (EOL) care, regardless of diagnosis
- Early identification of patients who are approaching EOL enables planning of appropriate care and treatment
- 'End of life' is recognised as last year of life (DH 2008) and is not confined to terminal phase

TRIGGERS FOR IDENTIFICATION OF END OF LIFE PATIENTS

- The surprise question – 'Would you be surprised if the patient died in the next 6–12 months'? If the answer is no, follow the recommended actions
- 'Proactive identification guidance' – see specific indicators of end stage disease on Trust intranet>Clinicians>Support services>Palliative care>Useful resources
- Aim of treatment is palliative

Definitions

Gold standards framework (GSF)

- Primary care led approach to support EOL care in the community
- Every GP practice has a GSF register of EOL patients, enabling community teams to identify, monitor and plan care for patients and carers

DS1500

- Short medical report completed for patients whose life expectancy is ≤6 months, to support a claim for rapid access to attendance allowance or disability living allowance. More details on 'DS1500 completion' available from Trust intranet>Clinicians>Support services>Palliative care>useful resources

Advanced care planning (ACP)

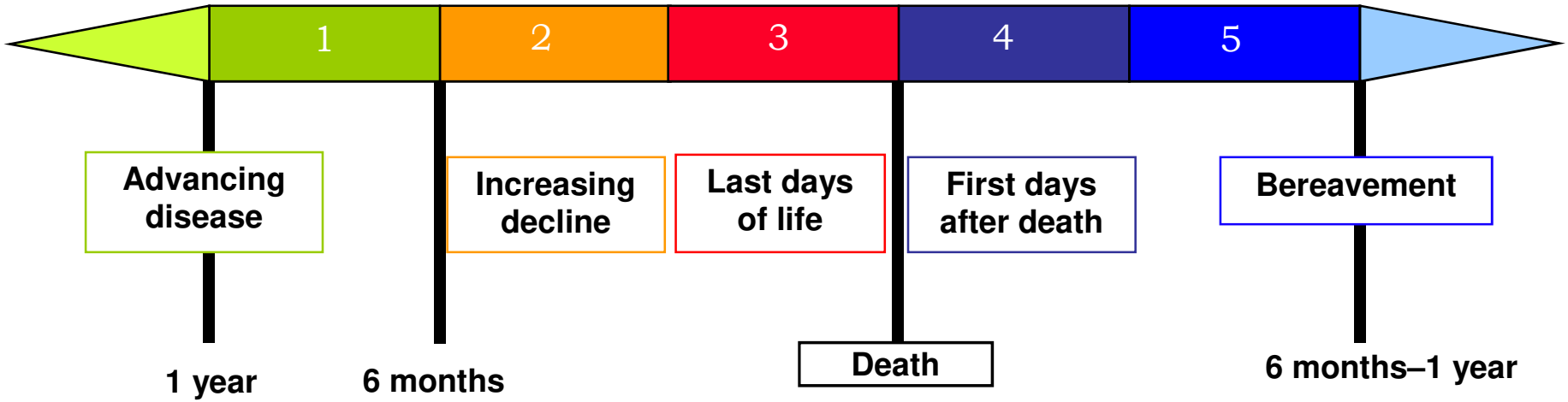
- Discussion process between patient and healthcare professional to ascertain patient's wishes in anticipation of future deterioration in condition
- Document and review discussions regularly and communicate with key staff involved in patient care
- See tools to document ACP discussions on Trust intranet>Clinicians>Support services>Palliative care>Advance care planning

Community specialist palliative care

- Holistic assessment of patients in their own home
- symptom management
- psychological support
- **North Staffordshire and Stoke-on-Trent**
- complete referral form for Douglas Macmillan Hospice (DMH) community services from Trust intranet>Clinicians>Support services>Palliative care>Community palliative care
- **South Staffordshire**
- complete referral form for Katherine House Community Team and phone 01785 254645
- **Outside Staffordshire**
- referral information available on Trust intranet>Clinicians>Support services>Palliative care>Community palliative care

END OF LIFE CARE • 2/2

UHNM end of life pathway tool



Actions required:
1. Contact GP to update and recommend addition to GSF register
2. Refer to district nurses

Also consider:
- Referral to community palliative care nurses
- Advanced care planning
- Review DNAR status
- Ask GP to complete DS1500

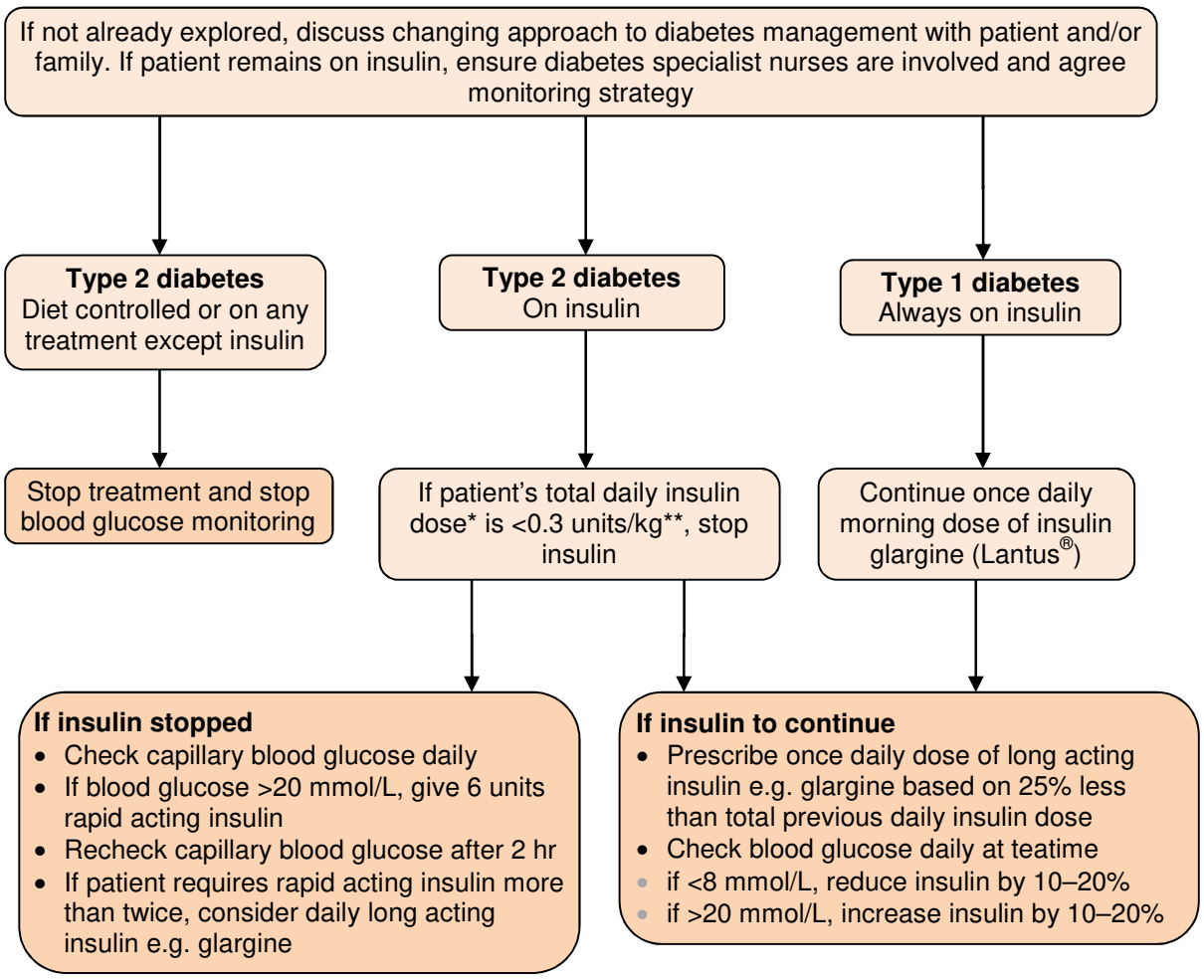
Actions required:
1. Confirm patient on GSF register
2. Refer to community palliative care nurses
3. Refer to district nurses
4. Advanced care planning
5. Review unnecessary medication
6. Utilise EOL rapid discharge pathway where necessary
7. Ask GP to complete DS1500
8. Discuss DNAR, record and communicate to GP

Actions required:
1. Discuss and update DNAR
2. Check for advance care planning
3. Communicate with patient/family
4. Complete individualised care bundle for last days of life
5. If home is preferred place of care, utilise rapid discharge pathway
6. Prescribe end of life drugs for discharge

Actions required:
1. Prompt verification of death
2. Carry out personal care after death
3. Allow adequate time to support family and carers
4. Provide Trust bereavement booklet
5. Give clear information on next steps
6. Refer out for local bereavement support if needed
7. Inform bereavement services

END OF LIFE DIABETES MANAGEMENT • 1/1

When oral intake reduced, use in last hours or days of life



- Keep tests to a minimum. It may be necessary to perform some tests to ensure unpleasant symptoms do not occur due to low or high blood glucose
- It is difficult to identify symptoms due to hypo or hyperglycaemia in a dying patient
- Symptoms may be due to abnormal blood glucose levels
- If patient symptomatic, test blood glucose.
- Observe for symptoms in previously insulin treated patient where insulin has been discontinued

For further advice contact diabetes specialist nurses or specialist palliative care team

* Total daily insulin dose is the total number of units of insulin the patient receives over a 24 hr period. If patient taking regular SC doses of insulin, add together the number of units from all doses in a day to calculate this:
e.g. Patient who takes Actrapid 12 units 3 times a day and insulatard 24 units at bedtime, the total daily dose is (3 x 12) + 24 = 60. If patient on an IV insulin infusion, calculate how many units have been infused over the last 24 hour period.

** If not appropriate to weigh the patient, use admission weight, last known weight or an estimate

PREVENTION AND CONTROL OF SEIZURES IN LAST DAYS OF LIFE ● 1/1

INTRODUCTION

- The focus of care should be on comfort during the last days of life
- It is distressing to witness a seizure, if seizures occur they should be treated
- Investigations to find the underlying cause are unlikely to help
- Seek specialist help at the earliest opportunity

Assessment

- Exclude other causes for loss of consciousness and/or uncontrolled movements e.g. vasovagal episodes, postural hypotension, arrhythmias, hypoglycaemia, extrapyramidal side effects
- Assess history of seizures and risk factors e.g. cerebral disease
- Assess compliance and ability to take current anti-epileptic medications

Acute seizures

- Follow **Seizure algorithm**

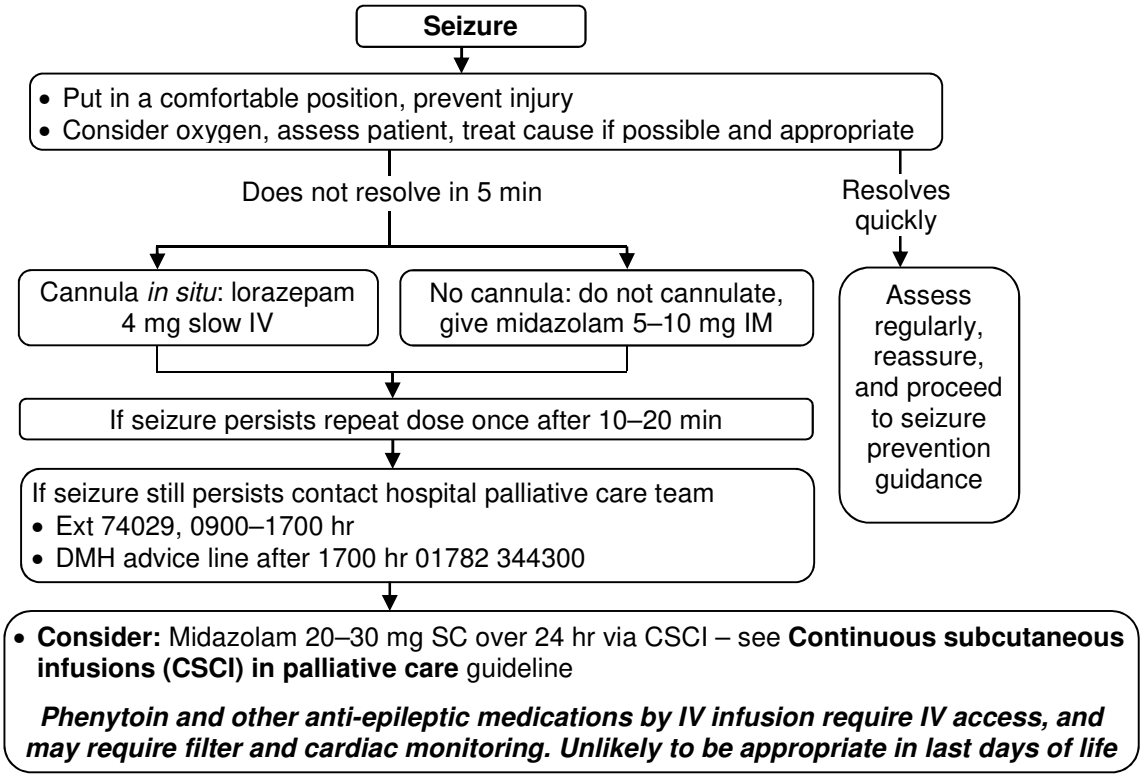
Seizure prevention

- Dying patients may be unable to take oral anti-epileptic drugs
- anti-epileptic drugs have long half-life therefore not all patients will need additional anticonvulsant treatment
- in some situations a continuous subcutaneous infusion of leviteracetam may be considered, this is only appropriate under the supervision of the specialist palliative care team
- patients with history or risk of seizures: prescribe midazolam 5–10 mg IM PRN in addition to normal end of life PRN medication
- If recent seizures or significant concern about seizures
- contact specialist palliative care team
- consider midazolam 20–30 mg by CSCI for prevention and control – see **Continuous subcutaneous infusions (CSCI) in palliative care** guideline
- If non convulsive seizures identified on EEG seek specialist advice from either neurologist/specialist palliative care team

For neurology advice contact on-call neurology SpR through Rotawatch

For palliative care advice contact hospital palliative care team (74029) 7 days a week 0900–1700 hr or out-of-hours Douglas Macmillan Hospice (01782 344300)

Seizure algorithm



CARING FOR PATIENTS IN THE LAST DAYS OF LIFE ● 1/2

INTRODUCTION

- This is a core skill for all clinicians
- High quality care in the last days of life is essential to ensure a peaceful and dignified death
- Involves complex decision making and can be emotionally challenging
- A longer version of this guidance is available on the trust intranet clinicians>support services>palliative care>last days of life>last days of life guidance

RECOGNITION OF DYING

- Based on clinical assessment
- Consider potentially reversible conditions (e.g. renal failure, infection and hypercalcaemia) which can mimic dying
- If patient clearly in the dying phase, investigation and treatment of specific medical problems (e.g. renal failure, infection and hypercalcaemia) may not provide benefit to the patient
- In cases of uncertainty or disagreement a second opinion may be helpful

Responsibility for decision making

- Unless urgent and unavoidable, the decision that patient is dying and any changes in treatment plan should be made in-hours by the responsible consultant

Communication

- With patient and family is central to providing effective end of life care and builds confidence and trust
- Can be challenging as it is common for patients to be fatigued, confused or have a reduced level of consciousness
- Involve patients and their family in decisions about their care as far as possible
- Be open and honest and follow trust guidelines for breaking bad news – see Trust intranet>policies and procedures>C18
- Explain that patient is in the last days of life, acknowledge uncertainty about exact prognosis. Explain any changes to the plan of care. Allow patient and their family opportunity to ask questions

REVIEWING THE PLAN OF CARE

- Review all treatments and interventions and assess whether each will provide a benefit to patient (e.g. making them more comfortable)
- Consider putting in place ceilings of care – deciding which interventions would be helpful or not in the future
- If a resuscitation decision has not been made, address it at this point. The cessation of cardiac and respiratory function is part of the natural dying process and resuscitation cannot reverse this – see Trust intranet>policies and procedures>C09
- Give all patients regular mouth care and support to take food and fluids when able
- Decision of whether to continue/commence clinically assisted nutrition or hydration should be made on an individual basis
- Prescribe SC medications to treat common symptoms without delay – see **Anticipatory prescribing** below
- If patient experiences symptoms or takes regular medications for symptom control (e.g. strong opioids), they may require continuous SC infusion of medication – see **Continuous subcutaneous infusions (CSCI) in palliative care** guideline
- Patient should be reviewed at least daily and reassessed if any significant change in their condition

Does patient have specialist palliative care needs?

- Refer to the hospital palliative care team if:
- pain or other symptoms, particularly if patient has required >2 doses of any PRN medication
- psychological distress
- complex social or family concerns
- assessment for a hospice bed
- difficult decision making

CARING FOR PATIENTS IN THE LAST DAYS OF LIFE ● 2/2

Anticipatory prescribing

- Prescribe the following for all patients
- midazolam 2.5–5 mg SC hourly PRN for agitation or dyspnoea
- haloperidol 1.5–3 mg SC 4-hrly PRN for nausea and vomiting (maximum 9 mg/24 hr)
- hyoscine butylbromide 20 mg SC 4-hrly PRN for respiratory secretions (maximum 120 mg/24 hr)
- morphine sulphate 2.5–5 mg SC hourly PRN for pain or dyspnoea

Circumstances when prescribing may differ

- If patient has renal impairment (i.e. eGFR <50), hepatic impairment or is taking regular strong opioid – dose or type of opioid medication may need adjustment
- If patient has severe renal impairment (i.e. eGFR <20, on peritoneal or haemodialysis) adjust medications and doses as follows:
- midazolam 1.25–2.5 mg SC hourly PRN for agitation or dyspnoea
- haloperidol 0.5–1.5 mg SC 4-hrly PRN for nausea and vomiting (maximum 4.5 mg/24 hr)
- hyoscine butylbromide 20 mg SC 4-hrly PRN for respiratory secretions (maximum 120 mg/24 hr)
- oxycodone 1.25–2.5 mg SC hourly PRN for pain or dyspnoea

For palliative care advice contact hospital palliative care team (74029) 7 days a week 0900–1700 hr or out-of-hours Douglas Macmillan Hospice (01782 344300)

DOCUMENTATION

- Decisions, plan of care and discussions with patient or family should be clearly documented
- Medical team should complete the 'Medical document for last days of life' found on page 3 of the Individualised care bundle for last days of life
- Nursing staff should use the 'Individualised care bundle for the last days of life'

Purple bow

- This scheme is in use and promotes caring and compassion for dying patients and their families
- The bow symbol is used with patient/family permission and placed on side room door/clipped to the curtain
- Families are offered open visiting, snacks, exemption parking and other support
- A purple bow pack containing resources and guidance should be used for each patient, supplies can be obtained by contacting 74029

BLEEDING DISORDERS IN ADULTS • 1/3

RECOGNITION AND ASSESSMENT

All patients known to have an inherited bleeding disorder possess a medical card identifying their condition and severity. Contact haematology medical staff for advice immediately regarding management even if no treatment deemed necessary. Unless major trauma or head injury, advise patient to attend emergency admissions bay on ward 201. To confirm nature of inherited bleeding disorder diagnosis, severity and treatment, contact main blood bank where information file is stored

Definition

Inherited bleeding disorders occur because of:

- Factor VIII deficiency (Haemophilia A)
- Factor IX deficiency (Haemophilia B)
- Factor XI deficiency (Haemophilia C)
- von Willebrand factor deficiency (vW disease)
- Hereditary intrinsic platelet defects (rare)
- Deficiency of other coagulation factors (rare)
- Haemophilia A and B; severity depends on baseline plasma concentration of Factor VIII/IX expressed as a percentage of normal:
  - mild (6–40%): muscle and joint bleeds, usually following trauma
  - moderate (1–5%): muscle and joint bleeds, usually following trauma
  - severe (<1%): spontaneous joint and muscle bleeds

Presentation

Haemophilia A or B

- Haemophilia A and B display X-linked inheritance and occur almost exclusively in men. Most patients with haemophilia A or B present with muscle or joint bleeds:
  - **minor bleeds** usually present with pain and slight restriction of movement with minimal or no joint swelling
  - **major bleeds** present with severe pain/tenderness with marked swelling and restriction of movements of the joint
  - **in the event of head injury or suspected intracranial bleed, administer appropriate factor concentrate immediately and arrange urgent CT scan of head. Do not wait for scan before starting treatment**
  - be alert for a major bleed into psoas muscle

von Willebrand's disease

- Affects men and women and usually presents with:
  - mucocutaneous bleeding frequent and prolonged epistaxis
  - menorrhagia
  - easy bruising

IMMEDIATE TREATMENT

- Treat all bleeds without delay – delayed treatment results in increased need for treatment and risk of irreversible complications – **call blood bank for factor preparations and ask to process urgently**
- Treatment of significant bleeds usually involves administration of clotting factors/desmopressin:
  - in Haemophilia A: recombinant Factor VIII, (Advate, Refacto AF) order from blood bank or desmopressin (pharmacy item)
  - in Haemophilia B: recombinant Factor IX, (Benefix)order from blood bank
  - in von Willebrand's disease: plasma-derived vW factor (order from blood bank) or desmopressin

Haemophilia A

Minor muscle or joint bleed

- In **mild/moderate** Haemophilia A, consider desmopressin
  - if patient has baseline Factor VIII >10% and is aged 2–65 yr with no history of hypertension or ischaemic heart disease, give desmopressin 0.3 microgram/kg either SC (preferable as no need for cannulation) or IV in 50 mL sodium chloride 0.9% over 20 min (warn patient that flushing and headache may occur and advise to restrict fluid intake to 1 L during next 24 hr)

Desmopressin is available in 15 microgram/mL vials for SC administration or 4 microgram/mL vials for IV. Care must be taken to ensure correct vial used at administration

- if patient does not meet these criteria, give Factor VIII concentrate to raise Factor VIII to 30–50%
- In **severe** Haemophilia A, give Factor VIII concentrate to raise factor percentage to 30–50%, usually by single injection, not suitable for desmopressin

Major muscle/joint bleed or head injuries

- Admit patient and inform on-call haematology medical staff
- In Haemophilia A of any severity, give Factor VIII concentrate to raise percentage to 80–100%
- Rest joint for at least 1 day, prescribe appropriate analgesia. Do not administer IM injections
- Check for neurological deficit (femoral nerve in a psoas bleed, median nerve compression in carpal tunnel with a forearm bleed)
- **In the event of head injury or suspected intracranial bleed, administer Factor VIII concentrate immediately and arrange urgent CT scan of head. Do not wait for scan before starting treatment**
- Further therapy requires monitoring of factor percentage with advice from haematology team
- repeated doses of Factor VIII concentrate usually given at 12-hrly intervals

Haemophilia B

Desmopressin has no role in treating Haemophilia B

Minor muscle or joint bleeds

- Give Factor IX concentrate to raise percentage to 30–50%

Major muscle/joint bleeds or head injuries

- Admit patient and inform on-call haematology medical staff
- In Haemophilia B of any severity, give Factor IX concentrate to raise percentage to 50–80%, Factor IX levels higher than 80% is a risk for venous thrombosis
- rest joint for at least 1 day and prescribe appropriate analgesia
- check for neurological deficit (femoral nerve in a psoas bleed, median nerve compression in carpal tunnel with a forearm bleed)
- **In the event of head injury or suspected intracranial bleed, administer Factor IX concentrate immediately and arrange urgent CT scan of head. Do not wait for scan before starting treatment**
- Further therapy requires monitoring of factor percentage with advice from haematology team
- repeated doses of Factor IX concentrate usually given once daily

Patients with von Willebrand's disease or hereditary platelet disorders

- Discuss with on-call haematology medical staff
- Use local measures to stop bleeding (e.g. nasal packing, etc)
- Give tranexamic acid 1 g oral 8-hrly
- Patients with type 1 disease usually respond well to desmopressin but non-responders will require treatment with von Willebrand's factor concentrate
- Consider desmopressin. If patient aged 2–65 yr with no history of hypertension or ischaemic heart disease, give desmopressin 0.3 microgram/kg SC (preferable to IV as no need to cannulate) or IV in 50 mL sodium chloride 0.9% over 20 min (see warning box above)
- Warn patient that flushing and headache may occur and advise to restrict fluid intake to 1 L during next 24 hr
- Patients with type 2 and 3 disease require vW factor concentrate

Patients with other coagulation factor deficiencies or other bleeding manifestations

- Contact on-call haematology consultant/SpR

USE OF COAGULATION FACTOR CONCENTRATES

- Coagulation factor concentrates are available from hospital blood bank
- Before initiating treatment, discuss management with Dr Chandra (during working hours); or on-call haematology medical staff to decide:
- factor concentrate required, dose, frequency and duration of treatment
- monitoring of pre- and post-infusion percentages (if required)
- Document use of any factor concentrate (including dose and time given) on treatment chart
- If patient admitted, monitor carefully to ensure bleeding has stopped

Calculation of factor dose

Give individual patients same brand of concentrate each time treatment is required (information in medical record or in blood bank)

- **Step 1**: calculate factor (%)
  increase required = desired factor percentage – baseline factor percentage of patient

- **Step 2**: calculate dose of specific factor required

  a) For Factor VIII concentrates (Advate, Refacto AF)

  $$\text{dose required (in units)} = \frac{\text{body weight (kg)} \times \text{factor (\%) increase required}}{2}$$

  b) For Factor IX concentrate (Benefix)

  $$\text{dose required (in units)} = \text{body weight (kg)} \times \text{factor (\%) increase required} \times 1.2$$

  c) For vW Factor concentrate (Haemate P, Wilate)

  $$\text{dose required (in units)} = \frac{\text{weight (kg)} \times \text{RIC* (\%) increase required}}{3}$$

* Ristocetin co-factor activity

Reconstitution of factor concentrate

Always wear gloves

- Check dosage of factor to be given and order appropriate factor concentrate from main blood bank
- Most factor concentrates are provided in packs with:
- concentrate powder
- diluent in syringe
- vial adapter for transfer of diluent
- infusion set
- Read instructions carefully before reconstituting factor, a clear step by step guide is in each package – incorrect reconstitution may result in wastage of expensive concentrate. If in doubt, seek advice from haematology nurses (72201 – ward 201) or haemophilia nurse specialist (72578, routine hours only). Can be given by any staff trained to give intravenous therapy, use guidelines for bolus administration, does not require specialist training
- Transfer diluent in to dried concentrate vial via a needleless adapter
- Ensure no concentrate remains undissolved
- Draw up concentrate into a syringe
- Administer concentrate via butterfly needle over no more than 3 mL/min. Flush cannula post infusion
- Allergic reactions are uncommon. If reaction occurs, treat with chlorphenamine +/- hydrocortisone (more common to react to factor IX), observe after administration for 30 min
- Discard all used bottles and needles into sharps bin
- Record dose administered and date and time in patient notes and treatment chart
- Return any unused concentrate (even if pack opened) to hospital blood bank

SUBSEQUENT MANAGEMENT, DISCHARGE AND FOLLOW-UP

- Inform haemophilia nurse specialist (72578) to arrange follow-up (if not already involved in the admission); if not available, leave answer-phone message
- All haemophilia patients admitted with a bleed must be reviewed by haematology team the following working day

CHRONIC ANAEMIA ● 1/5

BACKGROUND

- Anaemia is defined by the World Health Organisation (WHO) as haemoglobin (Hb) <130 g/L in males and Hb <120 g/L in non-pregnant females
- Anaemia is not a diagnosis – it requires a cause e.g. 'iron deficiency anaemia'
- Note the normal range for Hb includes patients who are anaemic
- In chronic anaemia patients may tolerate a very low Hb levels because of appropriate compensatory mechanisms – do not base clinical decisions on Hb value alone
- Severe anaemia tends to result in symptoms of heart failure rather than ischaemia
- Beware a second acute cause of anaemia on a background of chronic anaemia can cause a rapid fall in Hb in someone with little reserve and can confuse the clinical picture
- Interpret a positive direct antiglobulin test (DAT) in context – positive results are often found in ill patients in hospital without haemolysis

ASSESSMENT

History taking in anaemia

- Elicit any symptoms of anaemia and grade the severity (see **Table 1**)
- Identify potential sources of bleeding: recent frank bleeding; menstrual history; symptoms to support GI blood loss e.g. change in bowel habit, dyspepsia, melaena; haemolysis e.g. jaundice, urinary symptoms; bone marrow pathology e.g. B-symptoms; underlying malignancy
- Bleeding history: review previous surgery, dental extraction, epistaxis, mucocutaneous bleeding symptoms, menstrual history
- Diet: vegan/vegetarian, dietary content
- Medications: ensure if taking oral iron, assess how effectively they are taking the medication (see **Investigation and management of iron deficiency** guideline)
- Alcohol history
- Surgical history: including abdominal surgery
- Medical history: autoimmune diseases, inflammatory bowel disease, anaemia, transfusion/iron
- Family history: bleeding, anaemia, malignancy

Table 1: Grading of anaemia symptoms

Severity score	Anaemia symptoms
Mild	• Fatigue • Shortness of breath on exertion
Moderate	• Shortness of breath at rest • Palpitations
Severe	• Chest pain • Heart failure symptoms

Primary laboratory investigations for anaemia

- Review previous laboratory results before ordering tests as screening bloods may already have been performed (diagnosis may already be evident from the available results)
- For initial anaemia screening tests see **Table 2** (search 'anaemia' in OrderComms)
- *Only repeat tests if necessary – especially B_{12} levels, TFT (latter rarely required more than yearly)
- Always send tests before treatment/transfusion

Table 2: Laboratory screening tests for anaemia
(recent result may be available, only repeat where clinically indicated – see * above)

Who?	Request
All anaemic patients Hb <130 g/L male Hb <120 g/L female	• FBC, reticulocyte count and blood film • U&E, liver function, bone profile • Ferritin • Serum B_{12} (cobalamin)* • Serum folate • TSH*
Patients with ferritin <100 and raised CRP (or chronic inflammatory disorder/infection)	• Transferrin saturations[1]
Patients with eGFR <60	• Percentage hypochromic red cells (%HRC) – performed as part of the FBC – phone lab for result
Any patient who may require a blood transfusion in next 7 days	• Group & screen (G&S)
If jaundice/haemolysis suspected	• Lactate dehydrogenase (LDH) • Haptoglobin • Direct antiglobulin test (DAT) • Split bilirubin (Conj/unconj)
If anaemia with hypercalcaemia	• Immunoglobulins (Ig) and serum electrophoresis • Urine electrophoresis (BJP)

[1]This test can be added on to biochemistry samples for inpatients to save NHS costs (as the diagnosis may be fully evident from the initial ferritin result and is only needed in some patients). In the outpatient setting it is a useful primary test as results may dictate management and remove the need repeat testing

INTERPRETATION OF LABORATORY RESULTS

Table 3: Interpretation of laboratory results and suggested further investigation/action

Laboratory parameter	Result	Interpretation	Potential additional tests/actions
MCV	Microcytic (MCV <80 fL) Hypochromic (MCH <26.5 pg)	• Iron deficiency • Anaemia of chronic disease (ACD) • Haemoglobinopathies • ? Sideroblastic anaemia • ? Lead poisoning	• Review ferritin results +/- transferrin saturations • Consider haemoglobinopathy screening • Consider lead levels • Bone marrow aspirate/trephine (refer to haematology)
	Macrocytic (MCV >100 fL)	• Megaloblastic; B_{12} or folate deficiency • Drugs: MTX, azathioprine, cyclophosphamide (typically 105–115 fL), hydroxycarbamide <135 fL • Alcohol (usually MCV 100–110 fL) • Liver disease (typically <115 fL) • Haemolysis (100–130 fL) • ?Bone marrow disorders e.g. myelodysplasia • ? Pregnancy (<105 fL) • ? Hypothyroid (<110 fL)	• See **Investigation and management of symptoms of B_{12} deficiency** and/or **Investigation and management of symptoms of folate deficiency** guidelines • Review drug SPC's • Bone marrow aspirate/trephine (ref haematology) • GGT/USS abdomen/liver screen (discuss with gastro) • Haemolysis screen (refer to haematology if positive) • ? Pregnancy test

Laboratory parameter	Result	Interpretation	Potential additional tests/actions
Reticulocyte count	Percentage (%age) reticulocytes increased	• An increase in reticulocytes (immature RBC) is a natural response to anaemia as the bone marrow tries to correct the deficit e.g. raised in acute blood loss, haemolytic anaemia	• As dictated by history and lab results
	%age reticulocytes normal or reduced	• Suggests an inappropriate or ineffective BM response to the anaemia e.g. ACD, bone marrow failure (leukaemia, myeloma, infiltration by carcinoma etc.), haematinic deficiency	• As dictated by history and lab results • Potentially bone marrow aspirate/trephine (refer to haematology)
Blood film	Description of the morphological features of blood cells (written comment provided by BMS +/- haematology staff at end of FBC result)	• Morphological features may indicate underlying cause of anaemia e.g. iron deficiency, megaloblastic anaemia or highlight a bone marrow pathology e.g. dysplasia, acute leukaemia	• If bone marrow pathology identified liaise acutely with haematology on call • If leucoerythroblastic film (LEBF) identified – review clinical history and liaise as appropriate
Estimated glomerular filtration rate (eGFR)	>60 mL/min/1.73m^2	• Anaemia unlikely to be related to CKD/likely due to other causes	
	<60 mL/min/1.73m^2	• Anaemia may be due to CKD	• Review ferritin • ? %HRC >6% • Consider myeloma screen
	<30 mL/min/1.73m^2	• Anaemia may be due to CKD	• Check ferritin and %HRC • Refer to renal team for consideration of IVFe/EPO • Consider myeloma screen
Ferritin	<15 ng/mL	• Absolute iron deficiency (AID)	• See **Investigation and management of iron deficiency** guideline
	<30 ng/mL	• Likely absolute iron deficiency	• See **Investigation and management of iron deficiency** guideline
	<100 ng/mL with raised inflammatory markers/chronic inflammation	• Possible absolute iron deficiency	• Check transferrin saturations (add on possible) • If <20% see **Investigation and management of iron deficiency** guideline
	Normal/raised ferritin in a patient with infectious, inflammatory and malignant diseases including CKD	• Potential Functional iron deficiency (FID) due to iron restricted erythropoiesis (IRE)	• In patients with CKD review %age HRC

Laboratory parameter	Result	Interpretation	Potential additional tests/actions
Cobalamin/ B_{12} levels	Normal/reduced	• Interpret in light of clinical symptoms, history, medication	• See **Investigation and management of symptoms of B_{12} deficiency** guideline • ? anti-IFAB • ? MMA
	>600 pmol/L	• Iatrogenic, cancers (haematological e.g. MPN, CML, AML in addition to a weaker link with non-haem cancers and even as yet diagnosed cancers); liver disease	• As per clinical history
Serum folate	<3.0	• Indicative of folate deficiency	• See **Investigation and management of symptoms of folate deficiency** guideline
Percentage hypochromic red cells (%age HRC)	Aim <6%	• Part of FBC (although only reported if known renal patient). Useful in patients with CKD to identify functional iron deficiency (if testing performed within 6 hr of sampling)	• Interpret with ferritin result/U&E/Hb • Consider iron supplementation • Liaise with renal team

MANAGEMENT

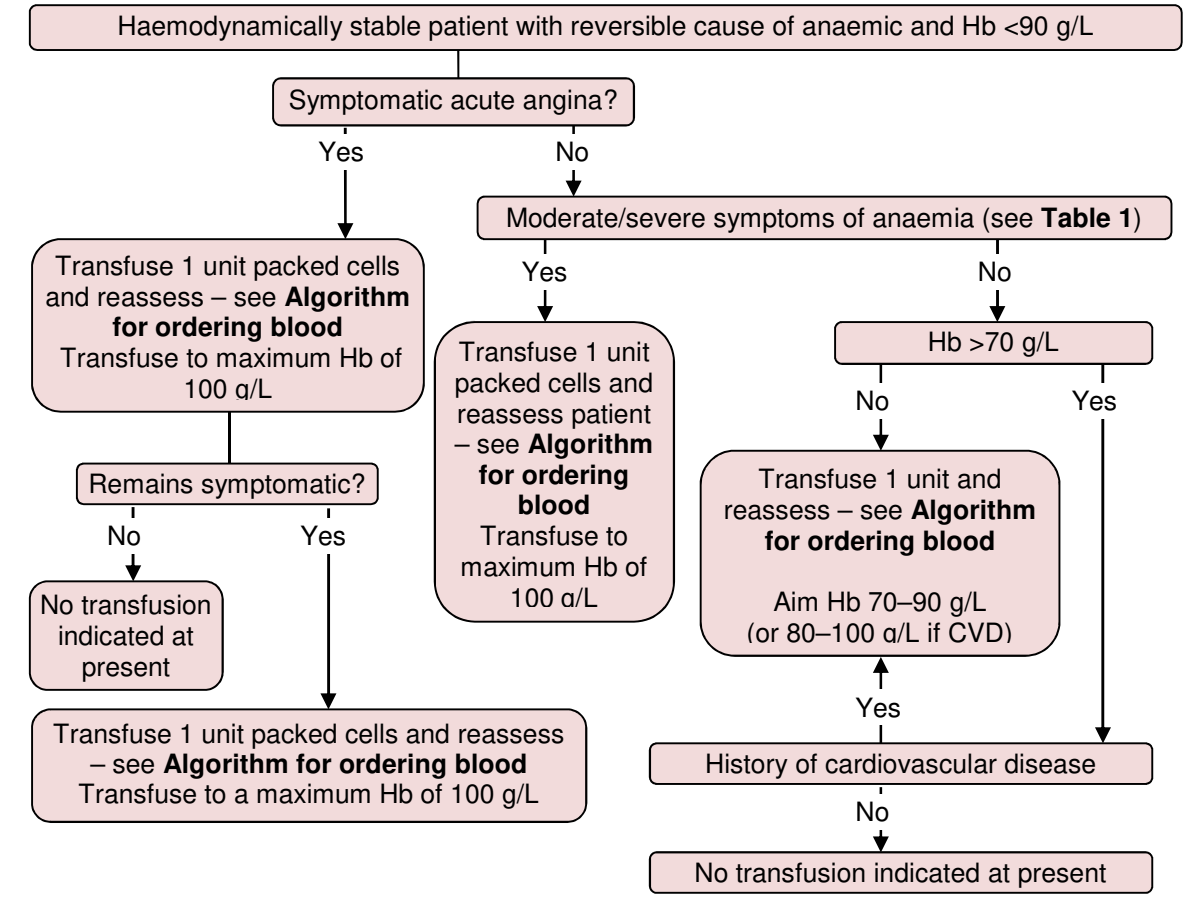
- Always treat the underlying cause of the anaemia e.g. B12, iron (see relevant medical guidelines) – **even if the patient receives a blood transfusion**
- Optimise medical co-morbidities – especially in ACD
- Consider a single unit RBC transfusion in patients with moderate/severe symptoms of anaemia to reach restrictive transfusion thresholds and improve symptoms/short term outcome (so definitive treatment can take effective) - see red cell transfusion guidelines
- Transfusion in acute bleeding is dictated by the clinical situation (see transfusion guidelines and major haemorrhage pathway MHP) – with an aim of upholding restrictive transfusion thresholds once haemostasis has been secured (particularly in upper GI bleeding)
- Transfuse cautiously in lower GI bleeds as over-transfusion is a frequent occurrence

EVALUATION

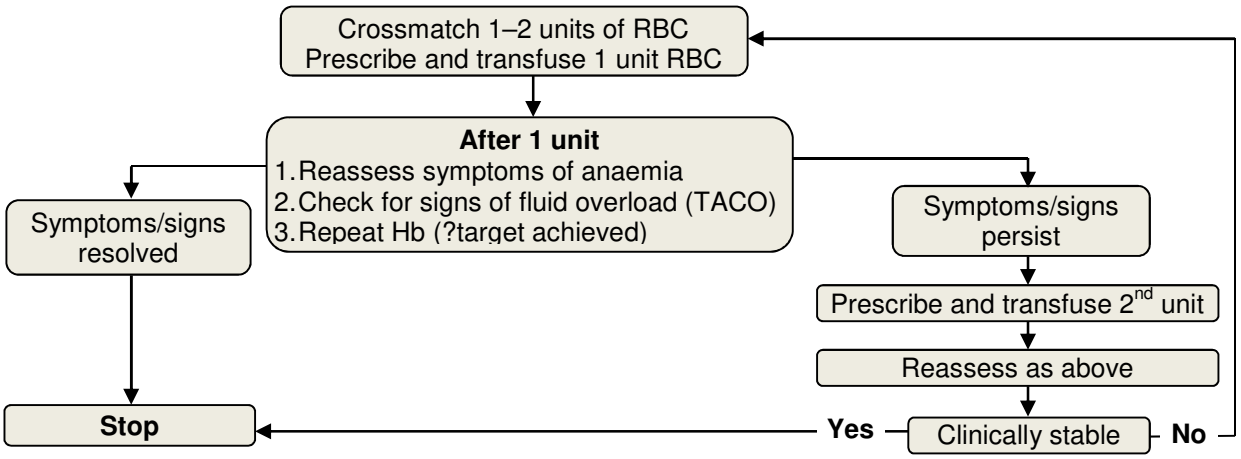
- See individual guidelines
- Ensure appropriate further investigations are arranged (may include 2WW referrals for suspected cancer) and results are followed-up
- Refer to haematology or relevant secondary care providers e.g. renal, gastro as appropriate
- Where primary care follow-up is scheduled, ensure full details regarding investigation, diagnosis, treatment and frequency of subsequent monitoring are provide in discharge letters

Transfusion flowchart for chronic anaemia

Remember each unit transfused is a treatment decision



Algorithm for ordering and prescribing blood



MANAGEMENT OF SICKLE CELL DISEASE ● 1/6

Most common presentation of patients with sickle cell disease (SCD) is pain due to vaso-occlusion (VOC). This guideline offers advice on management of VOC and some of the complications of SCD, especially acute chest syndrome. Alert haematology team to all admissions (bleep 15723 or on-call haematologist via call centre)

VASO-OCCLUSIVE CRISIS

Symptoms and signs

- Severe pain (usually in extremities, back or abdomen)
- Dehydration
- Enlarged liver or spleen
- Bone pain
- Low grade fever (<38°C) even in absence of infection

History

- Is pain similar to that of a sickle cell crisis, or is it different in any way?
- Analgesia already taken for current episode, before coming in to hospital?
- Any precipitating factors – infections, dehydration, stress?
- Any complicating factors:
  - shortness of breath/cough/chest pain
  - headache/neurological symptoms
  - abdominal pain/priapism
  - features to indicate infection
  - relevant specialty to assess features of other non sickle related presentations
- Previous episodes and complications
- Use age-appropriate pain score (see below)

Examination

- Look for:
  - tachycardia
  - tachypnoea
  - hypo and hypertension
  - fever
  - dehydration
  - SpO_2 on air and on oxygen (target oxygen saturation 95%)
  - chest signs
  - hepatosplenomegaly
- If neurological symptoms, full neurological findings

Investigations

Presence of sickle cells in blood film does not correlate with clinical events

- FBC and reticulocyte count
  - check whether Hb and reticulocyte count similar to patient's baseline. Worsening anaemia and low reticulocyte count may indicate virus (parvovirus) – induced bone marrow aplasia
- Group and save (new patients – obtain full red cell phenotype)
- U&E, LFT
- If fever or relevant symptoms or signs, septic screen
- Only if infection or acute chest syndrome suspected (see below), chest X-ray
- Painful bones need not normally be X-rayed

IMMEDIATE TREATMENT

Analgesia

- Administer first dose of analgesia within 30 min of presentation to emergency department
- Ensure drug, dose and administration route are suitable for severity of pain and age of patient
- Refer to patient's individual care plan if available
- Offer a bolus of strong opioid to all patients presenting with:
  - severe pain
  - moderate pain not relieved by analgesia already taken

Non-opioid analgesia

- Not all patients require opioid analgesia although many do. If no contraindications, offer the following regularly:
- paracetamol 1 g oral 6-hrly
- if well hydrated and eGFR ≥30 mL/min, naproxen 250 mg oral 6-hrly or ibuprofen 400 mg oral 8-hrly
- dihydrocodeine 30–60 mg oral 4–6 hrly (max 240 mg in 24 hr)
- Review doses in presence of renal impairment

Do not use pethidine for treating pain in an acute painful sickle cell episode

Opioids in opioid naïve patients

- If weight ≤50 kg, morphine 2.5 mg SC up to every 2 hr
- If weight >50 kg, morphine 5 mg SC up to every 2 hr

Opioids in patients using opiates/opioids regularly

- May require higher doses (e.g. morphine 5–10 mg SC up to every 2 hr or equivalent dose of diamorphine or other alternatives)
- if patient prefers and usually uses IV morphine, give morphine 0.1–0.15 mg/kg IV (maximum 10 mg) over 5 min
- pethidine is no longer recommended for sickle vaso-occlusive pain
- non-sedating antihistamines may be necessary for itch and ondansetron for nausea

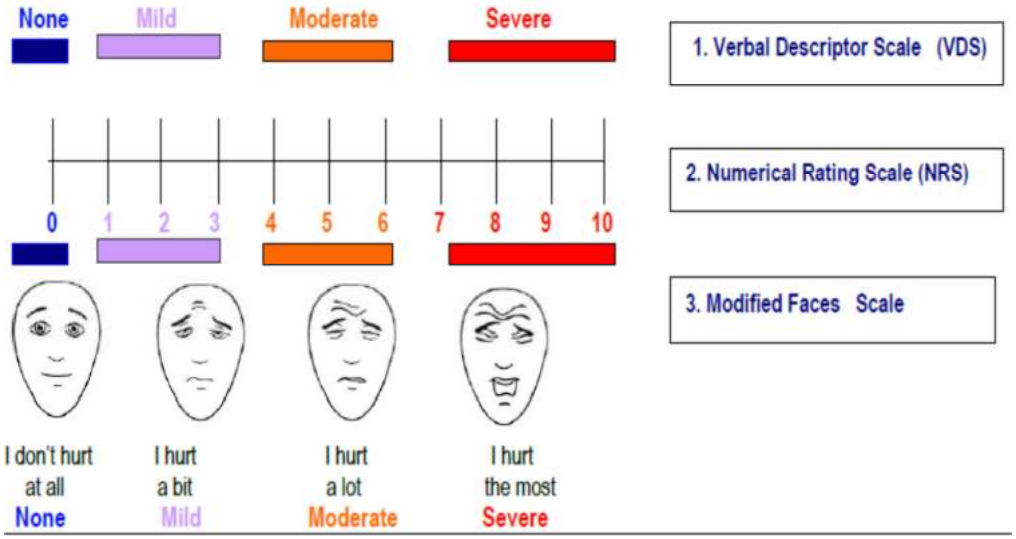
Monitoring

- Reassess response in approximately 15–30 min after the completion of the IV infusion, or 30–60 min after SC injection, and consider repeating/increasing dosage according to efficacy. Adjustment of the dose of morphine before the expected time of peak onset of pain relief (i.e. 20 min for IV dosing) is not recommended
- Assess pain every 30 min until satisfactory relief then monitor at least every 4 hr using an age-appropriate pain assessment tool – see below
- if patient has severe pain on reassessment, offer second bolus dose of a strong opioid
- if repeated bolus doses of a strong opioid are needed within 2 hr, consider admission to a surgical ward for patient-controlled analgesia – see **Patient-controlled analgesia** guideline in the **Surgical** guidelines
- monitor patients receiving opioid analgesia at least hourly for presence of adverse effects including respiratory depression (sedation score, respiratory rate) – see **Opioids: monitoring and dose adjustment** guideline in the **Surgical** guidelines

Select pain assessment tool (PAT)

- Whenever possible use the verbal descriptor scale (VDS) to measure pain intensity; if VDS inappropriate select an alternative pain assessment tool (PAT)
- PAT must be appropriate to the individual patient:
- consider patient's cognitive status, age, and language
- Continue to use the selected PAT for all subsequent pain assessments

Figure 1: Pain assessment tools



Types of scale and recommendations for assessing pain in adults who can self-report

Pain assessment tool (PAT)	Type of pain assessment	Comments
Verbal descriptor scale (VDS) • Measure pain intensity by asking patient: "Which of the following words best describes the intensity of your pain: none; mild; moderate; or severe"	• Acute pain • Post-operative pain • May be useful in adults with learning disability • Older people with none or mild/moderate cognitive/ communication impairment	• Self-report • Quick and simple to use • May be useful in visually impaired people • Can be used to grade pain relief following intervention • Meaning of descriptors may not be understood
Numerical rating scale (NRS) • Ask patient: 'On a scale of 0–10 with 0 being no pain and 10 being severe pain, which number best describes the intensity of your pain'	• Acute pain • Post-operative pain • May be useful in adults with learning disability • Older people with none or mild/moderate cognitive/ communication impairment	• Self-report • Simple to administer • Written or verbal forms • Recommended for use when a more sensitive assessment of pain is required • Can be used to grade pain relief following intervention
Modified faces scale • Ask patient to point to the face that best represents their level of pain	• Adult with learning disability who cannot understand VDS or NRS • People who lack verbal and numeracy skills e.g. those with cognitive impairment/ communication impairment following a stroke • When language barrier exists	• Self-report • May be misinterpreted as measure of emotion

Fluid replacement

- Replace fluid orally if possible. Venous access often difficult in patients with SCD: reserve for situations where oral intake inadequate or inappropriate (e.g. vomiting)
- if unable to give orally, glucose (4%) and sodium chloride (0.18%) 1 L by IV infusion over 3 hr; then follow **Fluid maintenance** guideline

Always use commercially produced pre-mixed bags of infusion fluid and potassium chloride. NEVER add potassium chloride to infusion bags

Avoid using veins in ankles/feet for venous access; cannulation carries high risk of leg ulceration. Avoid central lines as they carry high complication rate

Blood transfusion

- Indications for blood transfusion in sickle cell disease are very specific (see below) – discuss all cases with haematologist

Oxygen therapy

- If SpO_2 <94%, give oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline
- Carry out a full assessment of the reason for hypoxia to rule out opiate-induced respiratory suppression, severe chest infection or chest syndrome. Chest syndrome must be actively excluded in patients with abnormal respiratory signs or chest symptoms, chest pain, fever or hypoxia (see below)
- If SpO_2 cannot be maintained >94%, discuss with critical care team and haematology team

Antimicrobials

- Continue prophylactic antimicrobials as recommended by patient's haematologist (See BNF if not already on prophylaxis)
- For patients with evidence of infection – antimicrobials as per Trust policy. See appropriate guideline for type of infection

Other

- Unless contraindicated, give thromboprophylaxis. See **Prophylaxis against venous thromboembolism** guideline

SUBSEQUENT MANAGEMENT

- Painful crises usually last about 1 week
- Once pain controlled, reassess analgesic regimen daily and taper dosage gradually, changing to oral morphine as dosage reduced (1 mg SC diamorphine = 3 mg oral morphine)
- If Hb falls below 50 g/L, especially if reticulocyte count also decreased, blood transfusion is likely to be indicated – discuss with haematologist

MONITORING TREATMENT

- Respiratory rate hourly after opioid started for evidence of respiratory suppression
- Pulse oximetry
- Fluid balance
- U&E for dilutional hyponatraemia
- Consider visual analogue scale to record pain intensity and response to analgesia

OTHER COMPLICATIONS

- **Discuss with consultant haematologist**

Acute chest syndrome – sickle cell crises

- Acute life-threatening complication of sickle cell disease characterised by breathlessness, hypoxia, fever and new onset pulmonary infiltrates in CXR

Discuss patients with suspected acute chest syndrome urgently with consultant haematologist

Priapism

- Painful prolonged erection with/without prior sexual stimulus. This is an emergency, involve urologist early as penile aspiration/irrigation may be necessary. In some instances shunt procedures are needed

Stroke

- A major complication of SCD – more common in children
- Ischaemic stroke is more common in children, whereas haemorrhagic stroke is more common in adults

Investigations

- Emergency CT scan of head to confirm whether ischaemic or haemorrhagic
- MRI scan of brain to delineate area of ischaemia/haemorrhage
- Carotid Doppler ultrasound scan
- Urgent review by neurologist and haematologist for exchange transfusion to reduce HbS <30%

Splenic sequestration

- More common in infants and children and often associated with sepsis
- Clinical features:
- rapidly enlarging, painful spleen
- anaemia – may present with shock
- fall in Hb of 20 g/L from baseline

Management

- Resuscitate and treat shock
- Emergency (top-up) transfusion: to baseline Hb
- Broad spectrum antimicrobials to cover pneumococcus and haemophilus

Hepatic sequestration

- Acute tender hepatomegaly and anaemia. Manage with a top-up transfusion to baseline Hb

Gallstone complications

- Common in this patient population. Manage as any other patient

Aplastic crisis

- Transient arrest of erythropoiesis
- Abrupt reduction in haemoglobin concentration
- Associated with human parvovirus B19, streptococci, salmonella, streptococci, and Epstein-Barr virus infections
- Emergency (top-up) transfusion: to baseline Hb
- Reticulocytes typically reappear within 2–14 days

Osteomyelitis

- Increased incidence in SCD from infection of infarcted bone
- Usually due to salmonella or other gram-negative organisms, such as Escherichia coli but also Streptococcus pneumonia, Haemophilus influenzae, and *Staphylococcus aureus*
- Clinical presentation is often similar to a vaso-occlusive crisis but is more likely to be associated with a prolonged duration of fever and pain, and swelling and pain that is localised to a single site
- Discuss management with haematologist and orthopaedic surgeon
- surgical drainage or sequestrectomy may be required

Other infections

- Infection is a major cause of morbidity and mortality in SCD
- Therapy of specific infections varies with the clinical setting
- see relevant guideline for suspected source of infection

BLOOD TRANSFUSION

General principles

- All patients should carry a transfusion card with details ABO group, extended red cell phenotype, Rh phenotype and existence of any red cell alloantibodies (current and historic)
- Transfusion history is important, particularly if transferred/prime follow-up and care is a different hospital, may need to liase with transfusion laboratory at primary hospital to get transfusion history
- Advise transfusion laboratory/blood bank that transfusion is for a patient with Sickle cell disorder
- Discuss with haematology consultant to determine if simple top-up or exchange transfusion needed
- Determine post-transfusion target Hb and HbSS, record and document transfusion triggers and indications
- Monitor closely both during and after completion of transfusion for immune haemolytic transfusion reaction (IHTR), delayed haemolytic transfusion reaction (DHTR) and hyper haemolysis
- All patients should have annual viral screening for Hepatitis B, C and HIV 1 and 2

Venous access

- Simple top-up transfusion: single peripheral venous cannula
- Manual exchange transfusion: 2 separate large bore venous access. One for transfusion and inlet port (wide bore needle grey/orange) and another for venesection (vascath: femoral/central neck line)
- Automated red cell exchange: femoral line/vascath – double lumen
- Long-term transfusion programme: consider a port-a-cath

Top-up transfusion

Indications

- Severe anaemia (Hb <50 g/L) owing to:
- hepatic or splenic sequestration
- red cell aplasia or haemolysis
- severe anaemia when decrease in Hb >20% from baseline in a symptomatic patient (heart failure, dyspnoea, hypotension and marked fatigue)
- transfuse to baseline Hb (patient's Hb in steady state)
- Consider when exchange transfusion indicated and starting Hb <50 g/L. Discuss with consultant haematologist

Exchange transfusion

Indications

- Severe chest syndrome
- New ischaemic stroke
- Multi-organ failure
- Consider in priapism

Do not initiate exchange transfusion before discussing with on-call consultant haematologist

Targets

- To reduce HbS to <30%
- To maintain Hb <100 g/L – **Note:** haematocrit of donor blood is approximately double that of patient
- To maintain steady blood volume throughout procedure

Venous access

- Ideally, identify 2 ports for venous access; 1 for venesection, the other for transfusion. In emergency, it is often advisable to use a central line, or arterial line (e.g. on ITU)
- Exchange transfusion must be performed **isovolaemically** (equal quantities in and out)
- Ensure patient well hydrated before exchange
- prehydrate with sodium chloride 0.9% 500 mL as first 500 mL of blood is being removed, then give sodium chloride 0.9% 500 mL concurrently
- do not remove blood until venous access for transfusion is secure
- continue to administer IV fluids between transfusions at standard rate of 3 L/m^2/24 hr
- See **Blood and blood products** guidelines

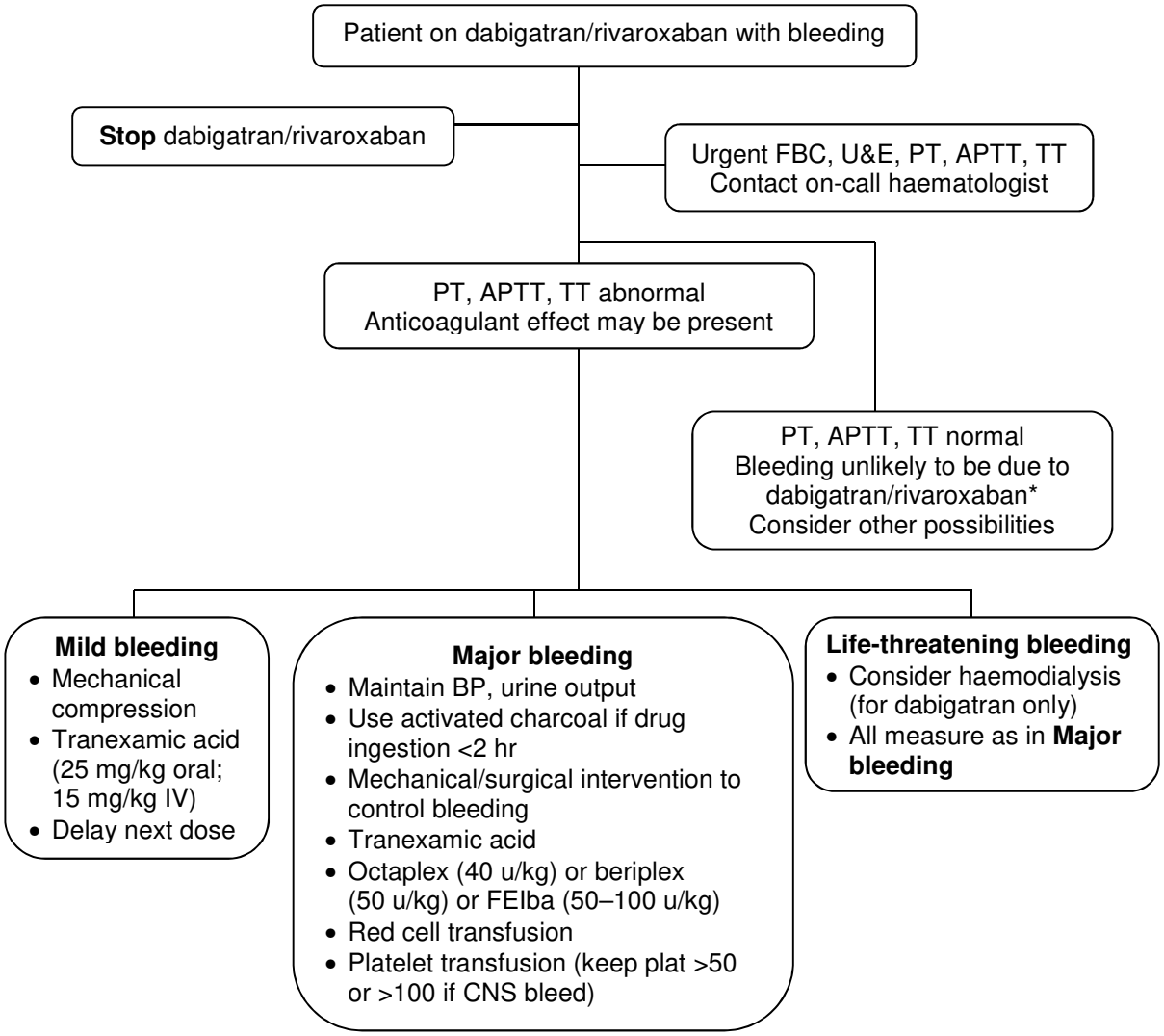
Method

- Usually requires at least 2 exchanges, each of 4 units venesected and 4 units transfused
- Venesect 500 mL of blood and simultaneously infuse 500 mL sodium chloride 0.9% (at same speed as the bleeding)
- As second 500 mL (and subsequent units) venesected, transfuse first unit of blood over 1–2 hr
- Venesect 500 mL and replace with blood and sodium chloride 0.9% five more times (discuss in advance with consultant)
- Check interim Hct and Hb
- A simple top-up transfusion may be required following isovolaemic exchange transfusion
- Post-RBC exchange – FBC and Hct

DISCHARGE AND FOLLOW-UP

- Discharge home when pain controlled by oral medication
- Provide 3–4 days' supply of analgesia
- Do not prescribe parenteral opioids TTO
- Provide patient or carer with information on the continuing management of the current episode including how to:
- obtain specialist support
- additional medication
- manage any potential side effects of treatment

MANAGEMENT OF BLEEDING IN PATIENT ON DABIGATRAN OR RIVAROXABAN ● 1/1



*Normal PT, APTT, TT and fibrinogen is indicative of either no anticoagulant activity or activity equivalent to prophylactic LMWH

Summary of direct oral anticoagulants

	Dabigatran	Rivaroxaban	Apixaban
Site of action	Direct thrombin inhibitor	Xa inhibitor	Xa inhibitor
Impact on standard coagulation tests*	APTT, TT	PT, anti Xa	PT, anti Xa
Half-life (normal renal function)	12–14 hr	9–13 hr	8–15 hr
Renal excretion	80%	66%	25%
Current indication	VTE prevention, AF	VTE prevention and treatment, AF	VTE prevention
Reversal in case of bleeding	Discuss with consultant haematologist	PCC, FEIBA, rVIIa	Discuss with consultant haematologist

*Non-linear correlation, can only be used to detect absence of activity

SPONTANEOUS LEUCOPENIA OR THROMBOCYTOPENIA ● 1/2

DEFINITION

- Leucopenia: Low total white cell count (<4)
- Neutropenia: Low neutrophil count (<1.8, severe <1.0)
- Thrombocytopenia: Low platelet count (<140, severe <50)

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Fever (may present with sepsis – see **Sepsis management** guideline)
- Rash – purpuric due to severe thrombocytopenia, or other due to underlying cause
- Bleeding/bruising due to low platelets
- Fatigue, malaise, dyspnoea (may be due to co-existing anaemia)
- May be asymptomatic and found on a FBC taken for other reasons

Causes

Common	• Viral illnesses; Epstein-Barr virus (EBV), cytomegalovirus (CMV), parvovirus • Severe bacterial infection, sepsis • Liver disease with portal hypertension (for any reason) • Ethanol excess • Drugs [prescribed, over the counter (OTC) and illicit] • Certain ethnic groups such as Afro-Caribbean, Yemenites, Arab Jordanians have lower normal range of neutrophils • Autoimmune
Less common	• Human immunodeficiency virus (HIV) infection • Disseminated intravascular coagulopathy (DIC) • Imported infections (malaria, dengue fever, leishmania) • Acute leukaemia • Aplastic anaemia • Other haematological malignancies/bone marrow infiltration • Haemolytic uraemic syndrome (HUS), thrombotic thrombocytopenic purpura • Idiopathic thrombocytopenic purpura (ITP) • Haemophagocytic syndrome (HLH), may co-exist with viral infections • Adult stills disease • Autoimmune diseases (SLE, rheumatoid arthritis, Felty's syndrome)

Additional history required (in addition to standard clerking)

- Full medication history, including 'over the counter' (OTC) and illicit drugs
- Full travel history (may be necessary to go back several years)
- Contact with infections
- Sexual history

IMMEDIATE INVESTIGATIONS

- Repeat FBC, reticulocyte count and blood film
- U&E, LFT, CRP, LDH
- Vitamin B_{12}, folate, ferritin, transferrin saturation
- Coagulation screen including fibrinogen
- Blood cultures, irrespective of temperature (see **Blood culture** guideline)
- If indicated by symptoms, sputum and urine culture
- If appropriate travel history, malaria film, (see **Febrile returning traveller** guideline)
- If symptoms suggestive of respiratory infection, chest X-ray (CXR)
- Serology for EBV, CMV, parvovirus, HIV

IMMEDIATE TREATMENT

- If clinical evidence of sepsis treat as neutropenic sepsis (see **Neutropenic sepsis** guideline)
- appropriate fluid and antimicrobial therapy in the correct setting according to severity
- discuss with on-call haematologist, patient my require GCSF support
- If patient bleeding and there is evidence of significant thrombocytopenia, discuss requirement of platelet transfusion with on-call haematologist

SPONTANEOUS LEUCOPENIA OR THROMBOCYTOPENIA ● 2/2

Further investigations

- If a cause is not apparent from the above investigations:
  - repeat FBC regularly
  - repeat coagulation screen including D-dimers and fibrinogen
  - screen for further infective causes (after discussion with infectious diseases or microbiology)
  - repeat malaria film (if appropriate travel history)
  - CT thorax, abdomen and pelvis (looking for significant lymphadenopathy, splenomegaly or collections)
  - bone marrow aspiration and trephine (after discussion with on-call haematologist)
- If patient's blood counts are deteriorating significantly, the patient is clinically unstable or the cause is not apparent from the above investigations, contact on-call haematologist
- If an infective cause is probable discuss with infectious diseases team

Further treatment

- Dependent on underlying cause, if not immediately apparent then will be supportive as advised by haematology team

DISCHARGE AND FOLLOW-UP

- If cause apparent, appropriate treatment instigated (if necessary) and patient's parameters are improving without complications, patient can be discharged
- arrange for blood parameters to be followed up (in Primary Care, or appropriate outpatient setting) until they are normal

INVESTIGATION AND MANAGEMENT OF SYMPTOMS OF B_{12} DEFICIENCY ● 1/2

BACKGROUND

- Serum cobalamin is the current first-line test to assess for cobalamin (B_{12}) deficiency although the test **must** be interpreted in context of the patient's symptoms and history
- Stores of B_{12} last 2-3 years so repeat testing within 12 months only if clinically indicated
- Assess patient diet, personal and family history of autoimmune conditions, neurological symptoms (paraesthesia, unsteadiness, peripheral neuropathy – especially proprioception), features of malabsorption, surgical history, medication use (especially proton pump inhibitors, metformin, OCP), pregnancy status
- Oestrogen reduces serum B_{12} (but not functional B_{12}) by 25% on oral contraceptive pill and <30% by third trimester of pregnancy. A level >150 pg/mL may therefore be normal
- More details can be found in the 2014 BSH guidelines: http://www.b-s-h.org.uk/guidelines/guidelines/diagnosis-of-b12-and-folate-deficiency/

INDICATIONS

- Classical symptoms of B_{12} include megaloblastic anaemia and neurological compromise e.g. peripheral neuropathy or sub-acute combined degeneration of the cord (which may occur in the absence of anaemia); although non-specific symptoms may also occur e.g. memory loss, breathlessness
- Early treatment is essential to avoid permanent neurological disability
- Where symptoms/signs of B_{12} are present refer to the management in **Flowchart 1**
- if serum cobalamin within reference range >200 pg/mL with high clinical suspicion of deficiency, discuss with duty biochemist before checking methylmethanoic acid (MMA) levels (taken pre-treatment)
- If symptoms/signs of B_{12} are absent – refer to **Flowchart 2**
- All patients with anaemia, neuropathy or glossitis and suspected of having pernicious anaemia, should be **tested for anti-intrinsic factor antibodies (anti-IFAB)** regardless of cobalamin levels
- Anti-GPC antibody testing for diagnosis of pernicious anaemia is not recommended
- If low serum cobalamin levels found in absence of anaemia and patient does not have food malabsorption/other causes of deficiency, screen for anti-IFAB to identify early/latent presentation of pernicious anaemia

TREATMENT

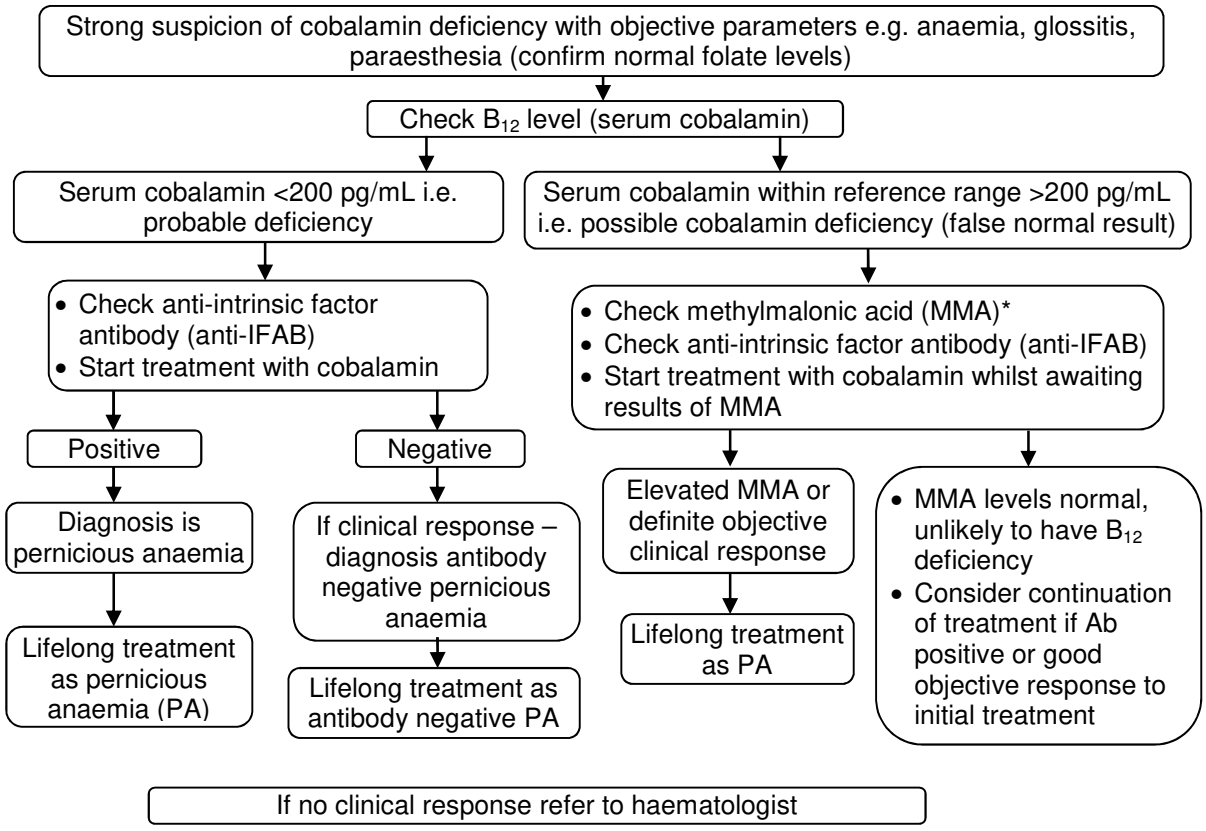
- Dietary sources of B_{12} include eggs, milk/dairy products, salmon, fortified products e.g. cereals
- Prescribe vitamin B_{12} as hydroxocobalamin
- Treatment regimens are dependent on symptoms/signs – see schedules outlined in the BNF
- Loading dose of IM hydroxocobalamin is required if neuropathy (1 mg alternate days with review at 3 weeks) or macrocytosis ± anaemia (1 mg 3 times per week for 2 weeks)
- Maintenance treatment is hydroxocobalamin 1 mg IM every 2–3 months depending on history of neurological symptoms
- **Do not routinely check B_{12} levels if patient receiving IM hydroxocobalamin**
- In the absence of neuropathy, where the cause is thought to be dietary, consider oral cyanocobalamin 50–250 microgram daily taken between meals (although higher doses <2000 mg may be required) and check B_{12} levels at 1–3 months
- Duration of B_{12} supplementation will depend on the cause of the deficiency and response
- When using oral cyanocobalamin caution regarding possible emerging pernicious anaemia

ASSESSING RESPONSE

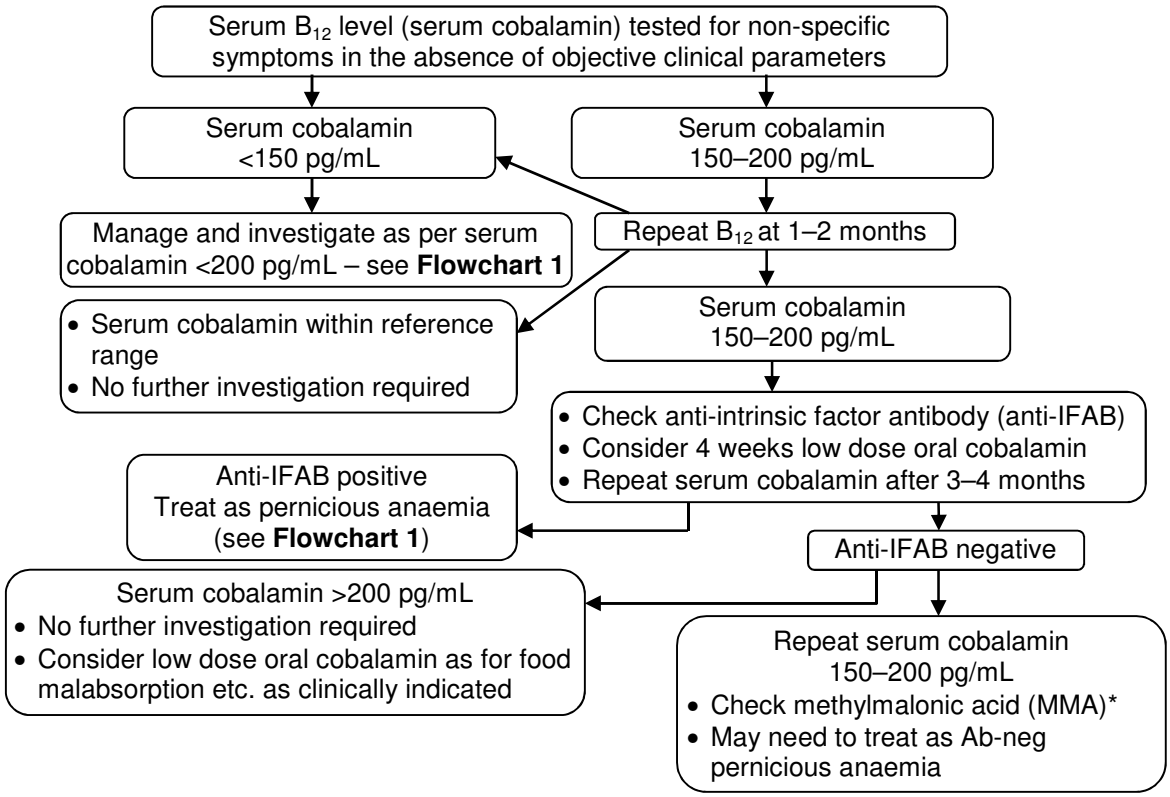
- Monitor for hypokalaemia after commencing B_{12} replacement and consider replacement
- If anaemia, assess reticulocyte response at 7–10 days
- Suboptimal response may indicate concomitant iron deficiency

INVESTIGATION AND MANAGEMENT OF SYMPTOMS OF B_{12} DEFICIENCY • 2/2

Flow chart 1: Management of low serum cobalamin (B_{12}) levels where symptoms/signs of B_{12} deficiency present



Flowchart 2: Management of low serum cobalamin (B_{12}) levels in the absence of objective clinical parameters



*after discussion with duty biochemist

INVESTIGATION AND MANAGEMENT OF FOLATE DEFICIENCY ● 1/1

BACKGROUND

- Folate refers to all the biologically active forms of the vitamin
- **Folic acid** is the synthetic form of folate used in supplements, fortified food and treatment
- Required for DNA synthesis hence earliest signs of deficiency seen in rapidly dividing cells e.g. bone marrow, gastrointestinal tract
- Status assessed through **serum folate levels**. **Caution: interpret in context of full clinical picture** e.g. 'false positive' reduced folate in normal pregnancy, anorexia, acute alcohol consumption, medications including anticonvulsant therapy
- May be associated with low serum cobalamin – treat with B_{12} before commencing folic acid
- Deficiency most commonly caused by low/insufficient dietary intake
- More details can be found in the 2014 BSH guidelines http://www.b-s-h.org.uk/guidelines/guidelines/diagnosis-of-b12-and-folate-deficiency/

INDICATIONS

- Serum folate <3 ug/L is indicative of folate deficiency (see above re 'false positive' results)
- If strong clinical suspicion of folate deficiency, despite a normal serum level, a red cell folate assay may be undertaken (having excluded cobalamin deficiency)
- Consult BNF and SPC to assess contribution of prescribed medicines to folate levels e.g. anticonvulsant therapy
- Assess patient with regards diet, alcohol consumption, gastrointestinal diseases (e.g. coeliac disease, IBD, liver disease, GI surgery), pregnancy status, exfoliative skin diseases, renal dialysis, medications and history/symptoms consistent with increased demand due to haemolytic anaemia

TREATMENT

- Dietary sources of folate include asparagus, broccoli, brown rice, chickpeas, sprouts, peas
- Follow schedules outlined in the BNF
- Folate deficient megaloblastic anaemia – 5 mg oral daily for 4 months (15 mg daily if due to malabsorptive states)
- Chronic haemolytic anaemia– 5 mg oral daily to weekly, depending on diet and rate of haemolysis
- Pregnancy 200–500 microgram oral daily as prophylaxis (5 mg oral daily to term as treatment dose)
- Supplement habitual poor dietary folate intake with 400 microgram oral daily
- Renal dialysis patients – note Renavit contains 1 mg folic acid. Give after dialysis. Discuss dosing of folic acid with pharmacy. Excess folic acid may cause dynamic bone disease

ASSESSING RESPONSE

- Monitor reticulocyte count and FBC parameters initially for megaloblastic anaemia
- Monitor serum folate level as dictated by clinical indication

INVESTIGATION AND MANAGEMENT OF IRON DEFICIENCY ● 1/4

BACKGROUND

- Up to 40% of anaemic patients have iron deficiency – iron deficiency anaemia (IDA)
- Serum ferritin levels most reliably correlate with relative total body iron stores
- Interpret ferritin with caution if infection or inflammation present, as levels can be high even in the presence of iron deficiency e.g. rheumatoid disease, liver disease, malignancy, hyperthyroidism, kidney disease, heavy alcohol intake, raised CRP/ESR
- Always ensure appropriate investigations for cause of iron deficiency are arranged according to patient history and age/co-morbidities:
  - OGD/colonoscopy/CT colonoscopy
  - urinalysis for haematuria
  - anti-tTG Ab for coeliac (+IgA levels) – if not previously done
  - gynaecological review where appropriate
  - consider stool screening for parasites as per travel history
  - consider screening for H.Pylori
- It is usually unnecessary to further investigate
  - healthy young people where there is a clear cause e.g. regular blood donors
  - menstruating young women with no history of GI symptoms or FHx colorectal cancer
  - pregnant women
  - patients who are terminally ill or unable to undergo invasive investigations
  - when management would not be influenced by the results e.g. severe comorbidity, potentially advanced age – as discussed with the patient and carers
  - patients who refuse further investigations
- Refer to specialist care where no cause has been found, IDA has recurred despite treatment or poor response to treatment

DIAGNOSTIC LABORATORY TESTS

- Absolute iron deficiency (AID) is supported by a ferritin <30 ng/mL (confirmed <15 ng/mL)
- AID likely where ferritin <100 ng/mL and CRP raised and/or transferrin saturation (TSATS) <20%
- In patients with established chronic kidney disease, iron deficiency supported by percentage hypochromic red cells (%HRC) >6% – where FBC processed within 6 hr of collection
- In patients with heart failure, iron deficiency supported by ferritin <300 ng/mL and TSTAS <20%
- In patients with ferritin >100 ng/mL, TSATS <20% likely indicates impaired iron mobilisation e.g. anaemia of chronic disease/anaemia of inflammation. Ensure optimal management of the underlying disease. Some patients may benefit from iron therapy

ORAL IRON

Indication

- Absolute iron deficiency +/- anaemia

Dose and duration

- Prescribe elemental iron 100 mg once daily where time/history allows – see **Table 1** e.g. Ferrous Sulphate 200 mg once daily, increasing to 400 mg once daily where tolerated
- Once daily dosing reduces side effects over 12-hrly/8-hrly dosing, with equivalent iron absorption
- Use concomitant laxatives where necessary
- If intolerance consider changing formulation, reducing dose or using alternate day dosing
- Continue oral iron for 3–6 months following normalisation of Hb/MCV/MCH (in absence of haemoglobinopathy) to ensure iron stores replenished
- Once iron replete, consider ongoing prophylaxis in people with ongoing risk of iron deficiency e.g. heavy menstrual bleeding
- Consider supplementary folic acid 400 microgram once daily where dietary intake poor
- Note oral iron absorption is reduced in the presence of inflammation e.g. post-operatively

Table 1: Oral iron dose according to iron preparation – aim 100 mg elemental iron per day

Ferrous Sulphate (dried)*	200 mg	65 mg
Ferrous Fumarate	200 mg	65 mg
Ferrous Gluconate	300 mg	35 mg
Ferrous Fumarate liquid (Galfer®)	140 mg/5 mL	45 mg/5 mL

* First choice oral iron preparation at UHNM
If vegan prescribe Sytron® (ferrous fumarate liquid 140 mg/5 mL)

Advice to patients

- To improve absorption, advise all patients that oral iron should be taken:
  - in the morning
  - with a source of vitamin C e.g. glass of orange juice or over-the-counter vitamin C tablet
  - away from other medications; especially proton pump inhibitors and antacid medications
  - away from tea, coffee and alcohol (as tannins reduce absorption)
  - away from calcium (including calcium-containing tablets and dietary sources e.g. dairy)
- Provide a patient information leaflet on oral iron – available UHNM intranet>clinicians>blood and blood products>Iron therapy support tools
- Signpost to 'Iron in your diet' leaflet available from NHS blood & transport – access online or request print version from UHNM transfusion team

Assessing response to oral iron

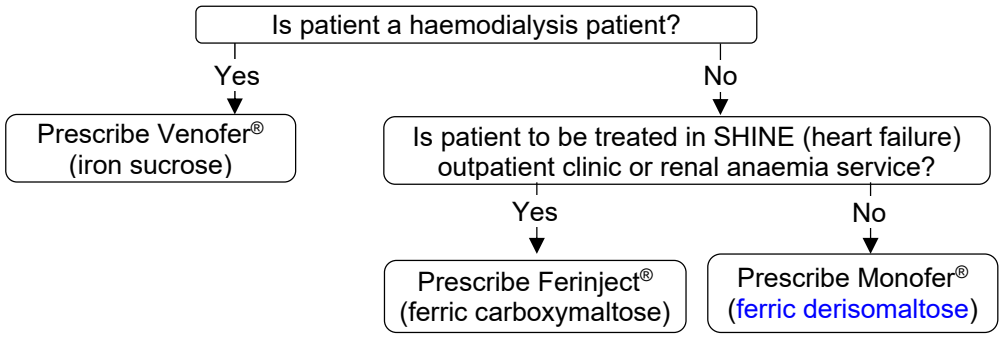
- Review tolerance and compliance at 1–2 weeks
- Schedule appropriate efficacy evaluation of iron supplementation according to initial Hb value, anaemia symptom severity and iron formulation
- Consider checking reticulocyte count and FBC parameters at 7–10 days (increased reticulocyte count demonstrates appropriate increased erythropoiesis)
- Repeat FBC and reticulocyte count (+/- ferritin) at 4–6 weeks to evaluate response
- Hb should improve at approximately 10 g/L per week, where no significant on-going blood loss
- Lack of response is defined as an Hb increase <20 g/L after 4 weeks treatment
- Continue oral iron for 3–6 months following normalisation of Hb/MCV/MCH (in absence of haemoglobinopathy) to ensure iron stores replenished
- After iron stores replenished; recommend monitoring FBC and ferritin every 3 months for 1 yr, then annually thereafter (or if symptoms of iron deficiency return)

INTRAVENOUS IRON

Indication

- Intravenous iron (IVFe) should be offered to patients with laboratory evidence of iron deficiency where oral iron is assessed as ineffective or inappropriate
- IVFe forms part of Patient Blood Management (PBM) strategies to optimise patient outcome and avoid unnecessary red cell transfusion
- IVFe has an evidence-based role in functional iron deficiency e.g. CKD, CCF and in patients receiving erythropoiesis stimulating agents (ESA/EPO)
- Choice of IV iron preparation at UHNM depends on patient history/location – see **Figure 1**

Figure 1: Parental iron preparations used in UHNM from January 2020



Dose

- Print and complete dedicated Monofer® prescription – available on UHNM intranet> clinicians>blood and blood products>Iron therapy support tools
- IVFe requirements depend on current and target Hb concentration, iron stores and patient weight; and must be individualised for each patient
- If patient at risk of **micronutrient deficiency** e.g. post bariatric surgery, use **ideal body weight** (IBW) to dose (or actual weight where lower)
- Otherwise, if **patient BMI>30**, cap dosing weight to equivalent BMI of 30 [see table on prescription chart or calculate using $Ht(m)^2$ x 30]
- Do not administer IV iron to patients with ferritin >800 ng/mL (consider dose reduction if ferritin >500 ng/mL)
- Monofer® maximum dose 20 mg/kg per infusion – administer single dose only

- Ferrinject® maximum dose 1000 mg (and 20 mg/kg) per infusion. Where second dose required, administer after ≥7 days
- Schedule efficacy evaluation at 4–6 weeks to assess if further dosing required
- Stop oral iron before IVFe administration, although consider restarting day +5 where appropriate
- Prescribe electronically where available (MedOnc)
- Concomitantly prescribe anaphylaxis medications (included in Monofer® prescription and on MedOnc)

Consent for IV iron

- Verbal consent should be obtained prospectively and documented in the medical notes
- Exclude first trimester pregnancy in women of childbearing age
- Consenting health professionals must be familiar with the product, indications and risk assessment
- Ensure patients have capacity to consent then discuss; indication, benefits, risks, alternatives, what if I don't have treatment?
- Consent must be individualized to each patient. **Table 2** provides an aide memoire only. Refer to individual product SPC for further details
- Provide a patient information leaflet on intravenous iron – available UHNM intranet >clinicians> blood and blood products > Iron therapy support tools
- Signpost to 'Iron in your diet' leaflet available from NHS blood & transport – access online or request print version from UHNM transfusion team

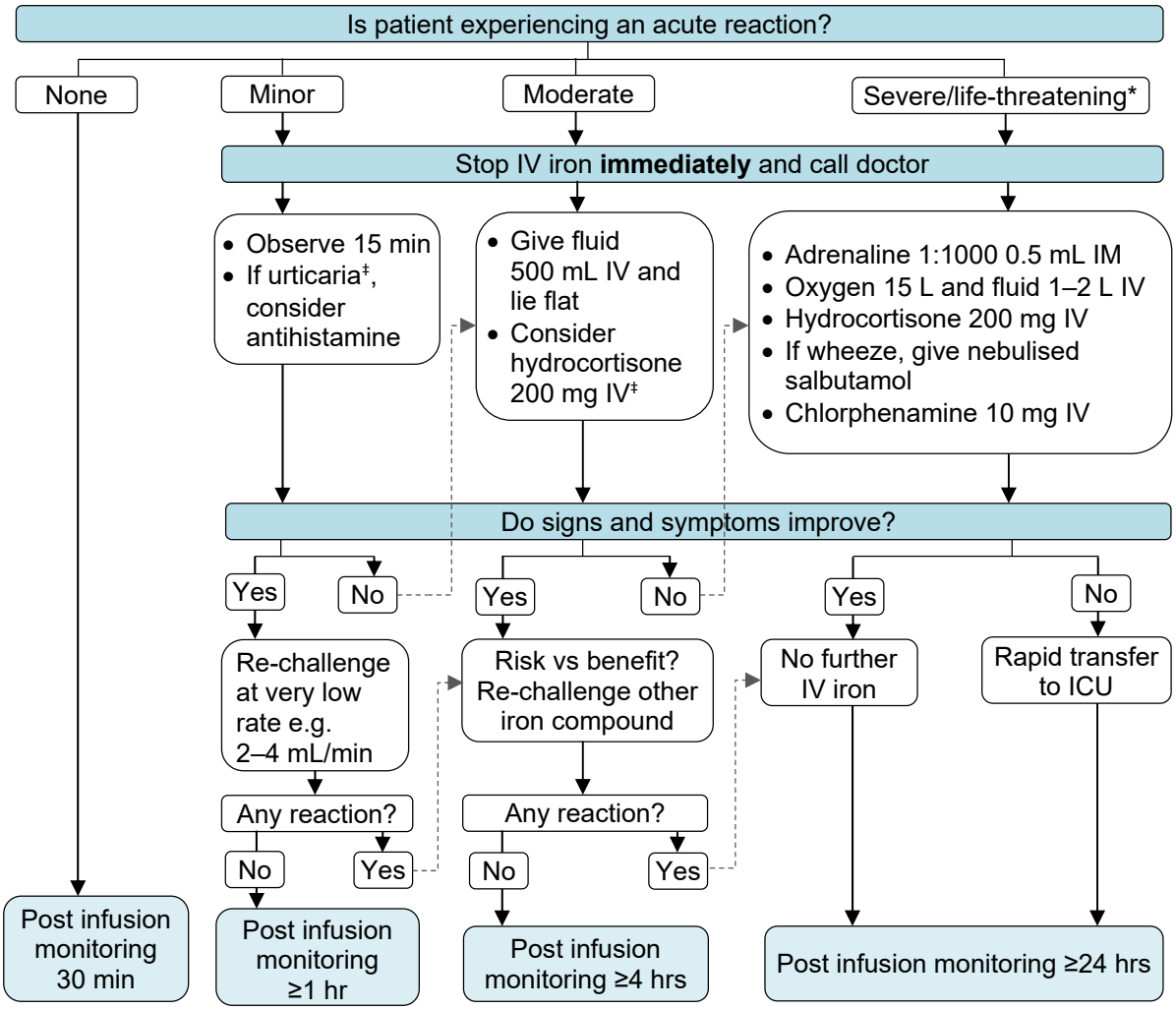
Table 2: Areas to cover when consenting for IV iron therapy

Areas to cover during consent	Comments
Indication	Treat iron deficiency (absolute and/or functional) and improve symptoms of anaemia/iron deficiency
Benefits (apply to situation)	• Bypasses oral absorption (and GI side effects) • Often provides complete iron replacement in single dose • Effective alternative to transfusion in IDA (avoids exposure to blood components, patient can remain a blood donor) • Pre-operatively – reduces risk of blood transfusion, reduces morbidity/mortality including length of stay
Risks • Infusion reactions[1] • Allergic reactions[2] • Skin staining[3] • Flare up of inflammatory conditions[4] • Headaches • Delayed reactions especially arthralgia[5]	[1] Occurs in 1:10–1:100 people. Termed hypersensitivity reaction (HSR). May include isolated symptoms e.g. IV site irritation, urticaria, GI symptoms, transient facial flushing with pain in back and chest – **responds to stopping the infusion and slower administration** (see **Figure 2: HSR flowchart**) [2] Range from mild to life-threatening. Risk of severe reactions very rare <1:250,000. Symptoms/signs include breathing difficulties, skin rash/itching/swelling, GI disturbance, low blood pressure [3] May be permanent. Follow cannulation SOPs and avoid 'back cannulation' (i.e. move up the arm if failed cannulation) [4] Include assessment for this in clinical decision making, rarely patients with rheumatoid arthritis may benefit from steroids [5] May occur from 30 min to 4 days post infusion. Use simple analgesia for arthralgia. If severe/concern contact health care professional promptly • Advise all patients they ◦ will be risk assessed at the time of dosing ◦ will be monitored closely by a health care professional during and for ≥30 minutes post infusion ◦ should report any symptoms or concerns to a health care professional **promptly**
Alternatives	Oral iron (discuss) ± red cell transfusion where appropriate (see policy C03) – adopt restrictive transfusion thresholds and single unit transfusion policy. **Do NOT** transfuse IDA patients without haemodynamic instability
What if I don't…	• Possible slower/suboptimal increase in Hb • Increased risk of requiring blood transfusion • Low iron stores impact on QoL/symptoms • Peri-operatively – potential increased length of stay/morbidity/mortality

Assessing response to IV iron

- Repeat FBC, reticulocyte count and ferritin (+/- TSATS) at 4–6 weeks and consider further IVFe or commencement/continuation of oral iron supplementation at this time point
- Frequency of monitoring thereafter will depend on individual clinical history – often FBC and ferritin 3 monthly for 1 yr, then annually thereafter (or if symptoms of iron deficiency return)
- Ensure it is clear who will monitor the patient
- Ensure appropriate investigations have been arranged where cause of IDA unknown (see above)
- Report any adverse events via MHRA yellow card scheme

Figure 2: Hypersensitivity (HSR) flowchart



* Anaphylaxis = acute onset persistent hypotension (↓ SBP <90 mmHg) or angioedema of tongue/airway or ≥2 of the following: skin/mucosal tissue involved ± respiratory compromise ± hypotension/end-organ dysfunction ± gastrointestinal symptoms

‡ Administration of H_1 antihistamines may result in inadvertent worsening of simple HSRs (through ↑ heart rate, ↓ blood pressure, ↑ somnolence). HSR responds to stopping the infusion then infusing more slowly. **Do not use antihistamines routinely**. Where urticarial consider ranitidine 50 mg IV. HSR may include isolated symptoms e.g. IV site irritation, urticarial, GI symptoms, transient flushing with pain in back and chest

CONSENT FOR TRANSFUSION (BLOOD AND BLOOD PRODUCTS) ● 1/1

Ideally, decision to transfuse is made with the patient or parent/carer and consent obtained in advance of a planned transfusion. This guideline applies to packed red blood cells (the usual "blood transfusion") and all other blood products

PROSPECTIVE CONSENT

- Before gaining consent, inform patient:
- reason for transfusion
- risks and benefits
- possible alternatives
- how the transfusion will be administered
- that following transfusion, they cannot donate blood
- If possible, provide written information
- Record discussion fully in patient's medical record
- note that it has been shown that patients retain only a minimal recollection of information given, and consider re-informing patients when seen for follow-up, or writing to them

RETROSPECTIVE INFORMATION

- In an emergency, it may not be possible to obtain valid consent. Discussion will be retrospective
- note specific guidance related to advance directives (see Trust intranet>clinicians>clinical-guidance>blood-and-blood-products>procedures)
- If patients told pre-procedure (e.g. pre-operatively) they *might* require a transfusion, inform them post-procedure whether they did/did not receive a transfusion
- Note that trauma transfer patients may have had blood products at another hospital or during transfer from scene of accident

LONG-TERM TRANSFUSION-DEPENDENT PATIENTS

- Modified consent is required and should include a discussion at the start of the transfusion regimen followed by regular updates including:
- benefits, risks and specific issues e.g. iron overload, risk of allo-immunisation including haemolysis risks (red cells) and platelet refractoriness (HLA antibodies), infective risks and other reactions

DISCHARGE

- Ensure patient is aware they have received a transfusion
- Record transfusion information in discharge summary

GUIDING PRINCIPLES OF TRANSFUSION INCLUDING ADMINISTRATION ● 1/5

For more detailed information refer to Trust Policy C03

BACKGROUND

- **Blood components** are derived from volunteer whole blood UK donors and include red cells, platelets, fresh frozen plasma (FFP), cryoprecipitate and granulocytes
- **Blood products** are medicinal products manufactured from non-UK sourced, pooled plasma e.g. Octaplas®, fibrinogen concentrate, IV immunoglobulin, albumin
- Blood transfusion is potentially hazardous and should only be undertaken when the benefits to the patient outweigh the risks
- Most adverse events are the result of administrative and clerical errors
- **Alternatives to transfusion should be used wherever possible**
- Clinical management (anaemia/thrombocytopaenia/deranged clotting) depends on the **underlying cause** and **clinical situation**
- National audits in England consistently show inappropriate use of all blood components; 15–20% of red cells and 20–30% of platelets/plasma
- Recipients of any blood components (or products) cannot be blood donors (as risk vCJD)

PATIENT BLOOD MANAGEMENT (PBM)

- Patient Blood Management (PBM) is a multidisciplinary approach to providing individualised, evidence-based transfusion practice for patients who may need a blood transfusion
- PBM minimises inappropriate and/or avoidable transfusion, supports best patient outcomes and allocation of finite NHS resources
- The '3-pillars' of PBM can be summarised as:
- **Maximise erythropoiesis** – identify, investigate and treat anaemia
- **Reduce bleeding** – anticoagulant management, surgical techniques, therapeutic agents
- **Optimise tolerance of anaemia** – oxygenation, disease management, restrictive transfusion thresholds

ASSESSMENT

- Anaemia is defined by WHO as Hb <130 g/L in men and Hb <120 g/L in non-pregnant women
- All anaemic patients should be identified and investigated to elicit underlying causes – see Trust policy C03 and medical guidelines
- The cause of anaemia should be treated wherever possible e.g. haematinic replacement
- Decision to transfuse should be based on the whole clinical picture; including cause of the abnormal results, current and historic laboratory parameters, symptom severity, underlying co-morbidities, clinical situation, bleeding risk of any procedure, risk of adverse events and patient choice
- Transfusion decisions may be made by a doctor, or a non-medical prescriber who has undertaken additional relevant training and competency assessment
- All patients must be risk-assessed for transfusion associated circulatory overload (TACO) before and after every unit transfused
- Always assess and document severity of anaemia symptoms and/or bleeding (see **Table 1** and **2**)

Table 1: Anaemia severity grading score

Severity score	Anaemia symptoms
Mild	Fatigue, shortness of breath on exertion
Moderate	Shortness of breath at rest, palpitations
Severe	Chest pain, symptoms of heart failure

Table 2: Modified World Health Organisation bleeding score

Bleeding grade	Description of bleeding
Grade 1	• Petechiae/purpura localised to 1 or 2 dependent sites, or sparse/non-confluent • Oropharyngeal bleeding, epistaxis <30 min duration
Grade 2	• Melaena, haematemesis, haemoptysis, fresh blood in stool, musculoskeletal bleeding, or soft tissue bleeding not requiring red cell transfusion within 24 hr of onset and without haemodynamic instability • Symptomatic oral blood blisters, i.e. bleeding/causing major discomfort. Multiple bruises, each >2 cm or any one >10 cm • Petechiae/purpura that is diffuse • Visible blood in urine • Abnormal bleeding from invasive or procedure sites • Unexpected vaginal bleeding saturating >2 pads in a 24 hr period • Bleeding in cavity – fluids evident macroscopically • Retinal haemorrhage without visual impairment
Grade 3	• Bleeding requiring red cell transfusion specifically for support of bleeding within 24 hr of onset and without haemodynamic instability • Bleeding in body cavity – fluids grossly visible • Cerebral bleeding noted on computed tomography (CT) without neurological signs and symptoms
Grade 4	• Debilitating bleeding including retinal bleeding and visual impairment* • Non-fatal cerebral bleeding with neurological signs and symptoms • Bleeding associated with haemodynamic instability (hypotension, >30 mmHg change in systolic or diastolic blood pressure) • Fatal bleeding from any source

'SINGLE UNIT POLICY'

- In the absence of active bleeding, use the minimum number of units required to achieve a target Hb threshold and improve symptoms
- **Each unit transfused is a treatment decision** – i.e. 1 unit RBC, 1 ATD platelets
- Assess every patient **clinically after each unit** transfused
  - have the symptoms/signs of anaemia (or thrombocytopaenia) resolved?
  - is there evidence of fluid overload (TACO)?
- Check Hb/platelet increment after each unit transfused (except in active bleeding, chronically transfused outpatients or where target threshold cannot realistically be achieved)
  - FBC can be performed at 15 min post transfusion (or consider blood gas for Hb check)
- Grade anaemia symptom severity especially if transfusing above recognised Hb thresholds

'TWO-SAMPLE RULE'

- Transfusion of ABO-incompatible blood is potentially fatal and occurs as a result of human error(s) in sampling/patient identification
- **ABO incompatible transfusion is a Department of Health 'never event'**
- In the **non-emergency setting**, blood components will only be issued when a patient's blood group has been confirmed via 2 independent samples e.g. a historic record
- Most recent G&S sample result will state if a second sample is required before the issue of blood components (although note the need for a second G&S will not delay the processing of a crossmatch sample)
- Second sample (where required) should be obtained **at a different time point using positive patient identification (PPID) at all stages**

CONSENT

- Valid consent for blood transfusion must be obtained and documented in the clinical record before transfusion
- Consent should include:
  - **indication** for transfusion
  - **benefits** e.g. symptom relief of heart failure/angina
  - **risks** including acute transfusion reactions, human error, fluid overload and delayed transfusion reactions (including antibody formation and transfusion related infections e.g. bacterial, viral, other)
  - **alternative treatments** available e.g. iron supplementation
  - that patient can **no longer be a blood donor**

- If patient is unconscious or unable to receive this information, obtain consent retrospectively/from patient's legal guardian
- Consent stickers should ideally be used for each transfusion episode (comes with first unit)
- At discharge, transfusion decisions, outcomes and adverse events should be included in the discharge summary
- Give patient information leaflets (PILs) to patients before transfusion (or retrospectively where not possible)

Jehovah's witnesses do not accept blood components (may accept blood products): Transfusion without consent is a gross physical violation. Discuss consequences of not transfusing. Record discussion in the medical notes and include a copy of the signed advanced decision document. For further advice see Trust policy C03 and contact the JW hospital liaison committee tel 07831 773793 (24 hr)
Use 'No blood' logo wristband – available from the transfusion team or blood bank

PRESCRIPTION

- Blood components/products can be prescribed by doctors or non-medical prescribers who have undergone additional training competency assessment
- Blood components should be prescribed on the fluid prescription of the drug chart
- Ensure the prescription includes;
- all **core patient identifiers** (full name, date of birth, NHS number)
- **component** type e.g. red cells, platelets
- **volume** e.g. 1 unit, 1 ATD
- specified **rate** (min) e.g. 120 min – depends on indications and risk of fluid overload/TACO
- **special blood requirements** (SBR) e.g. irradiated, HbS neg, Rh matched, 'no special blood requirements' (latter is just as important)
- additional medications e.g. diuretics
- It is the prescriber's responsibility to share information on SBR with the transfusion laboratory
- If unsure, refer to policy C03 and/or discuss with transfusion team
- From May 2017 all blood components are hepatitis E negative

REQUESTING BLOOD COMPONENTS

- Request form must be fully and legibly completed by a doctor or registered practitioner
- Full (accurate) patient identifiers must be used including NHS number (only RSUH currently accepts the hospital number)
- Person obtaining sample must sign the request form
- Compatibility testing must represent patient's current immune status

Patient transfused or pregnant within:	Valid G&S not to be taken more than:
3 days–3 months	72 hr before transfusion
>3 months	1 week before transfusion

- Timings of G&S validity may differ in chronically transfused patients with no allo-antibodies
- Telephone requests can be made to
- convert a G&S into a crossmatch (where valid G&S available)
- order non red cell blood components
- Always indicate the **urgency** of your request
- Use BloodTrack to identify if blood components are available for collection and to electronically generate demand slips (alternatively contact Sodexo with full patient details)

BLOOD SAMPLING FOR TRANSFUSION

- Patient must be wearing an approved wristband with full patient identifiers
- **Carry out positive patient identification (PPID):** Ask patient to state their full name and date of birth – check details given verbally by the patient match those on the wristband
- Check details on wristband identically match those on request form
- Take blood: 6 mL pink EDTA tube
- Fully label the sample bottle at the bedside **against the wristband** (no stickers allowed)
- Samples should only be labelled and signed by the person who has obtained the sample
- Illegible, misspelt or incorrect samples will be rejected by the laboratory (UHNM operates a 'Zero tolerance policy' i.e. no changes to labelling are permissible after sample receipt)
- Send G&S or crossmatch sample to lab with corresponding fully-completed request form

Use PPID and label from the wristband at the bedside

GUIDING PRINCIPLES OF TRANSFUSION INCLUDING ADMINISTRATION ● 4/5

UNKNOWN PATIENTS

- Minimal acceptable sample labelling comprises of temporary unique hospital number, gender and estimated date of birth (to indicate if special blood requirements indicated)
- Once unknown patient has been identified, new transfusion samples will be required
- Take crossmatch sample before administration of any blood components
- In the emergency setting, ABO specific blood will be issued in the absence of a confirmed blood group i.e. the 'Two-sample rule' does **not** apply in the emergency setting

COLLECTION/RECEIPT

- Blood components can only be collected by staff competency-assessed to do so
- **BloodTrack** is used to identify availability and location of blood components, to print demand slips and to log removal/placement of the components in designated blood fridges
- In areas without a satellite fridge, only one unit should be collected at a time (except renal dialysis unit and MHP activation)
- Receiving doctor/registered practitioner must check correct component has been delivered, arrive unit on BloodTrack enquiry and complete compatibility form (pink slip) with date/time received
- Transport blood components in designated transport bags, available from transfusion laboratory (or validated transport boxes where indicated)

Only ever store blood components in a designated blood refrigerator

ADMINISTRATION

- Blood components are viewed as medicines for administration purposes and prescribed medicines should only be administered by a medical officer, registered nurse, registered sick children's nurse or registered midwife
- Student nurses and trainee ODPs can be involved in the checking and administration of blood components under the direct supervision of a registered practitioner and must have their signatures countersigned
- Perfusionists may connect blood as directed by the anaesthetist who will take overall responsibility for the checking and administration of blood components
- Transfusions at night may proceed where there is a clear clinical indication, sufficient staffing levels to allow for safe monitoring of the patient and the patient's wishes have been taken into consideration

BEDSIDE CHECKS

- Two **independent** bedside checks must be undertaken by registered practitioners
- **Carry out positive patient ID (PPID) =** Ask patient to state his/her full name and date of birth and check these details match those on the patient's wristband **Check details** on patient's wristband (including NHS number) match full details on the prescription chart **and** the compatibility label (attached to unit)
- Check unique donation number and blood group on compatibility label matches that on unit
- Check unit complies with any special requirements on the prescription e.g. irradiated
- **Check quality** of blood component – inspect for leaks, discolouration and/or clots, check expiry date (to midnight on date of expiry)
- Record start/finish time/date on the compatibility form or 'pink slip' – this does **not** form part of the checking process
- **If any discrepancies found, do not transfuse**

Transfuse units as soon as possible
Complete within a maximum of 4 hr from leaving controlled storage

INFUSION

- Always use a standard blood transfusion giving set with **170–200 micron integral filter**
- Routinely change giving set every 12 hr or 3 units (sooner if delay between units anticipated) and use a new giving set for platelets (to avoid platelet clumping)
- Use an **electronic infusion pump** where available
- Administration times should be specified and may vary according to indication
- Use a **blood warmer** if clinically significant cold antibodies, as soon as possible after activation of the major haemorrhage protocol (MHP) and in all patients undergoing elective or emergency surgery requiring ≥500 mL fluids including blood components

- **Monitor patients closely** for fluid overload (TACO), allergic reactions (including TRALI)
- Any blood component connected to patient's IV access is regarded as 'transfused' for traceability purposes, even if unit was subsequently (partially) wasted
- **Pack-label stickers** can be used on the prescription chart to aid traceability

MONITORING

- Explain procedure and advise patient to report any symptoms of possible acute transfusion reactions
- Routine transfusion observations (temperature, pulse, BP, respiratory rate, oxygen saturations):
- <60 min pre-transfusion
- at 10–15 min
- <60 min of unit completion
- Perform observations more often where patient is unconscious, unable to report adverse events, at high risk of TACO or if an acute transfusion reaction is suspected
- Maintain a fluid balance chart (especially if at increased risk of TACO) and monitor IV access
- Observe patient throughout transfusion as appropriate monitoring aids early recognition of potential transfusion related adverse events

DOCUMENTATION

- It is a legal requirement to maintain a record of the fate of each donated unit for 30 years
- 100% compliance is required (transfusion team waste many hours chasing 'missing' units)
- Compatibility form (or 'pink slip'): record date/time of commencement (and completion) of each unit and both signatures of the doctor/registered practitioner who administered/checked unit
- Prescription chart: complete as per pink slip (NB unique donation number stickers are provided on pack label)
- BloodTrack: end fate unit as 'transfused' any blood component connected to patient's IV access even if unit was subsequently (partially) wasted
- County Hospital – sign and return pack labels to transfusion laboratory
- Medical notes: evaluate patient after each unit (clinically and laboratory results) and document outcome of transfusion and any adverse events. Include in discharge summary

STORAGE

- Each blood component is stored under 'optimal' conditions (see individual sections for details)
- Store red cells in designated blood refrigerators **only** (do **not** refrigerate platelets or cryoprecipitate)
- Administer components as soon as possible after receipt
- If unable to transfuse, return units to transfusion laboratory asap (within 30 min of leaving cold storage) so product can be safely re-issued to another patient
- Transfer boxes/disposable transport bags are validated for transport **not** for storage

CONTACT NUMBERS TRANSFUSION TEAM

Role	Availability	Contact no.
RSUH transfusion laboratory	Staffed 24/7 Use bleep <0900 hr or >1700 hr	74946/8 Bleep 390
County transfusion laboratory	Staffed 0600–2315 hr Use bleep 0600–0900 hr or 1700–2315 hr Requests outside these times (2315–0600 hr) must be made to transfusion laboratory at RSUH	4757 Bleep 4751 (Bleep 390)
Haematology consultant for transfusion	Tuesday, Thursday, Friday	74284/5 sec 71927 direct
Lead transfusion nurse	Monday–Friday. Pager 07623616520	72579
Transfusion nurses	Monday–Friday. Pager 07623950511	71909
Transfusion clerical assistant	Monday, Wednesday–Friday	71534

For further information refer to

- Trust policy C03 for full transfusion guidelines and relevant SOPs
- Trust intranet>Clinicians>Clinical guidance>Blood and blood products

ADVERSE REACTIONS TO BLOOD TRANSFUSION ● 1/5

BACKGROUND

- Human error is responsible for 1 in 3 transfusion related deaths
- Use **Positive Patient Identification (PPID)** at every step of the transfusion pathway to uphold patient safety. Ask patient to state his/her name and date of birth whilst checking against patient's wristband
- Patients must be encouraged to report any symptoms experienced during or following a transfusion

ACUTE TRANSFUSION REACTIONS (ATRS)

- **Acute transfusion reactions (ATRs)** occur during or <24 hr following a transfusion
- **Transfusion associated circulatory overload (TACO)** is the commonest cause of morbidity and mortality relating to transfusion
- For all suspected ATRs
- temporarily stop the transfusion
- confirm product against PPID and ensure component integrity
- perform full set of observations including fluid balance
- Categorise ATRs according to symptom severity to facilitate appropriate management and investigation
- Report moderate and severe ATRs via the trust DATIX system
- DATIX reporting enables appropriate investigation and reporting to SHOT/MHRA
- See **Flowchart: Recognition and primary management of ATR**, **Table 1** and **Table 2**

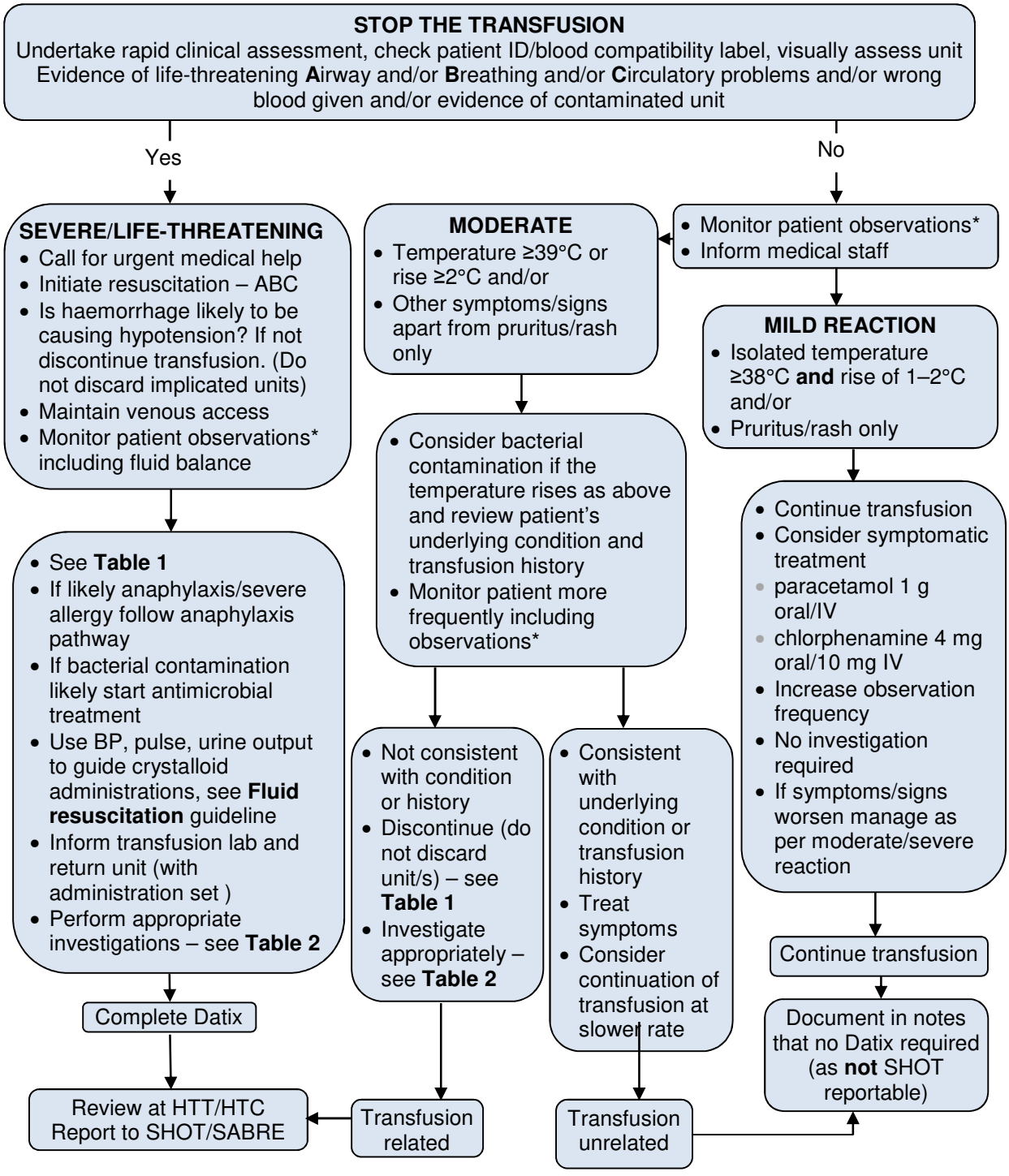
DELAYED ADVERSE REACTIONS

- Delayed haemolytic transfusion reactions (DHTR) occur >24 hr after transfusion in a patient who has been previously allo-immunised to a red cell antigen by blood transfusion or pregnancy
- Timings of G&S samples should reflect patient's current immune status although **allo-antibodies may be undetectable in pre-transfusion screening**
- Provide irradiated blood components where necessary to prevent transfusion-associated graft vs host disease (TaGVHD); where viable lymphocytes engraft and mount a fatal immune response in susceptible patients
- Viral transfusion transmitted infections are now very rare in developed countries
- Transmission of variant Creutzfeldt-Jakob disease (vCJD) remains a concern hence those patients born after 1/1/1996 should receive non-UK, virally inactivated plasma products; all patients who have received blood components or products must be informed that they can no longer be a blood donor

Delayed adverse reaction	Signs/symptoms
Delayed haemolytic transfusion reaction (DHTR)	Jaundice, fever, anaemia/poor increment, haemoglobinuria, possibly renal failure. Occurs <14 days post transfusion
Allo-antibody formation	Nil, but may have implications for future transfusion practice
Post-transfusion purpura (PTP)	Bleeding, thrombocytopenia 5–12 days post transfusion
Post-transfusion viral infection	Confirmation depends on extensive testing
Transfusion associated graft vs host disease (TaGVHD)	Fever, rash, diarrhoea, liver dysfunction, cytopaenia typically 7–14 days post transfusion – fatal
Iron overload	Deposition in liver, heart and endocrine organs resulting in organ failure (years)

RECOGNITION AND PRIMARY MANAGEMENT OF ATRs

Patient exhibiting possible features of an acute transfusion reaction, which may include: Fever, chills, rigors, tachycardia, hyper- or hypotension, collapse, flushing, urticaria, pain (bone, muscle, chest, abdominal), respiratory distress, nausea, general malaise



* Temperature, pulse, BP, respiratory rate, oxygen saturations, urine output and fluid balance

Table 1: Management of moderate/severe ATRs

Symptom	Management
ALL moderate/severe ATRs (generic management)	• Stop infusion immediately and replace giving set • Inform doctor and blood transfusion laboratory • Check patient identity and blood unit for compatibility using PPID • Check temperature, pulse, BP, respiratory rate and fluid balance • Resuscitate with crystalloid infusion according to **Fluid Resuscitation** guideline +/- furosemide IV aiming for SBP>100 mmHg, urine output >0.5 mg/kg/hr and euvolaemia • Send appropriate investigations (see **Table 2**) • Return all used blood components (with giving set) to transfusion laboratory with details of the reaction • Alert critical care outreach teams where appropriate • Contact transfusion team or on-call consultant haematologist where appropriate • Complete an adverse incident report/Datix • Contact renal team where ABO incompatible transfusion
Anaphylaxis	• See **generic management** above • Adrenaline 500 microgram IM (0.5 mL of 1:1000) • Chlorphenamine 10 mg IM or slow IV • Hydrocortisone 200 mg IM or slow IV • Salbutamol 5 mg nebulised (if bronchospasm) • See **Anaphylaxis** guideline • Alert critical care outreach teams
Fever/sepsis	• See **generic management** above • Refer to **Sepsis management** guideline • Alert critical care outreach teams where appropriate • Contact on-call consultant microbiologist where appropriate
Acute respiratory distress (non- anaphylaxis)	• See **generic management** above • Administer high flow oxygen – see **Oxygen therapy in acutely hypoxaemic patients** guideline • Administer diuretics with careful monitoring if ATR consistent with fluid overload (TACO) • Urgent mechanical ventilatory support may be needed in transfusion-related acute lung injury (TRALI) – worsened by diuretics • Alert critical care outreach teams where appropriate • Contact transfusion team or on-call consultant haematologist where appropriate
Hypotension	• See **generic management** above • If clinical condition dictates, transfuse compatible red cells e.g. during major haemorrhage • Alert critical care outreach teams
Allergy	• Chlorphenamine 10 mg IM or slow IV • Consider other measures as per anaphylaxis according to symptom severity

Table 2: Investigation of moderate/severe ATRs

Symptom	Differential diagnosis		Investigations	Colour tube
	Transfusion-related	Non-transfusion related		
ALL moderate/ severe ATRs (except allergic reactions with platelets/FFP)	• See below as guide	• See below as guide	• PT, APTT, fibrinogen • U&Es, LFTs • FBC & blood film • 'Transfusion reaction' and DAT • Haemoglobinuria	• Blue • Yellow/gold • Purple • Pink • Urine
Fever ≥39°C and/or >2°C rise and/or other symptoms • chills, rigors, myalgia, nausea, vomiting and/or loin pain	• Haemolysis • Bacterial contamination • Febrile non-haemolytic transfusion reaction (FNHTR)	• Sepsis • Underlying condition	• Blood cultures – peripheral and any lines • LDH and haptoglobin • Return units to transfusion lab (NHSBT will culture)	• Blood culture • Yellow/gold
Anaphylaxis	• Transfusion-related anaphylaxis	• Anaphylaxis - other e.g. drugs	• Mast cell tryptase levels – serial: immediate, 3 hr and 24 hr • IgA level (if <0.07 g/L and no hypo-gammaglobulinaemia, contact transfusion lab to exclude IgA antibodies)	• Plain • Yellow/gold
Allergic symptoms affecting ≥2 organ systems	• Allergy – transfusion related	• Allergy – other e.g. drugs	• IgA level (if <0.07 g/L and no hypo-gammaglobulinaemia, contact transfusion lab to exclude IgA antibodies)	• Yellow/gold
Hypotension Isolated decrease ≥30 mmHg resulting in SBP <80 mmHg	• Anaphylaxis • Haemolysis • Bacterial contamination	• Ongoing major haemorrhage • Underlying condition e.g. sepsis • Anaphylaxis (non-transfusion related)	• Investigate as per fever • If suspected severe allergy investigate as per anaphylaxis	• See above
Acute respiratory distress	• Anaphylaxis • Haemolysis • TACO • TRALI • Transfusion associated dyspnoea (TAD)	• Cardiac • Respiratory • Metabolic • Other	• Blood gas analysis • Chest X-ray • ECG • LDH and haptoglobin • If suspected severe allergy investigate as per anaphylaxis • If suspected TRALI discuss with transfusion team	• ABG • CXR • ECG • Yellow/gold • See above • Pink + red

- 'Haemolysis' refers to acute intravascular haemolysis i.e. an acute haemolytic transfusion reaction (AHTR)
- Rapid onset of loin/abdominal pain, a 'feeling of impending doom' and/or warmth along vein may represent an acute haemolytic transfusion reaction e.g. ABO incompatible transfusion
- In an unconscious patient, the first indication of ATR may include tachycardia, hypotension, bleeding

ALLERGIC TRANSFUSION REACTIONS AND FUTURE MANAGEMENT

- Most common with platelets (particularly apheresis) and plasma
- Occur early during transfusion (within 15 min for mild allergic, often within few minutes for severe)
- Increased incidence in patients with a history of hay fever (but not causal)
- Mild (>80% allergic reactions are mild) – affecting skin only e.g. rash, itching, hives
- Anaphylactic reactions affecting ≥2 organ systems can vary in severity from mild to life-threatening (vast majority the former)
- Risk of recurrence is very low (approximately <1:50 and even in 'frequent reactors' <1:20, although reactions may cluster)
- For management of future transfusions in patients with a history of allergic reactions see **Table 3**

Table 3: Management of future transfusions in patients with a history of allergic reaction

Allergic symptom severity	Management of future transfusions
Mild	• **No** role for pre-medication • Administer antihistamine if reaction re-occurs
Moderate	• **No** evidence for routine pre-medication • Monitor patient closely • Consider slower administration • Use pooled platelets in PAS • Administer antihistamine if reaction re-occurs • Consider pre-medication with non-sedating, long-acting antihistamine if history of chronic recurring reactions
Severe	• Avoid transfusion wherever possible (see **Red cell transfusion** guideline – **Alternatives to transfusion**) and uphold PBM strategies • Use plasma reduced products (i.e. pooled platelets in PAS or SD-FFP) • Pre-medicate with histamine H_1 (chlorphenamine or non-sedating antihistamine) and H_2 (cimetidine, ranitidine) receptor antagonists (**not** hydrocortisone) • Consider washed RBC/platelets (discuss with transfusion consultant/NHSBT) – especially if history of life-threatening reaction • If IgA antibodies – consider components from IgA deficient donors (discuss with transfusion consultant/NHSBT) • Administer slowly in closely monitored unit

- If pre-medication deemed appropriate consider non-sedating antihistamine, especially where patient known to have side-effects from chlorphenamine
- There is **no role for hydrocortisone pre-medication** – steroids are thought to be useful to suppress late phase reactions (so no role in anaphylaxis prophylaxis – consider administration if patient experiences moderate-severe allergic reaction)

CRYOPRECIPITATE ● 1/1

BACKGROUND

- Made by thawing UK donor FFP at 4°C (collected from UK volunteer whole blood donors), to produce a concentrated plasma product rich in fibrinogen, Factor VIII and von Willebrand factor
- Available as single-donor units (mean 43 mL) or pools of 5 units (mean 189 mL)
- Pools contain fibrinogen mean 1552 mg/pack (specification >700)
- Stored in controlled freezer at <–25°C for <36 months
- Once requested cryoprecipitate will be thawed at 37°C taking <20 min (use within 4 hr of thawing, **do not refrigerate**)
- Fibrinogen concentrate, a virally inactivated pooled plasma product, may be an available alternative for some patient cohorts (discuss with haematology team)

INDICATIONS

Discuss need for cryoprecipitate with haematologist before ordering (except MHP)

- Clinically significant bleeding and fibrinogen <1.5 g/L (<2 g/L in obstetric bleeding)
- Fibrinogen <1 g/L and pre procedure/surgery
- Bleeding associated with thrombolytic therapy
- Inherited hypofibrinogenaemia where fibrinogen concentrate is unavailable
- Consider in renal failure associated with abnormal bleeding where DDAVP is contraindicated or ineffective

DOSE

- Cryoprecipitate: dosed in pools (or mL/single donor packs in low body weight patients) – prescribe on fluid prescription of the drug chart
- Treatment dose of cryoprecipitate is 2 pools in an adult patient (or 1 single donor unit per 5–10 kg body weight)
- Assess every patient for risk of transfusion associated circulatory overload (TACO) and manage appropriately e.g. rate, diuretics, frequency of observations

ADMINISTRATION

- Transfuse as soon as possible after thawing using a standard blood giving set with a 170–200 micron filter
- If delay is unavoidable, store at ambient temperature and use within 4 hr
- Routinely administer each pool over 30–60 min (10–20 mL/kg/hr)
- Monitor patients closely for fluid overload (TACO) and allergic reactions (including TRALI)
- Any blood component connected to patient's IV access is regarded as 'transfused' for traceability purposes – even if unit was subsequently (partially) wasted

ASSESSING RESPONSE TO TRANSFUSION

- 2 pooled units are expected to increase fibrinogen by 1 g/L
- Assess patients clinically after cryoprecipitate transfusion to assess bleeding symptom severity and adverse events; especially signs/symptoms of respiratory distress (e.g. TACO, TRALI) and allergic reactions
- Assess laboratory parameters after each treatment dose of cryoprecipitate – PT/APTT and Clauss fibrinogen, plus near patient thromboelastography (TEG, ROTEM) where available

Methylene blue (MB) treated cryoprecipitate

- Virally inactivated, single donor, non-UK sourced plasma product potentially indicated for patients born after 01/01/1996 to minimise risk of transmission of vCJD
- Reduced fibrinogen and Factor VIII activity compared to standard cryoprecipitate

FRESH FROZEN PLASMA (FFP) ● 1/2

BACKGROUND

- Single donor FFP from male UK volunteer whole blood donors
- 1 unit mean volume = 275 mL (mean Factor VIII 0.83 – specification >0.7)
- Stored in controlled freezer at <–25°C for <36 months
- **Pre-thawed FFP** (5 day shelf life) **is available for major haemorrhage** (MHP activation)
- Once requested, prophylactic FFP will be thawed at 37°C taking <20 min
- Once thawed, stored in blood fridge at 4–6°C for <72 hr

Solvent Detergent FFP (SD-FFP, Octaplas LG®) or Methylene Blue Treated FFP (MB-FFP) should be given to those born after 1st January 1996

PATHOGEN – INACTIVATED FFP

- Indicated in patients born after 01/01/1996 to reduce the risk of transmission of vCJD
- Inactivates encapsulated viruses and bacteria
- Solvent detergent plasma (Octoplas LG®); standardised volume 200 mL, <1520 donors per batch, mean Factor VIII 0.8 (specification >0.5), mean fibrinogen 2.6 (1.5–4.0). Stored in controlled freezer at <-18°C for <4 yrs (shelf life 5 days post thaw)
- Methylene-blue treated FFP (MB-FFP); non-UK sourced, single-donor (43 mL) with reduced fibrinogen and Factor VIII activity

INDICATIONS

- Evidence supporting FFP use is sparse. Prophylactic plasma transfusion appears to be associated with increased patient morbidity
- PT/APTT ratios reflect coagulation function in vitro, not what actually happens in the body (as they measure clotting - not the natural inhibitors; protein C, protein S, antithrombin)
- FFP is **not** indicated to reverse warfarin, unless prothrombin complex concentrate (PCC) is contraindicated/unavailable

Discuss need for FFP with haematologist before ordering (except MHP)

- Upfront in major haemorrhage until bleeding is under control (at least 1:2 ratio FFP:RBC and aim for 1:1 in 'code red' trauma and vascular surgery – with the exception of obstetrics). See **Major haemorrhage policy** on Trust intranet>Clinicians>Clinical guidance>Blood and blood products>Procedures
- Clinically significant bleeding (WHO grade ≥2 – see **Table 2** in **Guiding principles of transfusion including administration** guideline) associated with coagulopathy (APTT ratio/INR>1.5) in the absence of major haemorrhage
- Pre-procedural prophylactic plasma use is dependent on the cause of the abnormal clotting results, PT/APTT ratio and the bleeding risk of the procedure – **consider** if PT ratio/INR>1.5 pre-invasive procedure with risk of clinically significant bleeding
- **Not** routinely indicated in chronic liver disease (CLD) with INR ≤2.0 pre-procedure. Remember patients with CLD and prolonged INRs may still be hypercoagulable. See **Coagulopathy** in **Acute liver failure with encephalopathy** guideline
- Replacement of single coagulation factor deficiencies, where a specific or combined factor concentrate is unavailable e.g. factor V deficiency
- Thrombotic thrombocytopenic purpura (TTP) in conjunction with plasma exchange – use SD-FFP/Octoplas LG®
- Acute disseminated intravascular coagulation (DIC) in the presence of bleeding and abnormal coagulation results

DOSE

- Fresh frozen plasma (FFP) – dosed in units [or mL in low weight patients or those at high risk of transfusion associated circulatory overload (TACO)] – prescribe on fluid prescription of the drug chart
- Adult treatment dose of FFP is **12–15 mL/kg = 4–6 units**
- Octaplas treatment dose 12–15 mL/kg dosed in mL (200 mL per unit)
- Assess every patient for risk of TACO and manage appropriately e.g. rate, diuretics, frequency of observations

FRESH FROZEN PLASMA (FFP) ● 2/2

ADMINISTRATION

- Transfuse as soon as possible after thawing using a standard blood giving set with a 170–200 micron filter
- Routinely administer each unit FFP/SD-FFP over 20–30 min ('stat' if MHP)
- If delay is unavoidable, store at controlled temperature (4–6°C) or complete within 4 hr of thawing if stored at ambient temperature
- Monitor patients closely for fluid overload (TACO) and allergic reactions (including transfusion related acute lung injury (TRALI)
- Any blood component connected to the patient's IV access is regarded as 'transfused' for traceability purposes – even if the unit was subsequently (partially) wasted
- Assess frequently during transfusion as high risk of fluid overload

ASSESSING RESPONSE TO TRANSFUSION

- Therapeutic doses of plasma (15 mL/kg) typically raise clotting factor levels by 20%
- Plasma is unlikely to correct INR to below 1.8
- After each treatment dose, assess and document
- bleeding severity score (see **Guiding principles of transfusion including administration** guideline – **Table 2**)
- laboratory parameters [PT/APTT and Clauss fibrinogen, plus near patient thromboelastography (TEG, ROTEM) where available and relevant]
- adverse events; especially signs/symptoms of respiratory distress (e.g. TACO, TRALI) and allergic reactions

For further information refer to

- Trust policy C03 for full transfusion guidelines and relevant SOPs
- Trust intranet>Clinicians>Clinical guidance>Blood and blood products

PLATELET TRANSFUSION ● 1/2

BACKGROUND

- Collected from UK volunteer whole blood and/or apheresis platelet donors
- Pooled buffy coat platelets (4 donors in 'platelet additive solution'); mean volume 308 mL, mean platelets 308 $x10^9$/unit (165–500), <0.3 mL red cells
- Apheresis platelets; mean volume 199 mL, mean platelets 280 $x10^9$/unit (165–510)
- Stored in controlled temperature 20–24°C with agitation for <7 days (including bacterial screening)
- There is no need to agitate platelets after removal from cold storage

INDICATIONS

- Indications for platelet transfusion can be broadly divided into
- **prophylactic** (WHO bleeding grade 0–1) – to prevent bleeding
- **pre-procedure** – to prevent bleeding expected to occur during surgery/invasive procedures
- **therapeutic** (WHO bleeding grade ≥2) – to treat active bleeding
- Assess WHO bleeding score (see **Table 2** in **Guiding principles of transfusion** guideline)
- Patients who may require platelet transfusion include those with
- bone marrow failure (BMF); reversible associated with treatable disease and/or chemotherapy and occasionally chronic irreversible BMF e.g. Myelodysplastic syndromes
- thrombocytopenia in critical care
- peripheral platelet consumption/destruction e.g. DIC
- abnormal platelet function; inherited or acquired disorders e.g. uraemia
- **Specific indications** for platelet transfusions in adults are detailed in table 1 as thresholds are dependent on the procedure/surgery
- In patients with inherited or acquired platelet disorders/abnormal platelet function, discuss transfusion with haematology first
- Platelet transfusion may be inferior to standard care in patients on anti-platelet agents with spontaneous intra-cerebral haemorrhage
- In some situations target platelet thresholds may not be achievable and individual case review is required

CONTRAINDICATIONS (unless life-threatening haemorrhage)

- Thrombotic thrombocytopenic purpura (TTP)

ALTERNATIVES TO PLATELET TRANSFUSION

- Apply surface pressure and correct any surgical causes
- Review/stop anticoagulants/antiplatelet drugs
- Consider tranexamic acid
- Uraemia with bleeding – dialysis, correct anaemia, consider desmopressin
- Inherited platelet function disorders – consider desmopressin
- If fibrinogen <1.5 g/L with severe bleeding – replace (see cryoprecipitate)

DOSE

- Platelets – dosed as 1 adult treatment dose (1ATD) – should be prescribed on the fluid prescription of the drug chart
- Adult treatment dose of platelets is **1 ATD**
- **Each single ATD platelets transfused is a treatment decision**
- Assess every patient for risk of transfusion associated circulatory overload (TACO) and manage appropriately e.g. rate, diuretics, frequency of observations

ADMINISTRATION

- Transfuse as soon as possible after component arrives using a standard blood administration set with a 170–200 micron filter
- **Do not** transfuse platelets through an administration set that has already been used to administer red blood cells (to avoid platelet clumping)
- Check product for signs of deterioration/bacterial contamination before use e.g. clumping/discolouration, damage to bag
- Transfusion rate depends on clinical situation/patient history and must be specified (typically 20–30 min per ATD if low risk of TACO, 30–60 min per ATD if high risk of TACO or 'stat' over 5–10 min if MHP)

PLATELET TRANSFUSION ● 2/2

ASSESSING RESPONSE TO TRANSFUSION

- 1 ATD typically increases platelet count by 20–40 x 10^9/L
- Platelet increment reduces with repeated platelet transfusions, even in the absence of allo-immunisation
- Platelet increment in patients with chronic liver disease may be lower but platelet activity is increased due to higher circulating von Willebrand factor
- **Assess patients clinically after each ATD** to assess bleeding symptom severity and signs/symptoms of adverse events including TACO (fluid overload) and TRALI
- **Assess laboratory parameters** after each unit (repeat FBC@≥15mins) to assess if target platelet threshold achieved

Table 1: Indications and thresholds for platelet transfusion (BCSH guidelines 2016)

Indication	Transfusion indicated (platelet threshold)
Prophylaxis (no bleeding or WHO grade 1)	
Reversible bone marrow failure (BMF) including stem cell transplantation (although consider no prophylaxis in autologous stem cell transplantation)	10 x 10^9/L
Critical illness	10 x 10^9/L
Chronic BMF receiving intensive therapy	10 x 10^9/L
Chronic BMF to prevent persistent bleeding of grade ≥2	Count variable
Chronic stable BMF (e.g. on low dose oral chemo or azacitadine) Abnormal platelet function Platelet consumption/destruction e.g. DIC, TTP Immune thrombocytopenia e.g. ITP, HIT, PTP	Not indicated
Prophylaxis in presence of risk factors for bleeding e.g. sepsis, antimicrobial treatment, abnormalities of haemostasis – consider	
Reversible BMF/chronic BMF on intensive therapy/critical illness	10–20 x 10^9/L
Abnormal platelet function; platelet consumption/destruction e.g. DIC, TTP; immune thrombocytopenia e.g. ITP, HIT, PTP	Not indicated
Platelet transfusions pre-procedure	
Central venous catheter insertion (excluding PICC)	20 x 10^9/L
Lumbar puncture	40 x 10^9/L
Percutaneous liver biopsy	50 x 10^9/L
Major surgery	50 x 10^9/L
Epidural anaesthesia, insertion and removal	80 x 10^9/L
Neurosurgery or ophthalmic surgery involving posterior segment of the eye	100 x 10^9/L
Bone marrow aspirate +/- trephine PICC line insertion Traction removal CVCs Cataract surgery	Not indicated
Therapeutic use (WHO bleeding grade 2 or above)	
Multiple trauma Brain or eye injury Spontaneous intracranial haemorrhage	100 x 10^9/L
Severe bleeding	50 x 10^9/L
Bleeding (WHO grade 2 but not severe)	30 x 10^9/L

PROTHROMBIN COMPLEX CONCENTRATE (OCTAPLEX®) TRANSFUSION ● 1/3

BACKGROUND

- 4-factor PCC is a manufactured plasma product containing clotting Factors II, VII, IX and X, plus the natural anticoagulant proteins C and S
- Available as Octaplex® 500 IU or 1000 IU coagulation factor IX
- Store in controlled temperature <25°C for <2 yr
- Once requested keep in controlled storage at 2–8°C until required
- **Only use PCC where clinically indicated as administration may exacerbate underlying pro-thrombotic states**
- There is small risk of disseminated intravascular coagulation (DIC), particularly with repeated dosing
- **Clinician direct access** from the transfusion laboratory is available for agreed indications to ensure prompt treatment provision in recognised indications – [(RSUH: 0900–1700 hr call 74948 or out-of-hours bleep 390) (County: 0900–1700 hr call 4758 or <midnight bleep 4751)]
- for further details and relevant SOPs see Trust policy C03 or Blood and blood products intranet page

INDICATIONS

- Treatment of patients receiving warfarin or alternative vitamin K antagonists (VKA) experiencing major bleeding i.e. life, limb or eye-threatening bleeding. Includes high clinical suspicion of major haemorrhage pre-imaging
- Patients receiving warfarin or VKA requiring surgery or invasive procedure within the next 6–8 hr, due to clinical urgency only
- May be indicated for patients with major bleeding/pre-operatively receiving direct oral anticoagulants (DOACs) apixaban, rivaroxaban, edoxaban – see guidelines and seek advice from consultant haematologist (see STAC guideline '**Management of Bleeding in Patients on Antithrombotic Therapy**')
- May be indicated for patients with other acquired coagulopathies (e.g. liver disease, cardiac surgery) where there is high risk of transfusion associated circulatory overload (TACO) – seek advice from consultant haematologist

CONTRAINDICATIONS

- Hypersensitivity to the active substance or any of the excipients (see SPC)
- Known allergy to heparin or history of heparin induced thrombocytopenia (HIT)

DOSE

- Dosed in 'international units' (IU) as multiples of 500 IU
- Maximum single dose 3000 IU (120 mL)

For anticoagulant reversal

- Dosed at 25–50 IU/kg according to patient weight and INR (where known) as advised by transfusion laboratory SOP (see **Table 1** and **2**, plus flowchart below)
- **Do not await INR** or imaging if high clinical suspicion of major haemorrhage – especially if suspected intracranial bleeding
- For warfarin reversal always **ensure vitamin K (phytomenadione) 5 mg IV has been prescribed and administered** – as PCC immediately (but only temporarily) reverses the anticoagulant effects of warfarin
- Ensure anticoagulant has been omitted
- Repeat INR 10–20 min post administration (see below re assessing response)

Table 1: PCC dose if major bleeding or urgent surgery/procedure but valid INR not yet available

Weight (kg)	PCC dose (25 units/kg)
≤60	1500 units
61–80	2000 units
81–100	2500 units
>100	3000 units

PROTHROMBIN COMPLEX CONCENTRATE (OCTAPLEX®) TRANSFUSION ● 2/3

Table 2: PCC dose if major bleeding or urgent surgery/procedure plus INR available and valid (i.e. taken within 8 hr and assess possible impact of previous vitamin K use)

INR	Weight (kg)	PCC issue	PCC dose
1.6–1.9	n/a	500 iu	
2.0–3.5	≤60	1500 units	25 units/kg
	61–80	2000 units	
	81–100	2500 units	
	>100	3000 units	
3.6–5.0	≤60	2000 units	33 units/kg
	61–75	2500 units	
	>75	3000 units	
>5.0	≤60	2500 units	40 units/kg
	>60	3000 units	

As low volume FFP alternative

- Treat each 500 IU PCC as a treatment decision and evaluate clinically ± NPT post dose
- 1 IU PCC has equivalent clotting factor activity to 1 mL plasma (500 IU approximately equivalent to 2 units FFP)

ADMINISTRATION

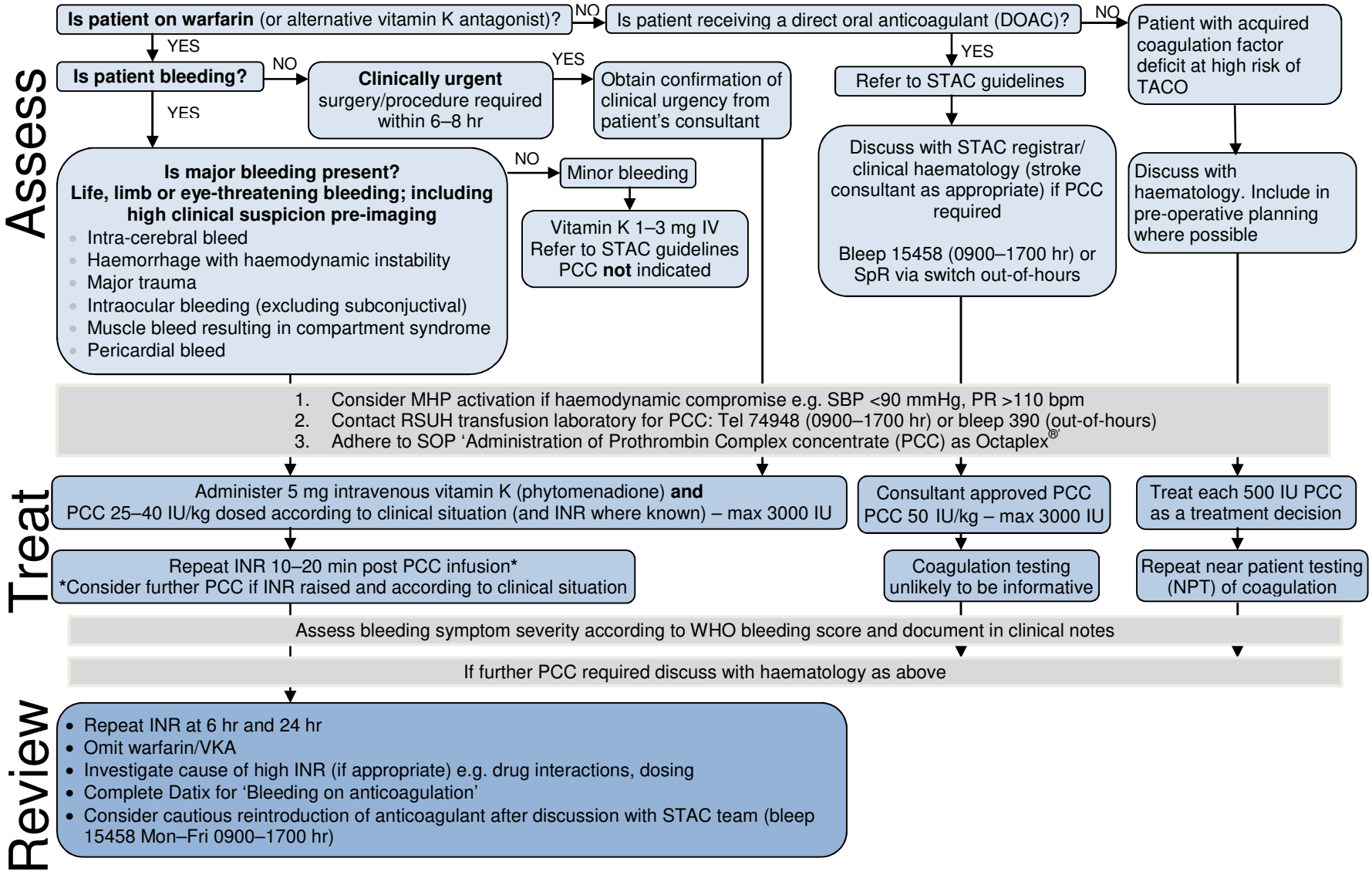
- Commence infusion at 1 mL/min and observe closely for allergic reactions/anaphylaxis
- In major bleeding increase rate to 8–10 mL/min under direct clinical instruction
- Pre-surgery/procedure increase rate to 2–3 mL/min
- Return unused PCC to transfusion laboratory as soon as possible to avoid wastage

ASSESSING RESPONSE TO TRANSFUSION

- Post PCC administration, assess and document bleeding symptom severity according to WHO bleeding severity score (see **Guiding principles of transfusion** guideline **Table 2**)
- For warfarin reversal – repeat INR 10–20 min post PCC administration
- If adequate correction, recheck clotting after 4-6 hours then daily
- If INR ≥1.5 or suboptimal correction and further PCC may be required – seek advice from a consultant haematologist
- Monitor for adverse events of PCC usage – especially thrombosis
- Complete Datix where indication is ‘major bleeding on anticoagulation’ and discuss with STAC registrar on 15458

PROTHROMBIN COMPLEX CONCENTRATE (OCTAPLEX®) TRANSFUSION • 3/3

Flowchart: Direct clinician access to prothrombin complex concentrate (PCC)



RED BLOOD CELL TRANSFUSION ● 1/3

BACKGROUND

- Packed red blood cells (RBC) in SAG-M additive solution, 280 ± 60 mL, Hct 0.5-0.7
- Collected from UK volunteer whole blood donors i.e. allogeneic
- Stored in controlled temperature at 2–6°C for <35 days
- Only store red cells in designated blood fridges
- Allocated RBC routinely derequisitioned (i.e. returned to stock) at 24 hr
- Areas without a satellite fridge should collect 1 unit of blood at a time (except renal dialysis patients and MHP activation)

INDICATIONS

- Red cells are used to restore oxygen carrying capacity in patients with anaemia or blood loss, **where alternative treatments are ineffective or inappropriate**
- **Decision to transfuse** should be based on the whole clinical picture; including cause of anaemia, chronicity, current and historic laboratory parameters, symptom severity, underlying co-morbidities and patient choice; not just the haemoglobin value (see **Table 1** for guidance)
- **Regard each unit of red blood cells transfused as a treatment decision**
- Blood transfusion is associated with significant risk and its use should be minimised wherever possible
- use the minimum number of units required to achieve target Hb/relieve moderate-severe symptoms i.e. **single unit transfusion policy**
- use **alternatives to transfusion** wherever possible and appropriate
- do not transfuse stable patients with iron deficiency anaemia – give iron
- where evidence suggests no harm from withholding transfusion, **uphold restrictive thresholds**
- Restrictive transfusion thresholds (versus liberal thresholds) result in equivalent patient outcome, reduced blood usage and reduced transfusion-associated morbidity in the populations studied (plus conserve finite resources)
- Patients with cardiovascular disease, especially acute MI, likely require a more liberal threshold
- Except in circumstances where patient's condition is life threatening, the patient must be given time to ask questions and to make a decision to proceed with transfusion
- Always document indication for transfusion and consent in the medical notes

Table 1: Indications and benefits of red cell transfusion based on NBTC (2016) indication codes for transfusion

Code	Indication for RBC transfusion	Benefit	Target Hb	Threshold for transfusion*
R1	**Acute blood loss** with haemodynamic instability/uncontrolled haemorrhage	Save life	70–90 g/L (once haemodynamically stable)	n/a
R2	**Recoverable anaemia** in a haemodynamically stable patient e.g. post op, IDA	Improve short term outcome	70–90 g/L	<70 g/L†
R3	As per R2 in patients with **known cardiovascular disease**	Improve short term outcome	80–100 g/L‡	<80 g/L†
R4	**Chronic transfusion dependence** e.g. bone marrow failure (MDS, thalassaemia)	Improve quality of life	Individual to patient (depending on cause and response)	Start at 80 g/L and adjust as required
R5	**Radiotherapy** (weak evidence)	Improved response to therapy		Consider if <110 g/L in cervical cancer
R6	**Exchange transfusion** e.g. sickle cell disease, HDFN	Replace red cells and treat/prevent symptoms	n/a	n/a

* Decisions to transfuse are based on more than Hb level (see text above)
† Do not transfuse stable patients with iron deficiency anaemia – give iron (consider IV iron as transfusion alternative)
‡ Higher restrictive threshold also currently supported in cardiac surgery (75 g/L), orthopaedic surgery, haemato-oncology patients and acute coronary syndrome – pending further RCT evidence

Acute blood loss

- Blood loss of >20–30% (where average circulating blood volume is 70 mL/kg) with on-going bleeding will likely require urgent transfusion – aim to use cell salvage where possible to minimise allogeneic transfusion requirements
- See specific guidelines, including **Acute upper gastrointestinal haemorrhage** guideline and **Major haemorrhage pathway** on Trust intranet>Clinicians>Clinical guidance>Blood and blood products

Anaemia

- See **Chronic anaemia** guideline, **Investigation and management of symptoms of B_{12} deficiency/Investigation and management of folate deficiency** guidelines where appropriate

ALTERNATIVES TO TRANSFUSION

- Blood transfusion is associated with significant risk and its use should be minimised wherever possible
- Use alternatives to allogeneic transfusion wherever possible and appropriate e.g. oral or intravenous iron, B_{12}/folate supplementation. Consider erythropoietin stimulating agents, although note issues regarding funding
- Optimise oxygenation and management of underlying medical conditions to improve tolerance of anaemia and maximise erythropoiesis

DOSE

- Uphold a **'single unit transfusion policy'** = each single unit RBC transfused is a treatment decision (except in active bleeding). Full clinical and laboratory evaluation required post transfusion – see below
- Red blood cells (RBC) – dosed in units (or mL in low weight patients e.g. <50 kg, who are at high risk of TACO) – prescribe on fluid prescription of the drug chart
- In the absence of active bleeding use the **minimum number of units required to achieve a target Hb** taking into account patient size
  - 1 unit RBC expected to raise Hb by 10 g/L in 70 kg patient (but note 1 unit = 220–340 mL)
  - 4 mL/kg RBC expected to raise Hb by 10 g/L (use in adult patients <50 kg)
- **Prior to every transfusion, assess all patients for risk of Transfusion Associated Circulatory Overload (TACO)** and manage appropriately e.g. slow infusion rate, diuretic use, increase frequency of observations
- Indicate special blood requirements (SBR) e.g. irradiated, HbS neg, Rh/Kell matched on prescription (see Trust policy C03 section 7.2 for screening questions and details)
- Note 'No SBR' just as important to document as e.g. irradiated

ADMINISTRATION

- Transfuse RBC as soon as possible after removal from designated temperature-controlled storage using a standard blood giving set with a 170–200 micron filter
- Complete transfusion within 4 hr of red cells leaving cold storage
- Transfusion rate depends on the clinical situation and patient history and must be specified (do **not** give a range on the prescription chart)
  - 90–120 min per unit if low risk of TACO
  - 3 hr per unit ± diuretics if high risk of TACO
  - 'STAT' through blood warmer if MHP (i.e. over 5–10 min)
- **If delay is unavoidable, return to designated controlled temperature storage as soon as possible** (within 30 min)
- Monitor patients closely for fluid overload (TACO)
- **Any blood component connected to the patient's IV access is regarded as 'transfused' for traceability purposes** - even if the unit was subsequently (partially) wasted
- Trace administration of components on BloodTrack (see **Guiding principles of transfusion including administration** guideline) – also used to assess availability of RBC and location

ASSESSING RESPONSE TO TRANSFUSION

- Assess every patient **clinically after each unit** transfused
- **have the symptoms/signs of anaemia resolved?** – document severity grade
- **is there evidence of fluid overload (TACO)?** – document any symptoms/signs
- Check **Hb increment** after each unit transfused (except in active bleeding, chronically transfused outpatients or where target threshold cannot realistically be achieved)
- repeat Hb can be performed from 15 min post transfusion as FBC or blood gas (latter for response assessment only)
- **Patients transfused to >20 g/L above target threshold are deemed 'over transfused'**
- Adhere to national guidance on transfusion indications wherever possible (see Table above) and document deviation rationale in the medical notes
- Fully document transfusion and any complications in medical and nursing notes (plus discharge letter)
- **Ensure definitive treatment also prescribed where appropriate** e.g. iron therapy

For further information refer to

- Refer to:
- Trust policy C03 for full transfusion guidelines and relevant SOPs
- Trust intranet>Clinicians>Clinical guidance>Blood and blood products

EMERGENCY RED CELLS

- Group O RhD negative blood cells are a finite resource and should only be used where clinically indicated i.e. Group O RhD negative patients and emergency situations (if required) whilst awaiting group specific blood
- Where a valid G&S is available in the lab, crossmatched blood (or group specific if inappropriate for electronic issue) can be available almost immediately
- Where no sample is available, group specific blood available within 15 min of sample receipt
- Take XM sample before group O red cell administration (NB 2-sample rule does **not** apply in emergency setting)
- Switch to group specific red cells as soon as available

Access

- Only staff who have undergone appropriate fridge training can access O RhD negative units (barcode required)
- Patient's unique ID (NHS number) must be entered in fridge kiosk when removing to aid traceability
- The A5 form included with the unit must be fully completed and sent back to transfusion laboratory as soon as possible to ensure traceability
- Inform transfusion laboratory immediately emergency units have been used so they can be replaced
- Location of group O RhD negative blood is detailed below:

Location of Group O RhD negative red blood cells for emergency use only

Royal Stoke – A&E	2 units*
Royal Stoke – Theatre -1-5	2 units*
Royal Stoke – Theatre Hub	2 units*
Royal Stoke – Main issue fridge (Pathology 2nd floor)	2 units*
Royal Stoke – Maternity	2 units* 1 unit for neonatal use (in green bag)
County- Main issue fridge (Pathology 1st floor)	8 units*

*Suitable for emergency paediatric use (but not neonatal)

INTRODUCTION OF AN ANGIOTENSIN-CONVERTING ENZYME INHIBITOR (ACEI) ● 1/1

INDICATIONS

- Left ventricular systolic dysfunction
  - patients with heart failure and left ventricular systolic dysfunction discharged on >50% target dose of ACEI have a mortality that is half that of patients on lower doses of ACEI
- Heart failure following myocardial infarction
- For use in uncomplicated hypertension see BNF

CONTRAINDICATIONS

- Tight aortic stenosis
- Bilateral renal artery stenosis
- Concurrent use of NSAID
- Pregnancy

INPATIENT PROCEDURE

- Initiate ACEI therapy under close clinical supervision in patients who are taking high doses of diuretics, have hyponatraemia or a low sodium diet, who are hypotensive, or who are dehydrated
- Check renal function and electrolytes before starting therapy
  - if eGFR <60, select appropriate dose from BNF, determined by chosen drug
  - if eGFR <30, discuss with SpR/consultant and consult BNF
- In order to avoid dangerous hyperkalaemia, review need for any potassium-sparing agent or potassium supplement, and stop if possible

Left ventricular systolic dysfunction

Preparation and first dose

- Profound first-dose hypotension may occur in hypovolaemic patients. Improve ability to tolerate ACEI by ensuring patient is not excessively dehydrated
- Ensure patient is supine. Give first dose of ramipril 1.25 mg oral
- In patients with BP <90 mmHg systolic before starting or if symptomatic, check BP after 1 hr

Titration of dose

- If patient has symptomatic hypotension with ACEI, ensure any non-prognostic medications that could induce hypotension are stopped to facilitate ACEI titration
- In patients with LVSD and persistent BP >120 mmHg systolic and who have no significant worsening of renal function in 24 hr, aim to increase ramipril dosage (usually by doubling dose) every other day to achieve target dose (10 mg daily or 5 mg 12-hrly) as quickly as possible
  - titrate ACEI to target doses in a more cautious fashion in other patients
  - aim to achieve target dose for LVSD irrespective of speed of titration

Monitor

- Check BP 6-hrly
- Recheck renal function 24 hr after increasing dosage
- Assess patients with worsening renal function to ensure they are not hypovolaemic (i.e. excessive diuretics), ensure non-essential potentially nephrotoxic medications stopped/reduced (as appropriate) before suggesting that ACEI has caused renal dysfunction

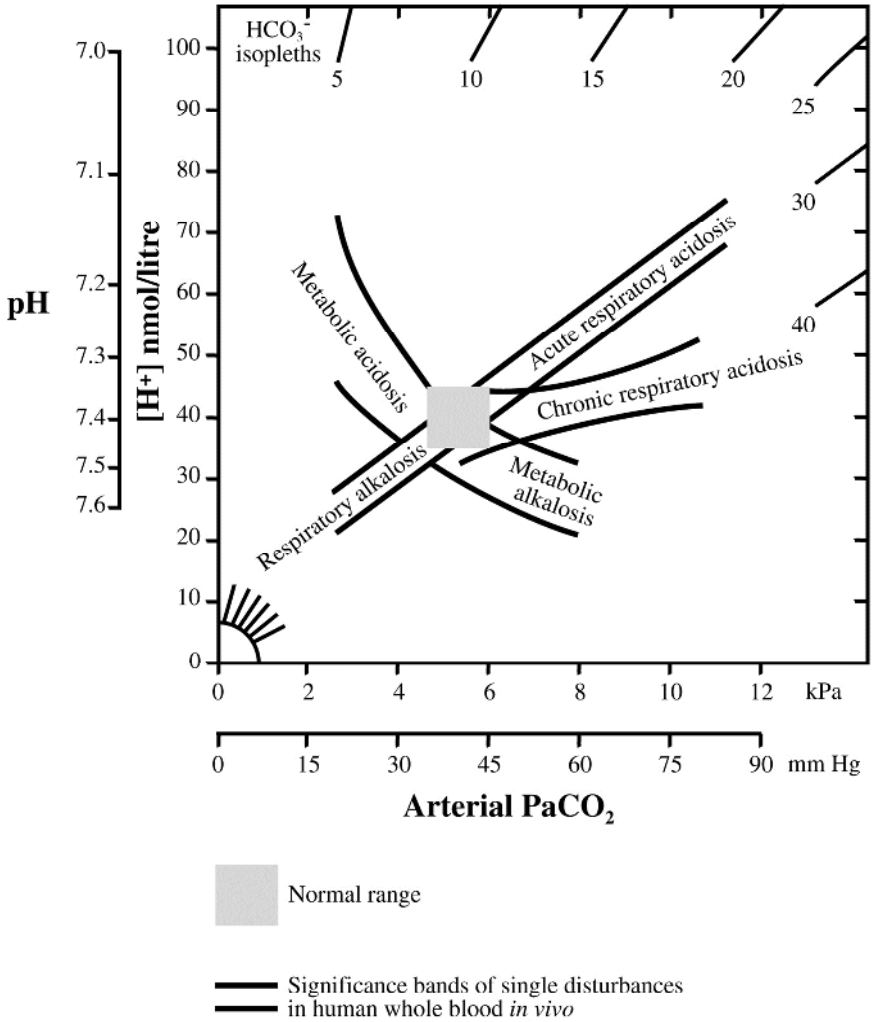
Myocardial infarction

- In normotensive/hypertensive patients, start treatment within 24 hr of infarction if there are no contraindications
- Give ramipril 2.5 mg oral 12-hrly for 2 days
  - if eGFR <30, start with 1.25 mg once daily for 2 days and recheck renal function
  - if eGFR >30, give 2.5 mg oral 12-hrly
- If treatment not tolerated (symptomatic fall in BP or BP <90 mmHg), reduce dose by half. Continue **only** if patient tolerates a maintenance dose of at least 2.5 mg oral 12-hrly (1.25 mg in elderly or in patients with eGFR <30)
- Recheck renal function 48 hr after starting therapy

DISCHARGE AND FOLLOW-UP

- Inform GP that an ACEI has been introduced

ACID-BASE DIAGRAM • 1/1



Ref: Flenley D.C. Lancet 1 921, (1971)

AMINOPHYLLINE ● 1/2

INDICATIONS

- Acute severe asthma
- Reversible airways obstruction

DOSAGE

- Appropriate drug concentration and infusion rate are determined by body weight, concurrent medical problems and drug therapy
- In obese patients (where actual body weight >120% of ideal body weight), use ideal body weight to calculate the dose – see **Ideal body weight guideline**
- In all other patients (including underweight patients), use actual body weight to calculate dose

Above weights should be used to calculate both maintenance and loading dose (if appropriate)

Loading

Give loading dose only if patient has NOT received any theophylline or aminophylline within last 24 hr

- 5 mg/kg (up to a maximum of 500 mg) IV by infusion over 20–30 min
- **dilute in 100 mL bag of diluent** (see **Diluents** below)
- Monitor heart rate continuously during infusion

Maintenance

- Risk of markedly reduced aminophylline clearance (i.e. increased serum concentration) requires a lower maintenance dose (0.25 mg/kg/hr) and includes
- elderly patients
- patients with liver failure, heart failure, viral infection or prolonged fever
- concurrent treatment with ciprofloxacin, clarithromycin, cimetidine, erythromycin, fluconazole, fluvoxamine, propranolol, allopurinol, oral contraceptives, and calcium channel blockers. Refer to **BNF Appendix 1** for full list of interactions

Maintenance dose for patients with markedly reduced clearance

- Give continuous IV infusion at 0.25 mg/kg/hr
- Add 250 mg (10 mL) to 500 mL of diluent after first removing 10 mL from the bag
- Concentration = 250 mg in 500 mL = 0.5 mg/mL

Table 1: Infusion rate (mL/hr) for a range of body weights (dosage 0.25 mg/kg/hr)

Weight (kg)	0.25 mg/kg/hr											
	40	45	50	55	60	65	70	75	80	85	90	95
Infusion rate (mL/hr)	20	23	25	28	30	33	35	38	40	43	45	48

Maintenance dose where clearance is not compromised

- Give continuous IV infusion at 0.5 mg/kg/hr
- Add 250 mg (10 mL) to 500 mL of diluent after first removing 10 mL from the bag
- Concentration = 250 mg in 500 mL = 0.5 mg/mL

Table 2: Infusion rate (mL/hr) for a range of body weights (dosage 0.5 mg/kg/hr)

Weight (kg)	0.5 mg/kg/hr											
	40	45	50	55	60	65	70	75	80	85	90	95
Infusion rate (mL/hr)	40	45	50	55	60	65	70	75	80	85	90	95

MONITORING

Potassium

- If loading dose given, monitor heart rate continuously throughout infusion and check serum potassium 1–2 hr after dose
- Monitor serum potassium daily while infusion continues

Theophylline

- Draw samples from opposite arm to that receiving infusion
- Monitor serum theophylline 4–6 hr after starting maintenance infusion (to prevent toxicity)
  - if level is <10 mg/L, do not increase rate of infusion
  - if level is >20 mg/L and patient has symptoms or signs of toxicity (vomiting which may be severs and intractable, agitation, restlessness, dilated pupils, sinus tachycardia and hyperglycaemia), stop infusion and repeat level every 6 hr until <20 mg/L and restart infusion at a reduced rate and repeat level at 4–6 hr
  - if level is >20 mg/L and patient **does not** have symptoms or signs of toxicity, reduce rate of infusion and repeat level at 4–6 hr
- Monitor serum theophylline after 24 hr to check steady-state concentration. Target range = 10–20 mg/L. Adjust maintenance dosage of aminophylline according to plasma theophylline concentration (relationship is linear, so doubling dosage will double steady-state concentration)

There are several medications that may increase or decrease theophylline concentration. Always check current BNF Appendix 1 for full list of interactions

PREPARATIONS

- Aminophylline injection = 25 mg/mL, 10 mL ampoules

DILUENTS

- Sodium chloride 0.9%, glucose 5%

DALTEPARIN FOR VTE ● 1/2

This guideline is only for use in patients with venous thromboembolism
Guidance on use in other clinical problems is contained in appropriate guidelines e.g. unstable angina

BEFORE STARTING TREATMENT

- FBC, INR and APTT
- If platelet count <100 × 10^9/L, seek advice from on-call haematologist (bleep via call centre) before starting anticoagulation
- If platelet count ≥100 × 10^9/L, or if advised by haematologist, start dalteparin

DOSE

- Weigh patient

ALWAYS weigh patient – do NOT guess the body weight or rely on patient's own estimate

- Determine dose of SC dalteparin using appropriate table below
- If required, arrange for outpatient to return **daily** for further SC injections of dalteparin sodium and check they have an advice sheet

Table 1: Daily dose for administration of SC dalteparin for non-pregnant patients with eGFR ≥20 mL/min

Body weight	Dose SC dalteparin
≤45 kg	7,500 units daily
46–56 kg	10,000 units daily
57–68 kg	12,500 units daily
69–82 kg	15,000 units daily
≥83 kg	18,000 units daily

Table 2: Daily dalteparin dosage for pregnant women based on early pregnancy or booking weight

Weight	Dose
<49 kg	5,000 units 12-hrly
50–69 kg	6,000 units 12-hrly
70–89 kg	8,000 units 12-hrly
≥90 kg	10,000 units 12-hrly

Table 3: Extended treatment of SC dalteparin for patients with solid tumour

Body weight	Once daily dose SC dalteparin	
	Dose for 30 days	Dose for following 5 months
≤45 kg	7,500 units daily	7,500 units daily
46–56 kg	10,000 units daily	7,500 units daily
57–68 kg	12,500 units daily	10,000 units daily
69–82 kg	15,000 units daily	12,500 units daily
83–98 kg	18,000 units daily	15,000 units daily
≥99 kg	18,000 units daily	18,000 units daily

Risk of bleeding is increased in patients with severe liver or renal failure (eGFR <20), thrombocytopenia or defective platelet function, and following surgery, trauma or haemorrhagic stroke. Adjust dalteparin dose accordingly with advice from appropriate team e.g. renal (see Table 4), liver or haematology

Table 4: Daily dalteparin dosage for patients with eGFR <20 mL/min

Weight	Dose SC dalteparin
<46 kg	5,000 units daily
46–56 kg	7,500 units daily
57–68 kg	9,000 units daily
69–82 kg	11,000 units daily
≥83 kg	13,500 units daily

Monitoring dalteparin treatment

- In a medical patient who has not been given unfractionated heparin, monitoring for heparin-induced thrombocytopenia is not required
- If patient is being, or has (in last 3 months) been, treated with unfractionated heparin or is a post-operative surgical patient being treated with LMWH, check platelet count on alternate days starting from day 4 until day 14 of heparin treatment (from day 2 if patient has been given heparin in preceding 100 days). Compare platelet count with pre-treatment result – see **Heparin-induced thrombocytopenia** guideline
- If patient weighs, or early pregnancy weight was <50 kg or >90 kg, or patient has bleeding problems, renal impairment, or massive PE, discuss need for anti-Xa monitoring with haematology consultant

DIGOXIN ● 1/2

INDICATIONS

- See **Cardiac failure** guideline and **Atrial fibrillation** guideline

INSTRUCTIONS FOR USING NOMOGRAM

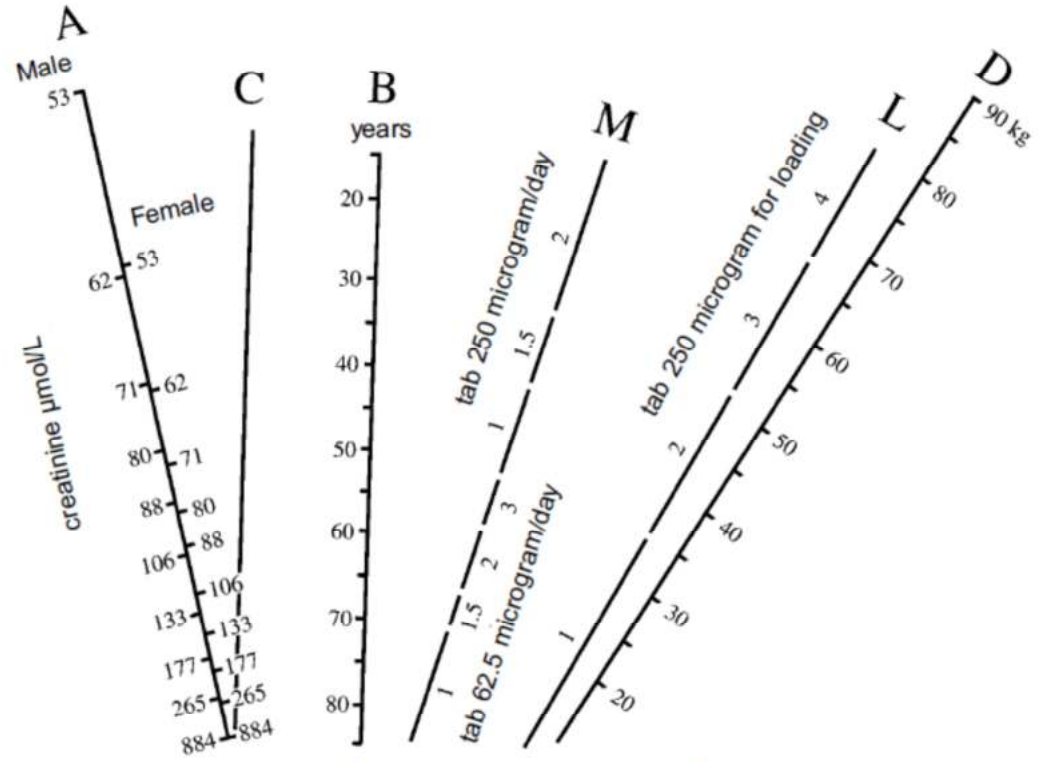
The nomogram for digoxin dosage provides a loading (L) and maintenance dose (M) for an adult patient whose plasma creatinine (A), age (B), and body weight (D) are known

Method

- Join A to B with a line that crosses C
- Join this intercept on C to D with a line that crosses M and L
- Note the intercept on L, which provides the total number of 250 microgram tablets to be taken on day 1 (if the loading recommendation is ≥3 tablets, it is usual to give 2 immediately followed by the third 6 hrs later)
- Note the intercept on M, which provides the number and strength of tablets to be prescribed as a single daily dose from day 2

Specific circumstances

- Do not give loading dose if patient currently taking digoxin, and consider reducing recommended loading dose if digoxin (or other cardiac glycoside) given in preceding 2 weeks
- In elderly patients with reduced muscle mass, serum creatinine may be artificially low and will not reflect renal function. Assume a value of 100 micromol/L for A in such patients
- In obese patients, body weight will not reflect distribution volume of digoxin. Use ideal body weight calculated from height (see **Ideal body weight** guideline) for D in such patients
- In patients with heart failure and in sinus rhythm, do not give a loading dose and give maintenance dose of 62.5–125 microgram/day



Nomogram reproduced from the original devised by Prof George Mawer, with permission

MONITORING

Indications for measurement

- To question need for continued treatment in patients with sinus rhythm
- To monitor effect of concurrent disease or drug treatment
- To confirm diagnosis of suspected toxicity, and to aid dose reduction
- To investigate suspected treatment failure or non-compliance

DIGOXIN ● 2/2

Sampling

- Steady state is not achieved until 1–3 weeks after starting therapy or changing the dosage, depending on patient's renal function
- Take samples at least 6 hr post-dose. It is often easier to sample immediately before a dose is due

Target range

- 0.8–2.0 microgram/L
- concentrations <0.8 microgram/L have no useful inotropic effect
- Sensitivity to digoxin is affected by thyroid function, oxygen saturation, and serum concentrations of potassium and calcium. Sensitivity is increased by hypothyroidism, hypoxia, hypomagnesaemia, hypokalaemia and hypercalcaemia, and decreased by hyperthyroidism and hyperkalaemia. This should be taken into account when interpreting individual serum digoxin concentrations in relation to the target range. Decisions about dosage adjustment should always consider the clinical effect of the drug as well as the serum concentration
- In atrial fibrillation, once treatment is established, ventricular rate is the best guide to the appropriate dosage for patients taking digoxin alone for rate control

DOBUTAMINE HYDROCHLORIDE ● 1/2

INDICATIONS

- Inotropic support in low output cardiac failure associated with myocardial infarction, cardiogenic shock. Dobutamine hydrochloride is contraindicated in septic shock

Administer dobutamine through a central line, if available. Dobutamine should only be given peripherally on the advice of a consultant; use a large vein high up in a limb, preferably the arm, in order to reduce risk of tissue necrosis and administer the 2 mg/mL solution only

DOSAGE

Seek advice from cardiology team before commencing dobutamine

- By continuous IV infusion 0.5–10 microgram/kg/min, adjusted according to response. Monitor heart rate and rhythm, BP, cardiac output (if possible), and urine output. If no response, seek advice of cardiology team **before** increasing dose further

NOTES

- IV solutions prepared as below are stable for 24 hr at room temperature. The solutions may turn pink and the colour may intensify with time, owing to slight oxidation of the drug, but there is no significant potency loss over 24 hr
- Where dobutamine is being infused via a peripheral vein (on advice of consultant) only the 2 mg/mL solution must be used
- When withdrawing treatment, decrease dosage gradually by small decrements according to response, rather than discontinuing therapy abruptly

PREPARATIONS

- Dobutamine hydrochloride 250 mg in 20 mL vials

DILUENTS

- Sodium chloride 0.9% or glucose 5%
- Dobutamine hydrochloride is incompatible with sodium bicarbonate and other strongly alkaline solutions

Infusion via syringe pump (for administration only via central line)

- See **Table 1** for dosage and corresponding pump rate
- Using a 50 mL syringe make up 250 mg dobutamine (20 mL) to 50 mL with diluent (see **Diluents**) = 5 mg/mL = 5000 microgram/mL

Table 1: Infusion via syringe pump (flow rate mL/hr)

Dosage microgram/kg per min	Weight (kg)													
	45	50	55	60	65	70	75	80	85	90	95	100	105	110
0.5	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7
1	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1	1	1.1	1.1	1.2	1.3	1.3
2	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2	2.2	2.3	2.4	2.5	2.6
3	1.6	1.8	2	2.2	2.3	2.5	2.7	2.9	3.1	3.2	3.4	3.6	3.8	4
4	2.2	2.4	2.6	2.9	3.1	3.4	3.6	3.8	4.1	4.3	4.6	4.8	5	5.3
5	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6	6.3	6.6
6	3.2	3.6	4	4.3	4.7	5	5.4	5.8	6.1	6.5	6.8	7.2	7.6	7.9
7	3.8	4.2	4.6	5	5.5	5.9	6.3	6.7	7.1	7.6	8	8.4	8.8	9.2
8	4.3	4.8	5.3	5.8	6.2	6.7	7.2	7.7	8.2	8.6	9.1	9.6	10.1	10.6
9	4.9	5.4	5.9	6.5	7	7.6	8.1	8.6	9.2	9.7	10.3	10.8	11.3	11.9
10	5.4	6	6.6	7.2	7.8	8.4	9	9.6	10.2	10.8	11.4	12	12.6	13.2
12	6.5	7.2	7.9	8.6	9.4	10.1	10.8	11.5	12.2	13	13.7	14.4	15.1	15.8
14	7.6	8.4	9.2	10.1	10.9	11.8	12.6	13.4	14.3	15.1	16	16.8	17.6	18.5
16	8.6	9.6	10.6	11.5	12.5	13.4	14.4	15.4	16.3	17.3	18.2	19.2	20.2	21.1
18	9.7	10.8	11.9	13	14	15.1	16.2	17.3	18.4	19.4	20.5	21.6	22.7	23.8
20	10.8	12	13.2	14.4	15.6	16.8	18	19.2	20.4	21.6	22.8	24	25.2	26.4
25	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30	31.5	33
30	16.2	18	19.8	21.6	23.4	25.2	27	28.8	30.6	32.4	34.2	36	37.8	39.6
35	18.9	21	23.1	25.2	27.3	29.4	31.5	33.6	35.7	37.8	39.9	42	44.1	46.2
40	21.6	24	26.4	28.8	31.2	33.6	36	38.4	40.8	43.2	45.6	48	50.4	52.8

Minibag infusion via controlled-infusion device

- See **Table 2** for dosage and corresponding infusion rate
  Withdraw 40 mL from a 250 mL bag of diluent (see **Diluents**). Add two 250 mg vials of dobutamine (40 mL) to the bag and mix well. 500 mg in 250 mL = 2 mg/mL = 2000 microgram/mL

Table 2: Minibag infusion via controlled-infusion device (flow rate mL/hr)

Dosage microgram/kg per min	Weight (kg)													
	45	50	55	60	65	70	75	80	85	90	95	100	105	110
0.5	1	1	1	1	1	1	1	1	1	1	1	2	2	2
1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
2	3	3	3	4	4	4	5	5	5	5	6	6	6	7
3	4	5	5	5	6	6	7	7	8	8	9	9	9	10
4	5	6	7	7	8	8	9	10	10	11	11	12	13	13
5	7	8	8	9	10	11	11	12	13	14	14	15	16	17
6	8	9	10	11	12	13	14	14	15	16	17	18	19	20
7	9	11	12	13	14	15	16	17	18	19	20	21	22	23
8	11	12	13	14	16	17	18	19	20	22	23	24	25	26
9	12	14	15	16	18	19	20	22	23	24	26	27	28	30
10	14	15	17	18	20	21	23	24	26	27	29	30	32	33
12	16	18	20	22	23	25	27	29	31	32	34	36	38	40
14	19	21	23	25	27	29	32	34	36	38	40	42	44	46
16	22	24	26	29	31	34	36	38	41	43	46	48	50	53
18	24	27	30	32	35	38	41	43	46	49	51	54	57	59
20	27	30	33	36	39	42	45	48	51	54	57	60	63	66
25	34	38	41	45	49	53	56	60	64	68	71	75	79	83
30	41	45	50	54	59	63	68	72	77	81	86	90	95	99
35	47	53	58	63	68	74	79	84	89	95	100	105	110	116
40	54	60	66	72	78	84	90	96	102	108	114	120	126	132

DOPAMINE HYDROCHLORIDE ● 1/2

INDICATIONS

- Management of cardiac failure after acute myocardial infarction (MI) – see **Management flowchart** in **Acute myocardial infarction** guideline

Dopamine must only be used in critical care and in the coronary care unit and administered preferably via a central line

Dopamine should only be given peripherally on the advice of a consultant; use a large vein high up in a limb, preferably the arm, in order to reduce risk of tissue necrosis and administer the 2 mg/mL solution only

DOSAGE

- Start with 2 microgram/kg/min by continuous IV infusion via as large a vein as possible
- Increase following **Table 1** or **2** up to 10 microgram/kg/min if required. An IV infusion pump is essential for controlling infusion rate
- Monoamine oxidase inhibitors (MAOIs) potentiate effects of dopamine and its duration of action. If patient has been treated with an MAOI (e.g. linezolid, isoniazid, phenelzine, isocarboxazid – see BNF) within the last 2 weeks, give one-tenth of the usual starting dose
- Patients taking MAO-B inhibitors, such as rasagiline, or standard doses of selegiline, do not need to be given a reduced dose of dopamine

Dopamine given at rates >5 microgram/kg/min causes vasoconstriction, which can reduce renal perfusion and worsen heart failure

NOTES

- Do not use ampoules of dopamine if solution is darker than slightly yellow, or discoloured in any other way (it should be clear, colourless or pale yellow)

The 2 mg/mL solution is preferable where dopamine is being infused via a peripheral vein. Reserve 4 mg/mL solution for infusion via a central line

- Extravasation of dopamine at the infusion site can cause local vasoconstriction, which may lead to tissue necrosis and sloughing. Inspect infusion site regularly for signs of irritation or vasoconstriction

PREPARATIONS

- Dopamine hydrochloride 40 mg/mL in 5 mL ampoules (200 mg)

DILUENTS

- Sodium chloride 0.9% or glucose 5%
- Dopamine is inactivated by sodium bicarbonate 5% and alkaline solutions

ADMINISTRATION VIA SYRINGE PUMP

For 2 mg/mL solution (preferable for infusion via a peripheral vein)

- Take 2.5 mL (100 mg) of dopamine hydrochloride solution and make up to 50 mL with diluent (see **Diluents**) in a 50 mL syringe. The diluted solution is stable for 24 hr
- **Concentration = 100 mg in 50 mL = 2 mg/mL (2000 microgram/mL)**

Table 1: Flow rate (mL/hr) for dopamine hydrochloride infusion (2 mg/mL)

Dosage microgram/ kg/min	Weight (kg)											
	45	50	55	60	65	70	75	80	85	90	95	100
0.5	0.7	0.8	0.8	0.9	1	1.1	1.1	1.2	1.3	1.4	1.4	1.5
1	1.4	1.5	1.7	1.8	2	2.1	2.3	2.4	2.6	2.7	2.9	3
1.5	2	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4.1	4.3	4.5
2	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6
2.5	3.4	3.8	4.1	4.5	4.9	5.3	5.6	6	6.4	6.8	7.1	7.5
3	4.1	4.5	5	5.4	5.9	6.3	6.8	7.2	7.7	8.1	8.6	9
3.5	4.7	5.3	5.8	6.3	6.8	7.4	7.9	8.4	8.9	9.5	10	10.5
4	5.4	6	6.6	7.2	7.8	8.4	9	9.6	10.2	10.8	11.4	12
4.5	6.1	6.8	7.4	8.1	8.8	9.5	10.1	10.8	11.5	12.2	12.8	13.5
5	6.8	7.5	8.3	9	9.8	10.5	11.3	12	12.8	13.5	14.3	15
7.5	10.1	11.3	12.4	13.5	14.6	15.8	16.9	18	19.1	20.2	21.4	22.5
10	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30

For 4 mg/mL solution (infuse via a central line only)

- Take 5 mL (200 mg) of dopamine hydrochloride solution and make up to 50 mL with diluent (see **Diluents**) in a 50 mL syringe. The diluted solution is stable for 24 hr
- **Concentration = 200 mg in 50 mL = 4 mg/mL (4000 microgram/mL)**

Table 2: Flow rate (mL/hr) for dopamine hydrochloride infusion (4 mg/mL)

Dosage microgram/ kg/min	Weight (kg)											
	45	50	55	60	65	70	75	80	85	90	95	100
0.5	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8
1	0.7	0.8	0.8	0.9	1	1.1	1.1	1.2	1.3	1.4	1.4	1.5
1.5	1	1.1	1.2	1.4	1.5	1.6	1.7	1.8	1.9	2	2.1	2.3
2	1.4	1.5	1.7	1.8	2	2.1	2.3	2.4	2.6	2.7	2.9	3
2.5	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8
3	2	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4.1	4.3	4.5
3.5	2.4	2.6	2.9	3.2	3.4	3.7	3.9	4.2	4.5	4.7	5	5.3
4	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6
4.5	3	3.4	3.7	4.1	4.4	4.7	5.1	5.4	5.7	6.1	6.4	6.8
5	3.4	3.8	4.1	4.5	4.9	5.3	5.6	6	6.4	6.8	7.1	7.5
7.5	5.1	5.6	6.2	6.8	7,3	7.9	8.4	9	9.6	10.1	10.7	11.3
10	6.8	7.5	8.3	9	9.8	10.5	11.3	12	12.8	13.5	14.3	15

Withdraw dopamine gradually, monitoring for hypotension

GENTAMICIN • 1/4

Do not prescribe gentamicin treatment for >3 days unless advised in a guideline or by consultant in infectious diseases or consultant microbiologist. In all patients being treated with gentamicin, measure serum creatinine daily and serum gentamicin where recommended. As gentamicin has a narrow therapeutic index, accurate dosing is essential to prevent toxicity

Note – deafness and balance problems may occur at therapeutic levels. If they occur, stop gentamicin

ONCE-DAILY DOSING

DO NOT use this protocol for patients in the following categories:

- ***Ascites***
- ***Pregnant women***
- ***Endocarditis***
- ***Major burns***
- ***Creatinine clearance (CrCl) <20 mL/min***
- ***If gentamicin needs to be used in cystic fibrosis (CF) contact CF team for advice***

In these situations, unless a specific protocol exists, use gentamicin nomogram for multiple daily dose regimens (see* Multiple daily dosing*) to select an initial dosage and regimen, then adjust on the basis of serum gentamicin concentration (see* Monitoring multiple daily dose regimens*)

- If there are no contraindications to its use, once-daily dosing with gentamicin is safer, more convenient, and cheaper than multiple daily dose regimens

Always use the gentamicin calculator on Trust intranet or MicroGuide app on smartphones. If unable to access the calculator – calculate dose as below

First dose

- Weigh patient and calculate ideal body weight (IBW). See **Ideal body weight** guideline. Choose which of these 2 weights to use according to instructions below
- If unfit to be weighed, estimate weight

If patient emaciated and unfit to be weighed do not use IBW. Estimate weight (this estimate will be lower than ideal body weight in emaciated patients)

- Use lowest weight [actual (or estimated) or ideal] to select dose from **Table 1**
- Dilute gentamicin dose in 100 mL glucose 5% or sodium chloride 0.9% and administer by IV infusion over 1 hr
- Record time infusion started on drug chart

Table 1: Dose banding for gentamicin 7 mg/kg (maximum dose 600 mg* daily) IV by infusion over 60 min

Lowest weight (actual or ideal) (kg)	Dose of gentamicin (mg)
40–<45	280
45–<50	320
50–<55	360
55–<60	400
60–<66	440
66–<72	480
72–<78	520
78–<83	560
≥83	600

***In some situations the online calculator may recommend a maximum dose of 600 mg; this dose should NOT be exceeded**

Monitoring of first dose

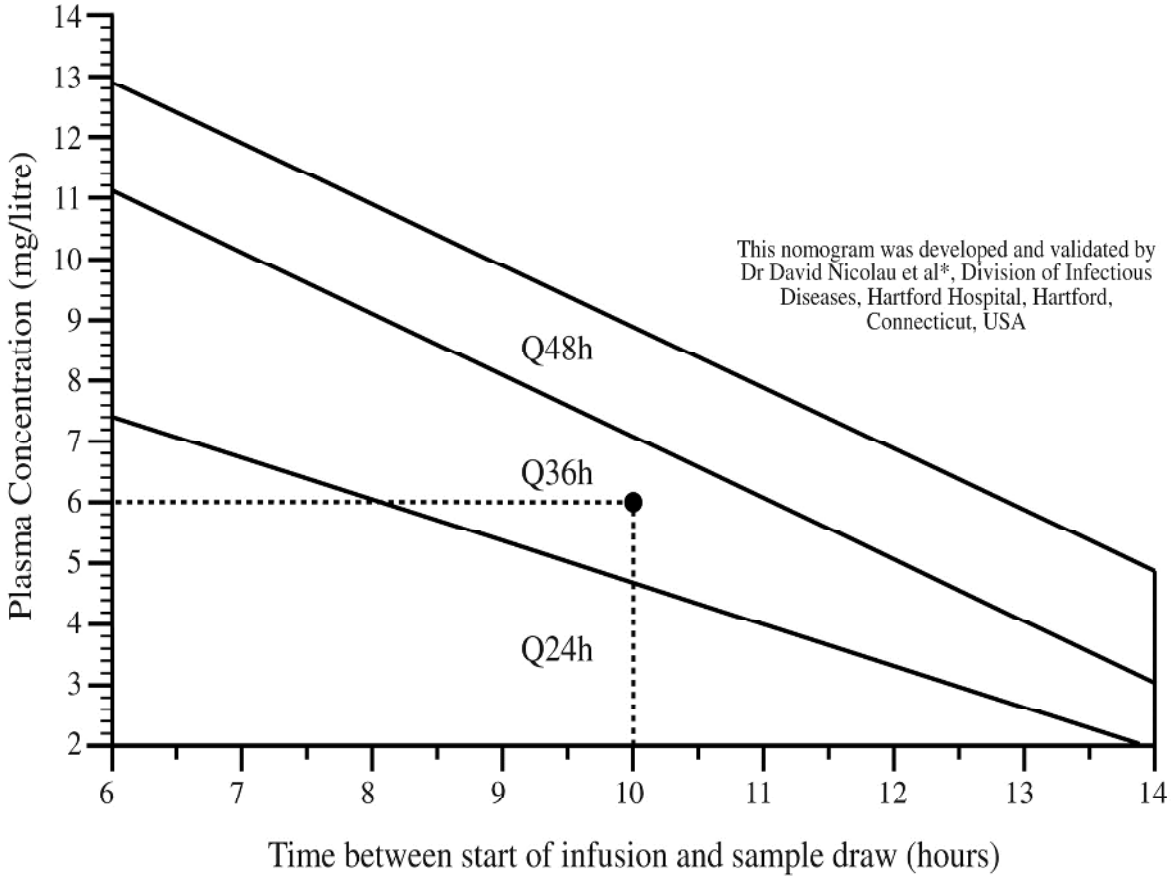
Measure concentration 6–14 hr after first infusion started

- Take blood samples for gentamicin (10 mL clotted blood) and creatinine 6–14 hr after start of infusion. Do not sample via cannula used for infusion
- Request measurement of gentamicin concentration and document in patient record**. It is imperative that time when infusion began and time when sample was taken are accurately documented on the microbiology request card; this will appear on the report**
- **Complete electronic microbiology request form on Medway as follows:**
- antimicrobial assay type – tick gentamicin box
- dose frequency – tick once daily box
- enter dose and date and time of last dose
- sample(s) taken – tick random box for samples taken after 6–14 hr
- enter date and time of random sample taken
- enter date taken and time taken again at bottom of form

Interpretation and dose interval

- Check blood results for gentamicin level on iCM/iPortal
- Calculate time interval between start of gentamicin infusion and time level taken
- Plot time interval against gentamicin level to select dosing interval on **Figure 1**

Figure 1: **Use values of plasma gentamicin concentration and time interval to find intercept**
Example: a concentration of 6 mg/L after 10 hr yields a dose interval of 36 hr (i.e. give dose every 36 hr)



Antimicrob Agents Chemother 1995;39(3):650-655

- For additional information on dose intervals and subsequent monitoring, see **Table 2**
- Give next dose (7 mg/kg by infusion – see **Table 1**) at time after interval plotted in **Figure 1**

Table 2: Additional information on gentamicin dose intervals and subsequent monitoring

Serum gentamicin concentration result at 6–14 hr	Action and interval
Falls on the line dividing time intervals	Select the longer time interval
Above upper limit for Q48h	Abandon once daily regimen. Stop gentamicin and discuss indication and adjustment of dose and time interval with microbiologist
Falls in Q36h or Q48h area	Patient is likely to have impaired renal function. Continue with dose recommended in intermittent dosing regimen **Table 1**, but increase dose interval to 36 hr or 48 hr, depending upon where plot falls in **Figure 1** graph. Monitor gentamicin concentration 6–14 hr after every subsequent dose
Falls in Q24h sector or is <2 mg/L	Continue with once-daily regimen at dose interval of 24 hr. Check gentamicin concentration 6–14 hr after every subsequent dose

After measuring gentamicin concentration, do not give more than 1 dose to any patient without knowing the assay result

Further monitoring

- Check serum creatinine daily. Calculate CrCl from serum creatinine to check dose interval has not changed
- If dose interval has to be changed, check gentamicin concentration 6–14 hr after start of next infusion (note time of start of infusion and time of sampling) and use **Figure 1** to verify correct dose interval

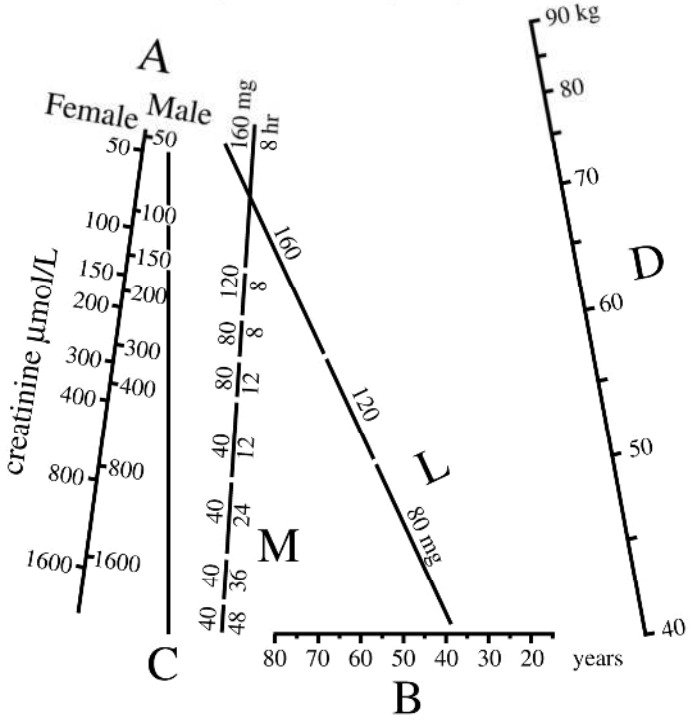
Do not send pre-dose (to measure trough concentration) or 1 hr post-dose (to measure peak concentration) sample unless treatment is following multiple daily dose regimen

MULTIPLE DAILY DOSING

Gentamicin nomogram for multiple daily dose regimens

This nomogram is NOT to be used for children or patients with cystic fibrosis (CF)

Nomogram for gentamicin dosage (devised by Prof. G. Mawer), which provides a loading dose (L), a maintenance dose (M), and a suitable interval between doses for an adult patient whose serum creatinine concentration (A), age (B) and body weight (D) are known



To use, join A to B with a line that crosses C; then join this intercept on C to D with a line that crosses M and L

Monitoring multiple daily dose regimens

- If gentamicin needs to be used in cystic fibrosis (CF) contact CF team for advice
- For patients with infective endocarditis, refer to **Infective endocarditis** guideline as **target levels differ in this indication**
- Measure serum gentamicin after 24 hr. Take a trough sample immediately before third dose, and a peak sample 1 hr after dose (doses are given by IV injection NOT infusion)
- Target peak concentration is 5–10 mg/L
- Trough concentration should be maintained <2 mg/L
- The relationship between maintenance dose and steady state concentration is linear. Doubling the dose will double peak and trough serum concentrations, assuming renal function stable

Measurement of trough and peak concentrations

- Take blood samples for gentamicin (10 mL clotted blood) just before IV injection for pre-dose trough concentration and 1 hr after IV injection for post-dose peak concentration. Do not sample via cannula used for IV injection
- Request measurement of gentamicin concentration and document in patient record**. It is imperative that time when IV injection was given and time when sample was taken are accurately documented on the microbiology request card; this will appear on the report**
- **Complete blue microbiology request form (or request on 'order coms') as follows:**
- antimicrobial assay type – tick gentamicin box
- dose frequency – tick 8-hrly or 12-hrly box. If dosing interval longer than this (e.g. 24-hrly or 36-hrly), tick ….. hrly box and complete frequency
- enter dose, date and time of the dose around which trough and peak are to be measured
- sample(s) taken – tick pre-dose or post-dose box as applicable
- enter date and time of sample taken
- enter date taken and time taken again at bottom of form

GLASGOW COMA SCALE ● 1/1

- Normal aggregate score: 15
- It is good practice to record score in each domain (e.g. eye opening 4, motor response 6, verbal response 5)
- If patient has dementia or a learning disability it may affect the GCS score, take into account when assessing
- Note the accepted terminology for a potentially awake but intubated patient is “T” for the verbal response domain

Eye opening response	Score
Spontaneous	4
To sound/voice	3
To pain	2
No response	1

Verbal response	Score
Orientated	5
Confused conversation	4
Inappropriate words	3
Incomprehensible sounds	2
No response	1

Motor response	Score
Obeys complex command	6
Localises to pain	5
Flexion – withdraws from pain	4
Abnormal flexion (decorticate rigidity)	3
Extension to pain (decerebrate rigidity)	2
No response	1

GLYCERYL TRINITRATE ● 1/1

INDICATIONS

- Acute pulmonary oedema
- Uncontrolled pain of cardiac origin, including aortic dissection
- Accelerated hypertension with pulmonary oedema or acute coronary syndrome

DOSAGE

- **Acute pulmonary oedema:** glyceryl trinitrate (GTN) by continuous IV infusion, initially 20 microgram/min, decreasing to 10 microgram/min; or increasing in increments of 20 microgram/min at 15–30 min intervals until desired response or a maximum of 200 microgram/min is achieved, provided BP remains >90 mmHg systolic and >60 mmHg diastolic
- **Uncontrolled pain of cardiac origin:** GTN by continuous IV infusion, initially 10 microgram/min, titrated upwards at 15 min intervals in increments of 5 or 10 microgram/min according to patient response to a maximum of 200 microgram/min if necessary to control pain, provided BP remains >90 mmHg systolic and >60 mmHg diastolic
- **Accelerated hypertension:** follow dosage instructions according to clinical presentation (see above); otherwise give GTN by continuous IV infusion, initially 5 microgram/min, titrated upwards at 15 min intervals in increments of 5 or 10 microgram/min according to patient response to a maximum of 100 microgram/min. See **Accelerated (malignant) hypertension** guideline

Administration

- Fill a compatible 50 mL syringe (see **Notes**) with GTN solution 1 mg/mL (50 mL)
- Administer via a syringe pump, and titrate according to patient response (**Table 1**)

Table 1: GTN infusion via syringe pump (flow rate – mL/hr)

Dosage (microgram/min)	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
Flow rate (mL/hr)	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3
Dosage (microgram/min)	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
Flow rate (mL/hr)	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6
Dosage (microgram/min)	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**
Flow rate (mL/hr)	6.3	6.6	6.9	7.2	7.5	7.8	8.1	8.4	8.7	9
Dosage (microgram/min)	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
Flow rate (mL/hr)	9.3	9.6	9.9	10.2	10.5	10.8	11.1	11.4	11.7	12

NOTES

- **Compatible syringes and tubing**; rigid plastic syringes (e.g. Gillette Sabre, Brunswick Disposable, BD Plastipak); polyethylene tubing (e.g. Vygon Lectrocath, David Bull Laboratories Types A261 or A2001)
- GTN is **incompatible** with polyvinylchloride (PVC) infusion bags (e.g. Steriflex, Boots, Viaflex, Travenol)

PREPARATIONS

- GTN 1 mg/mL in 50 mL ampoule

IDEAL BODY WEIGHT ● 1/1

Use this guideline for drug dose calculations. Do not use as a dietary advice guideline

CALCULATION

- Calculate ideal body weight (IBW) from height/length, using formula:
- 1 cm = 0.394 inch and 1 foot = 12 inches

Males

IBW (kg) = 50 + [2.3 × (height in inches – 60)]

Females

IBW (kg) = 45 + [2.3 × (height in inches – 60)]

TABLES

- Read ideal body weight from tables below for heights in feet and inches or centimetres

MALE		
Height (feet and inches)	**Height (cm)**	**Ideal body weight (kg)**
5’ 0”	152	50.0
5’ 1”	155	52.3
5’ 2”	157	54.6
5’ 3”	160	56.9
5’ 4”	163	59.2
5’ 5”	165	61.5
5’ 6”	168	63.8
5’ 7”	170	66.1
5’ 8”	173	68.4
5’ 9”	175	70.7
5’ 10”	178	73.0
5’ 11”	180	75.3
6’	183	77.6
6’ 1”	185	79.9
6’ 2”	188	82.2
6’ 3”	191	84.5
6’ 4”	193	86.8
6’ 5”	196	89.1
6’ 6”	198	91.4
6’ 7”	201	93.7
6’ 8”	203	96.0
6’ 9”	206	98.3

FEMALE		
Height (feet and inches)	**Height (cm)**	**Ideal body weight (kg)**
4’ 10”	147	40.4
4’ 11”	150	42.7
5’ 0”	152	45.0
5’ 1”	155	47.3
5’ 2”	157	49.6
5’ 3”	160	51.9
5’ 4”	163	54.2
5’ 5”	165	56.5
5’ 6”	168	58.8
5’ 7”	170	61.1
5’ 8”	173	63.4
5’ 9”	175	65.7
5’ 10”	178	68.0
5’ 11”	180	70.3
6’	183	72.6
6’ 1”	185	74.9
6’ 2“	188	77.2
6’ 3”	191	79.5

IV UNFRACTIONATED HEPARIN • 1/2

Before prescribing, check indication for use of IV unfractionated heparin in relevant guideline. Is this correct regime? E.g. use for post thromboembolism but not following post MI thrombolysis
In the event of overdose or incorrect administration, contact on-call haematology consultant, who will advise whether patient requires urgent reversal of anticoagulant effect

- The anticoagulant response to IV unfractionated heparin (IVUH) varies widely among patients with thromboembolic disease, possibly because of variations in the plasma concentration of heparin-binding proteins. Thus, IVUH treatment is monitored to maintain the ratio of patient's Activated Partial Thromboplastin Time (APTT) to the mean control APTT within a defined target range of 2.0–3.0. Dose adjustment is complicated because IVUH displays saturation kinetics
- Before starting treatment with IVUH check the following:
- no allergy or previous history of heparin-induced thrombocytopenia
- FBC (especially to check baseline platelets)
- International Normalised Ratio (INR)
- APTT ratio
- U&E (to check baseline serum potassium)

If starting a pregnant woman on IV unfractionated heparin, discuss with consultant haematologist to arrange anti-Xa monitoring

Use the separate pre-printed supplementary prescription chart (NSH8051) to prescribe IV infusion of unfractionated heparin. Ensure that use of the supplementary chart is documented on the front of the main adult inpatient prescription chart, drug infusion section 'Heparin infusion'

INITIATION OF TREATMENT – LOADING DOSE

- Weigh patient
- give bolus dose of unfractionated heparin (1000 units/mL) 75 units/kg IV over 5 min (**Table 1**)
- if patient unfit to be weighed, give bolus dose of unfractionated heparin 5000 units (5 mL 1000 units/mL) IV over 5 min

Do you need loading dose? Check indication for use of IV unfractionated heparin in relevant guideline

Table 1

Volume of 1000 units/mL solution required to give loading dose of 75 units/kg												
Weight (kg)	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
Draw up required mL of heparin and administer IV over 5 min	3.4	3.8	4.1	4.5	4.9	5.3	5.6	6.0	6.4	6.8	7.1	7.5

MAINTENANCE OF TREATMENT – INFUSION

IV unfractionated heparin is supplied in various concentrations. Check concentration carefully to avoid risk of overdose and death due to over anticoagulation.
IV heparin therapy without strict monitoring as stated below carries high risk of bleeding. Warn all staff members involved when patient on IV heparin infusion

- **Prepare solution of 500 units unfractionated heparin per mL**
- take 20 mL unfractionated heparin 1000 units/mL (which therefore contains 20,000 units)
- add the same volume of sodium chloride 0.9% injection to produce a total volume of 40 mL
- start infusion dose at 18 units/kg/hr which is equivalent to 0.036 mL/kg/hr (see **Table 2**)
- Check APTT ratio 4 hr (6 hr if no loading dose) after starting infusion and then 4 hr after any dose change
- Adjust rate as dictated by APTT ratio (**Table 3**)
- Patients with renal impairment may have delayed clearance of heparin
- Once APTT ratio lies within target range of 2.0–3.0, check APTT once daily

IV UNFRACTIONATED HEPARIN ● 2/2

Table 2:

Maintenance infusion rate of IV heparin 500 units/mL required for a range of body weights to give 18 units/kg/hr												
Weight (kg)	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
Rate in mL/hr	1.6	1.8	2.0	2.2	2.3	2.5	2.7	2.9	3.1	3.2	3.4	3.6

Table 3: APTT ratio and corresponding change in infusion rate

APTT ratio	Change in infusion rate
>5.00	Stop infusion for 1 hr, then reduce by 1 mL/hr. If infusion rate is ≤1 mL/hr, stop infusion for 1 hr then restart after reducing rate by one-third
4.01–5.00	Reduce by 0.6 mL/hr
3.51–4.00	Reduce by 0.2 mL/hr
3.01–3.50	Reduce by 0.1 mL/hr
2.00–3.00	No change
1.50–1.99	Increase by 0.2 mL/hr
1.20–1.49	Increase by 0.4 mL/hr
<1.20	Increase by 0.8 mL/hr

Adapted from Fennerty A.G., Renowden S., Scolding N. et al. BMJ 1986; 292: 579-80

MONITORING

- Platelet count before starting heparin and then on alternate days from day 5 (day 2 if unfractionated heparin, dalteparin or any other low-molecular-weight heparin given within last 100 days). If platelet count falls by >50% during heparin therapy, suspect heparin-induced thrombocytopenia – see **Heparin-induced thrombocytopenia** guideline
- Monitor for hyperkalaemia – see **Electrolyte disturbances – Hyperkalaemia** guideline
- U&E before starting heparin and then twice weekly if IV unfractionated heparin likely to continue for >7 days or patient has raised baseline serum potassium, diabetes mellitus, chronic kidney disease or acidosis, or is taking a potassium-sparing agent

HEPARIN REVERSAL

- In the event of bleeding associated with unfractionated heparin therapy, protamine can be given to reverse the anticoagulant effect but be aware that protamine carries significant risk of serious adverse drug reaction. 1 mg of protamine neutralises 80–100 units unfractionated heparin when administered within 15 min of the heparin dose. Less is required if protamine is given after a longer period. 50 mg protamine sulphate is enough for most bleeds
- Report all anticoagulant related bleeding events via DATIX or to anticoagulation service
- Contact on-call haematology consultant for advice if necessary

LABETALOL ● 1/1

INDICATIONS

- Accelerated hypertension
- Aortic dissection

DOSAGE

- Aim to reduce diastolic BP to 110–115 mmHg over several hours. Labetalol can be given by either IV injection or IV infusion

IV bolus injection

- Initially 50 mg (10 mL) of labetalol hydrochloride over at least 1 min
- After bolus injection, maximum effect usually occurs within 5 min and the effective duration of action is usually about 6 hr, but can be as long as 18 hr
- If necessary, repeat after 5 min and, if still no response, again 10 and 15 min after initial dose
- Total dose should not exceed 200 mg

IV infusion via a syringe pump

- Withdraw 100 mL from a 500 mL bag of glucose 5%. Add 5 × 100 mg vials of labetalol (100 mL) to the bag and mix well. 500 mg in 500mL = 1 mg/mL
- Diluted solution is stable for 24 hr
- Start with 0.5 mg/min by IV infusion, lower rate commenced to avoid hypotension, increasing according to response to 2 mg/min
- Continue infusion until a satisfactory response is achieved, then stop
- In most patients, the effective cumulative dose is usually 50–200 mg depending on initial blood pressure, but occasionally higher doses may be required. **Table 1** gives corresponding flow rate for a range of doses

Table 1: Labetalol IV infusion and flow rates

Dose (mg/min)	0.5	1	1.5	2
Flow rate (mL/hr)	30	60	90	120

NOTES

- Ensure patient remains supine **during and for 3 hr after** end of administration to avoid excessive postural hypotension. Monitor heart rate after injection and during infusion. In most patients, there will be a small decrease in heart rate: severe bradycardia is unusual but can be controlled by giving atropine sulphate 600 microgram by IV injection, repeated if necessary at 5-min intervals. Total dose of atropine sulphate should not exceed 2.4 mg. Watch for signs of bronchospasm, especially in patients with any known impairment in respiratory function

PREPARATIONS

- Labetalol hydrochloride injection 100 mg in 20 mL ampoule (5 mg/mL)

DILUENTS

- Glucose 5%
- **Labetalol hydrochloride is incompatible with sodium bicarbonate 4.2%**

OXYGEN THERAPY IN ACUTELY HYPOXAEMIC PATIENTS ● 1/4

INDICATIONS

- Critically ill patient (see list of possible critical illnesses below)
- Documented hypoxaemia (SpO_2 <94% or PaO_2 <8 kPa)
- Acute hypoxaemia suspected on clinical grounds
- Risk of intermittent hypoxaemia in surgical post-operative patient

Aim

- To deliver oxygen at the minimum concentration required to achieve adequate tissue oxygenation and minimise complications of hyperoxia

OXYGEN PRESCRIPTION

Include

- Oxygen saturation target:
- SpO_2 88–92% for non-critical patients at risk of type 2 (hypercapnic) respiratory failure
- SpO_2 94–98% for all other patients
- Oxygen flow rate
- Delivery device (e.g. simple face mask, Venturi mask, nasal cannulae, reservoir mask)
- Frequency (continuous or PRN use)
- For post-operative surgical patients at risk of intermittent hypoxaemia who require continuous oxygen regardless of their saturations – see **Surgical high-risk post-operative patients** for suggested oxygen flow rate, device and escalation strategy

CRITICAL ILLNESS

Indications for oxygen therapy

- Cardiac/respiratory arrest or resuscitation
- Acute life-threatening asthma
- Shock/severe hypovolaemia/haemorrhage
- Sepsis
- Major trauma
- Near-drowning
- Anaphylaxis
- Major pulmonary haemorrhage
- Major head injury
- Carbon monoxide poisoning
- Acute neurological or respiratory compromise caused by drugs (e.g. opioids), injury or suspected intracerebral pathology
- Acute localised tissue ischaemia (e.g. acute peripheral vascular disease, reduced bowel perfusion)

Management

- Follow ABC approach and address underlying cause
- **Initial oxygen therapy is via reservoir mask at 15 L/min** (use bag-valve-mask for active resuscitation during cardiac/respiratory arrest)
- Once stable, reduce oxygen dose and aim for target saturation range of 94–98%

Patients with COPD and other risk factors for hypercapnia who develop critical illness should have the same initial target oxygen saturation as other critically ill patients pending blood gas results, after which these patients may need controlled oxygen therapy or supported ventilation if there is severe hypoxia and/or hypercapnia.
***See* Flowchart**

OXYGEN THERAPY IN ACUTELY HYPOXAEMIC PATIENTS ● 2/4

SURGICAL HIGH-RISK POST-OPERATIVE PATIENTS

Who

- Patients who have had general anaesthetic within previous 72 hr and one of the following:
- ischaemic heart disease, known or suspected
- obstructive sleep apnoea
- receiving drugs known to reduce respiratory drive, especially patients using PCA or epidural for analgesia or other systemic opioids

Risks of surgery

- Hypoventilation and consequent significant desaturation during sleep despite normal SpO_2 when awake

Management (even if SpO_2 normal)

No risk of hypercapnic respiratory failure

- Give oxygen 2 L/min via nasal cannulae or 5 L/min via simple face mask. If SpO_2 falls below 94%, follow **Flowchart for oxygen administraton on general ward**
- If patient tachypnoeic, seek advice in accordance with NEWS escalation strategy

Risk of hypercapnic respiratory failure

- These are high-risk surgical patients – follow specific advice regarding oxygen therapy and ABG monitoring given by anaesthetist (or critical care if involved). Document this advice on the anaesthetic chart, in patient notes and/or on prescription chart. If unsure, contact anaesthetist who cared for patient, duty anaesthetist or critical care team

Length of oxygen therapy

- Continue oxygen therapy until systemic opioids discontinued or, for IHD/OSA groups, 72 hr have elapsed since anaesthesia

NON-CRITICAL ILLNESS

All other patients with documented hypoxaemia (PaO_2 <8 kPa or SpO_2 <94%) other than those with critical illnesses, follow **Flowchart for non-critical illness requiring moderate amounts of supplemental oxygen**

MONITORING

- Monitor SpO_2 continuously. Follow **Flowchart for oxygen administration on general ward**
- If oxygen requirement increases, seek senior advice
- Closely observe patients at risk of CO_2 retention for signs of reduced respiratory effort, or conscious level, (GCS <14 or V on the AVPU scale)
- if patient at risk of CO_2 retention, repeat ABGs in 30–60 min after any further adjustment to FiO_2 or if conscious level deteriorates
- Discuss any deteriorating patient with consultant responsible for management of co-morbidity and critical care team

Do not restrict oxygen therapy below minimum target saturations of 88% in patients retaining CO_2

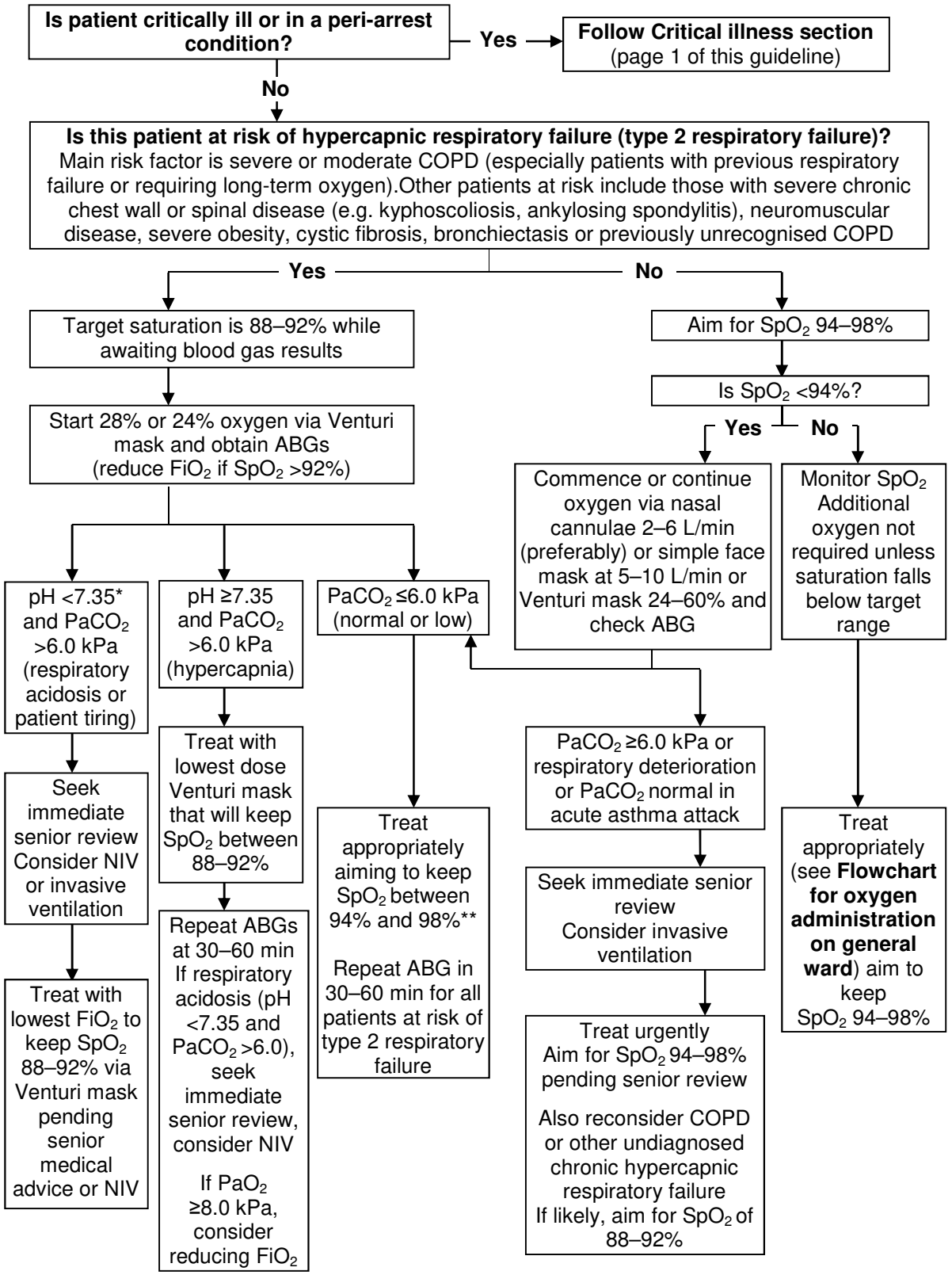
Patients with obstruction or pseudo-obstruction of bowel and reduced conscious level may not be suitable for non-invasive positive pressure ventilation (NIPPV)

WEANING FROM OXYGEN

- When oxygen therapy is no longer indicated, step down oxygen to room air as soon as possible, monitoring SpO_2 – see **Flowchart for oxygen administration on general ward**

OXYGEN THERAPY IN ACUTELY HYPOXAEMIC PATIENTS ● 3/4

Flowchart for non-critical illness requiring moderate amounts of supplemental oxygen (See separate advice in guideline for high-risk post-operative surgical patients)



A need for an increase in FiO_2 requires a medical review. Patients at risk of carbon dioxide retention must be monitored by repeat ABGs in 1 hr (or sooner if conscious level deteriorates)

* If pH is <7.35 with normal or low $PaCO_2$, investigate and treat for metabolic acidosis and keep SpO_2 94–98%

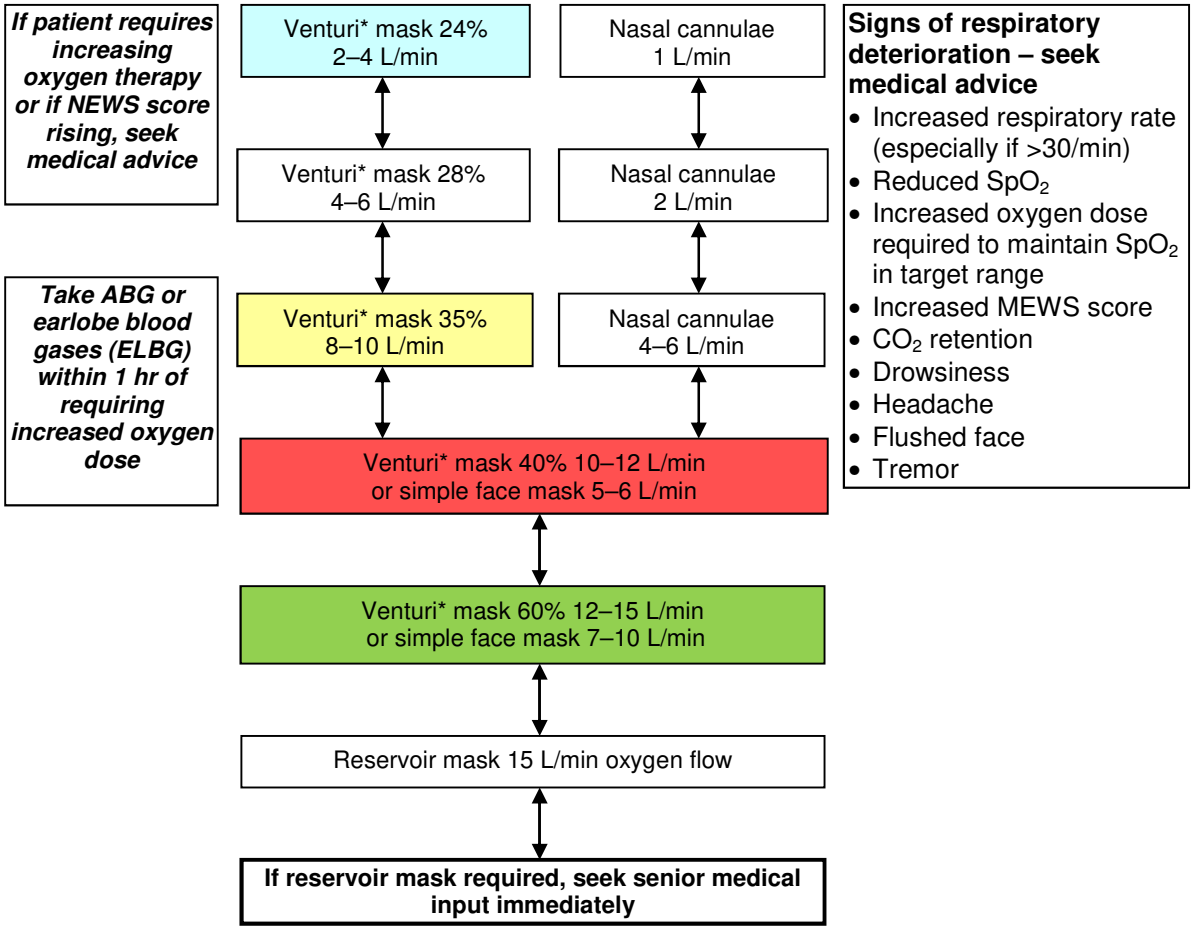
** Patients previously requiring NIV or IPPV should have a target range of 88–92%, even if the initial $PaCO_2$ is normal

Key:
ABG = arterial blood gas
COPD = chronic obstructive pulmonary disease
FiO_2 = fraction of inspired oxygen
SpO_2 = peripheral oxygen saturation measured by pulse oximetry
CCU = Critical care unit
NIV = non-invasive ventilation
$PaCO_2$ = arterial partial pressure of carbon dioxide
PaO_2 = arterial partial pressure of oxygen

OXYGEN THERAPY IN ACUTELY HYPOXAEMIC PATIENTS ● 4/4

Flowchart for oxygen administration on general ward

- Choose most suitable delivery system and flow rate
- Titrate oxygen up or down, using the least oxygen necessary to maintain target oxygen saturation
- **Flowchart** below shows available options for stepping dosage up or down. Chart does not imply any equivalence of dose between Venturi* masks and nasal cannulae
- Except in major and sudden fall in saturation, allow at least 5 min at each dose before adjusting further upwards or downwards
- Once patient has adequate and stable saturation on minimal oxygen dosage, consider discontinuation



*For Venturi masks, if respiratory rate >30 breaths/min, higher flow rate required. Colour of box matches colour of appropriate Venturi mask

Critically ill patients and those in peri-arrest situation – give maximal oxygen therapy via reservoir mask or bag-valve-mask whilst awaiting arrival of medical help.
Patients with COPD and other risk factors for hypercapnia who develop critical illness should have the same initial target saturations as other critically ill patients pending the results of blood gas measurements, after which these patients may need controlled oxygen therapy or supported ventilation if there is severe hypoxaemia and/or hypercapnia with respiratory acidosis

PHENYTOIN – ADJUSTMENT OF ORAL DOSAGE ● 1/1

If the steady-state concentration at a given dose is known, the dose increment required to raise the concentration to a target level can be estimated using the nomogram below

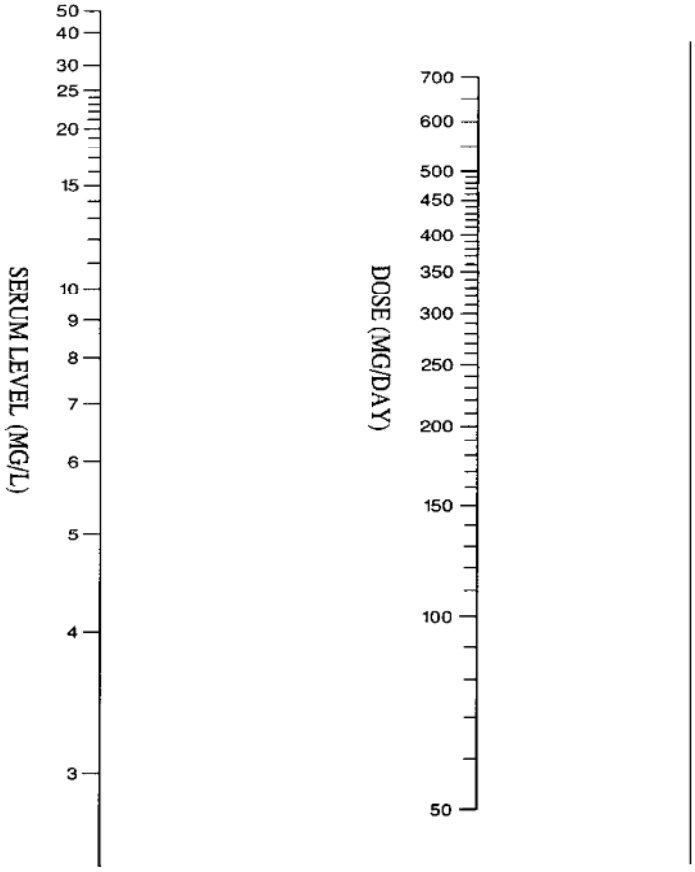
- The higher the concentration, the smaller is the difference between the old dose and the new
- The nomogram is equally helpful in the selection of dose decrement if there is a need to reduce dosage
- It may take 3–4 weeks for steady-state to be achieved after a change in phenytoin dosage
- If urgent advice about phenytoin dosage required out-of-hours in patients with suspected phenytoin toxicity, consult on-call pharmacist

The nomogram will give misleading prediction if:

- Serum concentration measurement is inaccurate because patient's compliance is in doubt
- Change in concurrent treatment has been made since measurement of serum concentration
- Binding of phenytoin to plasma albumin is reduced (in renal failure or when serum albumin is low)
- if creatinine clearance <25 mL/min, seek advice from your ward pharmacist or medicines information
- if serum albumin <40 g/L, use the following equation to correct serum phenytoin concentration, which can then be used in nomogram:

$$\text{Corrected serum phenytoin} = \frac{\text{Measured serum phenytoin (mg/L)}}{[0.0225 \times \text{measured serum albumin (g/L)}] + 0.1}$$

Use the following nomogram only if serum phenytoin is reported in units of mg/L



Given a single reliable serum concentration on a given daily dose of phenytoin, the dose required to achieve a desired concentration can be predicted

- Draw a line connecting the observed concentration (left-hand scale) with the dose administered (centre scale) and extend to intersect the right-hand vertical line
- From this point of intersection, draw another line back to the desired concentration (left-hand scale)
- Read the dose to produce the desired concentration off the centre scale

Nomogram devised by Prof. A. Richens and Dr B. Rambeck

INTRAVENOUS PHENYTOIN
(LOADING DOSAGE IN STATUS EPILEPTICUS) ● 1/2

INDICATIONS

- Status epilepticus – for patients not taking maintenance phenytoin therapy
- if already taking maintenance phenytoin therapy, contact neurology SpR to discuss reduced dose of IV phenytoin or use of phenobarbital or alternative agents

If phenytoin is given too rapidly, hypotension, cardiac arrhythmias, impaired cardiac conduction, CNS depression or respiratory arrest can occur. Monitor all patients with continuous ECG and BP throughout the infusion

NOTES

- Phenytoin sodium parenteral solution is highly alkaline. Soft tissue irritation and inflammation (varying from slight tenderness to extensive necrosis and sloughing, requiring amputation in rare instances) can occur with or without extravasation
- Administer **slowly** into a large vein
- Ensure extravasation does not occur – **check infusion site regularly**

PREPARATIONS

- Phenytoin sodium injection 50 mg/mL in 5 mL (250 mg) ampoules

DILUENTS

- Sodium chloride 0.9% only (see **Dosage**)

DOSAGE

- Phenytoin 20 mg/kg up to a maximum of 2 g by slow IV administration into a large vein through an in-line filter (0.22–0.5 micron) **no faster than 50 mg/min**

IV infusion of undiluted phenytoin via syringe pump (preferred method of delivery)

- Flush cannula with sodium chloride 0.9% before phenytoin administration
- Round patient's body weight to the nearest 5 kg and establish required dosage and infusion rate of phenytoin from **Table 1**
- Draw up required volume of phenytoin sodium injection 50 mg/mL in syringe used by syringe pump
- Administer over at least 30 min via syringe pump set at rate specified in **Table 1**
- Flush cannula with sodium chloride 0.9% after phenytoin administration

Table 1: Administration of undiluted phenytoin sodium 50 mg/mL via syringe pump at dose of 20 mg/kg

Weight (kg)	45	50	55	60	65	70	75	80	85	90	95	100
Dose (mg)	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
Volume to be drawn up (mL)	18	20	22	24	26	28	30	32	34	36	38	40
Syringe pump rate (mL/hr)	36	40	44	48	52	56	60	60	60	60	60	60

IV infusion of diluted phenytoin

- If a syringe pump is not available, phenytoin sodium injection can be diluted in 100 mL sodium chloride 0.9% to a maximum concentration of 10 mg/mL (i.e. max 1000 mg in 100 mL)
- if dose exceeds 1000 mg, (see first 2 columns of **Table 2**) divide total dose between 2 x 100 mL bags and run **concurrently**
- See **Table 2** for details of infusion preparation and rates
- Check that solution is free of haziness or precipitation
- Use a 0.22–0.50 micron in-line filter
- Flush cannula with sodium chloride 0.9% before phenytoin administration
- Start administration **immediately** after dilution to ensure **infusion is completed within 1 hr of preparation.** Follow **Table 2** to ensure **not administered faster than 50 mg/min**
- Flush cannula with sodium chloride 0.9% after phenytoin administration

INTRAVENOUS PHENYTOIN
(LOADING DOSAGE IN STATUS EPILEPTICUS) ● 2/2

Table 2: Administration of diluted phenytoin sodium by IV infusion at dose of 20 mg/kg

Weight (kg)	Total dose phenytoin (mg) required	Total volume (mL) of phenytoin concentrate (50 mg/mL)	Bag A Dose (volume) of phenytoin concentrate (50 mg/mL) to be added to 100 mL bag sodium chloride 0.9%	Bag B Dose (volume) of phenytoin concentrate (50 mg/mL) to be added to 100 mL bag sodium chloride 0.9%
Run bag A at 150 mL/hr				
When bag A and bag B both required, run together at the same time via the same cannula, each at 150 mL/hr				
45	900	18	900 mg (18 mL)	Bag B not required as dose ≤1000 mg
50	1000	20	1000 mg (20 mL)	
55	1100	22	500 mg (10 mL)	600 mg (12 mL)
60	1200	24	500 mg (10 mL)	700 mg (14 mL)
65	1300	26	500 mg (10 mL)	800 mg (16 mL)
70	1400	28	500 mg (10 mL)	900 mg (18 mL)
75	1500	30	1000 mg (20 mL)	500 mg (10 mL)
80	1600	32	1000 mg (20 mL)	600 mg (12 mL)
85	1700	34	1000 mg (20 mL)	700 mg (14 mL)
90	1800	36	1000 mg (20 mL)	800 mg (16 mL)
95	1900	38	1000 mg (20 mL)	900 mg (18 mL)
100	2000	40	1000 mg (20 mL)	1000 mg (20 mL)

MONITORING

- In patients requiring rapid achievement and maintenance of therapeutic phenytoin concentrations, who have been given an IV loading dose, it is usually wise to monitor phenytoin concentrations within 2–3 days of initiating therapy
- a second phenytoin concentration would normally be obtained in another 3–5 days; subsequent doses of phenytoin can then be adjusted
- if the plasma phenytoin concentrations have not changed over a 3–5 day period, monitoring interval can usually be increased to once weekly in the acute clinical setting
- In stable patients requiring long-term therapy, phenytoin plasma concentrations are generally monitored at 3–12 month intervals

SALBUTAMOL IV ● 1/1

INDICATIONS

- Severe bronchospasm

PREPARATIONS

- Salbutamol injection 500 microgram in 1 mL ampoule, dilute for **slow IV bolus injection**
- Salbutamol solution **for IV infusion** 5 mg in 5 mL ampoule (1 mg/mL) dilute before use

DOSAGE

IV bolus injection

This is a slow bolus for immediate treatment – *see* **Acute severe asthma in adults guideline – *Patients with life-threatening features. Do not use injection in absence of life-threatening features***

- 250 microgram over 10 min
- use **500 microgram in 1 mL preparation**, take 0.5 mL and make up to 20 mL with diluent in a Luer lock syringe (see **Diluents**) – this gives concentration of 12.5 microgram/mL
- Administer via a syringe driver at a rate of 120 mL/hr (= 2 mL/min)

IV infusion

Use this regimen for patients with non-life-threatening features. Note that the concentration is different from the IV bolus injection guidance above

- Initial rate = 5 microgram/min, adjusted according to response and heart rate, usual range 3–20 microgram/min or more if necessary **(Table 1)**
- Use preparation for IV infusion (5 mg in 5 mL). Remove 5 mL from a 500 mL bag of diluent (see **Diluents**), then add 5 mL (5 mg) of salbutamol to the bag (5 mg in 500 mL = 10 microgram/mL)

NOTES

- Salbutamol increases heart rate, which can lead to palpitations, and this may preclude further dosage increases. Cardiac monitoring is advised in patients with ischaemic heart disease
- Salbutamol also causes rapid cellular uptake of potassium, which can lead to serious **hypokalaemia**. Check plasma potassium 1–2 hr after starting IV salbutamol and after each dosage increase

DILUENTS

- Sodium chloride 0.9% or glucose 5%

Table 1: IV infusion (5 mg in 500 mL)

Dose (microgram/min)	3	4	5	6	7	8	9	10	11
Infusion rate (mL/min)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1
Pump rate (mL/hr)	18	24	30	36	42	48	54	60	66

Dose (microgram/min)	12	13	14	15	16	17	18	19	20
Infusion rate (mL/min)	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Pump rate (mL/hr)	72	78	84	90	96	102	108	114	120

SODIUM NITROPRUSSIDE ● 1/3

Sodium nitroprusside is a very potent agent and should only be used on the advice of a renal SpR or consultant and only on wards (e.g. critical care unit CCU) where continuous monitoring of BP (preferably via arterial line) is possible

INDICATIONS

- Accelerated hypertension

DOSAGE

- Aim to reduce diastolic BP to 110–115 mmHg over several hours
- Initially 0.3 microgram/kg/min by IV infusion, increase to 0.5 microgram/kg/min, then in increments of 0.5 microgram/kg/min according to response (**Tables 1–3**), allowing 5–10 min between each increment
- Maximum dose = 8 microgram/kg/min
- Patients already taking antihypertensive drugs and the elderly will be more sensitive to sodium nitroprusside
- If BP not adequately reduced within 10 min at maximum dosage, discontinue infusion – see **Accelerated (malignant) hypertension** guideline for alternative

ADMINISTRATION

- Administer sodium nitroprusside using a controlled infusion device, drip regulator or micro-drip regulator, or similar device that will allow precise control of flow rate
- Sodium nitroprusside may be administered in a 50 mL syringe via a syringe pump, or in 250 mL or 500 mL bags. Choice of bag size or use of syringe pump will depend on dosage, patient weight and fluid status and availability of equipment

Infusion via syringe pump

- **Table 1** gives dosage and corresponding flow rates
- Reconstitute sodium nitroprusside with 2 mL of glucose 5%. Withdraw resulting solution and make up to 50 mL with glucose 5% (50 mg in 50 mL = 1 mg/mL). Mix thoroughly. Infusion solution has a faint orange-brownish tint. **If it is highly coloured do not use**
- Sodium nitroprusside **must be protected from light**. Immediately wrap syringe and tubing with foil provided. Infusion solution is then stable for up to 24 hr from time of preparation

Table 1: Administration of sodium nitroprusside (1 mg/mL) via syringe pump (rate mL/hr) Concentration = 50 mg in 50 mL = 1000 microgram/mL (1 mg/mL)

Dosage (microgram/ kg/min)	Weight (kg)											
	45	50	55	60	65	70	75	80	85	90	95	100
0.3	0.8	0.9	1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8
0.5	1.4	1.5	1.7	1.8	2	2.1	2.3	2.4	2.6	2.7	2.9	3
1	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6
1.5	4.1	4.5	5	5.4	5.9	6.3	6.8	7.2	7.7	8.1	8.6	9
2	5.4	6	6.6	7.2	7.8	8.4	9	9.6	10.2	10.8	11.4	12
2.5	6.8	7.5	8.3	9	9.8	10.5	11.3	12	12.8	13.5	14.3	15
3	8.1	9	9.9	10.8	11.7	12.6	13.5	14.4	15.3	16.2	17.1	18
3.5	9.5	10.5	11.6	12.6	13.7	14.7	15.8	16.8	17.9	18.9	20	21
4	10.8	12	13.2	14.4	15.6	16.8	18	19.2	20.4	21.6	22.8	24
4.5	12.2	13.5	14.9	16.2	17.6	18.9	20.3	21.6	23	24.3	25.7	27
5	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30
5.5	14.9	16.5	18.2	19.8	21.5	23.1	24.8	26.4	28.1	29.7	31.4	33
6	16.2	18	19.8	21.6	23.4	25.2	27	28.8	30.6	32.4	34.2	36
6.5	17.6	19.5	21.5	23.4	25.4	27.3	29.3	31.2	33.2	35.1	37.1	39
7	18.9	21	23.1	25.2	27.3	29.4	31.5	33.6	35.7	37.8	39.9	42
7.5	20.3	22.5	24.8	27	29.3	31.5	33.8	36	38.3	40.5	42.8	45
8	21.6	24	26.4	28.8	31.2	33.6	36	38.4	40.8	43.2	45.6	48

Infusion in a bag via a controlled-infusion device

- **Tables 2 and 3** give dosage and corresponding flow rates. If flow rate corresponding to required dosage and patient's weight is in shaded area of **Table**, a more concentrated solution may be more appropriate/practical
- Select most appropriately sized bag of glucose 5% (250 mL or 500 mL). Withdraw 2 mL from bag and use to reconstitute sodium nitroprusside. Add resulting solution to infusion bag and mix thoroughly
- Infusion solution has a faint orange-brownish tint**. If it is highly coloured, do not use**
- Sodium nitroprusside must be **protected from light**. Immediately wrap infusion bag and all parts of administration set with foil provided. Infusion solution is then stable for up to 24 hr from time of preparation

Table 2: Administration of sodium nitroprusside (100 microgram/mL) via infusion bag (rate mL/hr). Concentration = 50 mg in 500 mL = 100 microgram/mL

Dosage (microgram/ kg/min)	Weight (kg)											
	45	50	55	60	65	70	75	80	85	90	95	100
0.3	8	9	10	11	12	13	14	14	15	16	17	18
0.5	14	15	17	18	20	21	23	24	26	27	29	30
1	27	30	33	36	39	42	45	48	51	54	57	60
1.5	41	45	50	54	59	63	68	72	77	81	86	90
2	54	60	66	72	78	84	90	96	102	108	114	120
2.5	68	75	83	90	98	105	113	120	128	135	143	150
3	81	90	99	108	117	126	135	144	153	162	171	180
3.5	95	105	116	126	137	147	158	168	179	189	200	210
4	108	120	132	144	156	168	180	192	204	216	228	240
4.5	122	135	149	162	176	189	203	216	230	243	257	270
5	135	150	165	180	195	210	225	240	255	270	285	300
5.5	149	165	182	198	215	231	248	264	281	297	314	330
6	162	180	198	216	234	252	270	288	306	324	342	360
6.5	176	195	215	234	254	273	293	312	332	351	371	390
7	189	210	231	252	273	294	315	336	357	378	399	420
7.5	203	225	248	270	293	315	338	360	383	405	428	450
8	216	240	264	288	312	336	360	384	408	432	456	480

Table 3: Administration of sodium nitroprusside (200 microgram/mL) via infusion bag (rate mL/hr). Concentration = 50 mg in 250 mL = 200 microgram/mL

Dosage (microgram/ kg/min)	Weight (kg)											
	45	50	55	60	65	70	75	80	85	90	95	100
0.3	4	5	5	5	6	6	7	7	8	8	9	9
0.5	7	8	8	9	10	11	11	12	13	14	14	15
1	14	15	17	18	20	21	23	24	26	27	29	30
1.5	20	23	25	27	29	32	34	36	38	41	43	45
2	27	30	33	36	39	42	45	48	51	54	57	60
2.5	34	38	41	45	49	53	56	60	64	68	71	75
3	41	45	50	54	59	63	68	72	77	81	86	90
3.5	47	53	58	63	68	74	79	84	89	95	100	105
4	54	60	66	72	78	84	90	96	102	108	114	120
4.5	61	68	74	81	88	95	101	108	115	122	128	135
5	68	75	83	90	98	105	113	120	128	135	143	150
5.5	74	83	91	99	107	116	124	132	140	149	157	165
6	81	90	99	108	117	126	135	144	153	162	171	180
6.5	88	98	107	117	127	137	146	156	166	176	185	195
7	95	105	116	126	137	147	158	168	179	189	200	210
7.5	101	113	124	135	146	158	169	180	191	203	214	225
8	108	120	132	144	156	168	180	192	204	216	228	240

SODIUM NITROPRUSSIDE ● 3/3

NOTES

- Take care to avoid extravasation – check infusion site regularly to ensure this has not occurred
- Sodium nitroprusside is metabolised to free cyanide, which is converted in the liver to thiocyanate. If response obtained, continue therapy only for a few hours to avoid risk of toxicity
- Start oral antihypertensive therapy while BP is being controlled by sodium nitroprusside
- Over-rapid reduction in BP may produce the following symptoms: headache, dizziness, nausea, retching, abdominal pain, perspiration, palpitations, apprehension, retrosternal discomfort. If these occur, reduce infusion rate in decrements of 0.5 microgram/kg/min, monitoring BP and symptoms carefully
- When finally withdrawing sodium nitroprusside, to prevent rebound increase in BP, reduce infusion rate gradually – reduce by 25–30% every 5 min, rechecking BP before each decrement
- If therapy required for >24 hr, consult manufacturer's literature on monitoring and management of potential toxicity. Signs of toxicity include tachycardia, sweating, hyperventilation, arrhythmias, marked metabolic acidosis

PREPARATIONS

- Sodium nitroprusside 50 mg ampoules/vials for reconstitution

DILUENTS

- Glucose 5%

THERAPEUTIC DRUG MONITORING • 1/2

INDICATIONS FOR MONITORING

- Undertake therapeutic drug monitoring only if the result is likely to affect patient management. Appropriate indications are to:
- assist dose adjustment for optimal serum concentrations
- confirm suspected toxicity
- monitor effect of drug/drug or drug/disease interactions
- investigate treatment failure
- investigate suspected non-adherence

ASSAYS AVAILABLE

Clinical biochemistry

- Carbamazepine
- Sodium valproate
- Phenobarbital
- Phenytoin
- Digoxin
- Theophylline
- Lithium
- Tacrolimus
- Ciclosporin

Microbiology

- Gentamicin
- Tobramycin
- Vancomycin
- All other drugs (teicoplanin, antiretroviral drugs) – discuss directly with laboratory concerned

Timing the sample

Unless toxicity is suspected, assays are unlikely to be of value until regular dosing has produced a steady state, usually 4–5 half-lives after treatment began or dose was last altered. See **Table 1** for further details

Note that half-lives of anticonvulsants can vary in patients taking >1 anticonvulsant

Sending a sample

- Send all samples in tube appropriate for assay required (as per Order Comms), unless laboratory advises otherwise, discuss as outlined above
- Send requests to microbiology using a microbiology form (or request on Order Comms), some requests require specific forms (which must reach laboratory by 1530 hr) – discuss with laboratory
- Ensure the following details are provided:
- dose, frequency and duration of treatment with drug
- time of last dose
- any impaired organ function (e.g. renal impairment, liver disease, cardiac failure)
- potentially interacting drugs (see individual drugs and BNF Appendix 1) including dose, frequency and duration of co-prescription

Unless these data are recorded, correct interpretation of assay result may not be possible

For further advice on therapeutic drug monitoring, or assistance when selecting a dose adjustment, contact your ward's clinical pharmacist or medicines information. Ensure you have details of the dose regimen, sample time and assay result to hand, together with patient's clinical details and other drug treatment. For advice on optimal use of antimicrobial agents, contact a microbiologist

THERAPEUTIC DRUG MONITORING ● 2/2

Table 1: Blood sampling and interpretation guidance

Drug	Assay day	Time from start or change of dosage	Sample	Half-life	Target range	Notes
Carbamazepine	Daily	From start: 2–3 weeks Adjust dose: 3–4 days	Pre-dose	35 hr (single dose) 10–20 hr (regular dosing)	4–12 mg/L	Induces own metabolism
Ciclosporin	Tues/Fri	<1 week	Pre-dose	11 hr	Range dependent on use	Whole blood EDTA sample
Digoxin	Daily	1–3 weeks*	At least 6 hr post-dose	40 hr	0.8–2 microgram/L	Hypokalaemia predisposes to toxicity therefore monitor potassium
Gentamicin	See **Gentamicin** guideline					
Lithium	Daily	1 week*	At least 12 hr post-dose	8–45 hr	0.6–1.2 mmol/L However, NICE and other authorities make different recommendations so not all patients will be managed within these BNF target ranges	If lithium toxicity suspected, stop lithium. Contact patient's consultant psychiatrist
Phenobarbital	Daily	2–4 weeks*	Anytime	2–6 days	15–40 mg/L	Contact laboratory if urgent
Phenytoin	Daily	3–4 weeks*	Anytime	35 hr	10–20 mg/L	Dose-concentration relationship non-linear – see **Phenytoin** guidelines
Tacrolimus	Tues/Fri	~1 week	Pre-dose	10–20 hr	Range dependent on use	Whole blood EDTA sample
Theophylline	Daily	5 days	**IV**: anytime **Oral**: at least 4–6 hr post-dose	6–8 hr	10–20 mg/L	Theophylline is given by injection as aminophylline
Tobramycin (8-hrly dosing)	Daily	12 hr	**Trough:** Immediately pre-dose **Peak:** 1 hr post-dose	2.5 hr	**Trough:** <2 mg/L **Peak:** 5–10 mg/L (8–10 mg/L for enterobacterial pneumonia and 8–12 mg/L for exacerbation of bronchiectasis in cystic fibrosis patients)	Tobramycin range based on 8-hrly dosing
Vancomycin	See **Vancomycin** guideline					

*These particular time intervals apply to patients taking oral maintenance doses of these drugs, and not to patients who have been given a loading dose

VANCOMYCIN ● 1/2

INDICATIONS

- Use vancomycin IV for serious MRSA infections on advice of consultant microbiologist

Do not use this guideline if CrCl <10 mL/min or patient on haemodialysis/peritoneal dialysis – seek advice from renal SpR or consultant

DOSAGE

- As vancomycin has a narrow therapeutic index, accurate dosing is imperative to prevent toxicity
- Use **Vancomycin calculator** on Trust intranet>Clinical section> Clinical guidelines> Antimicrobial guidelines>Vancomycin calculator
- After completing calculation on the calculator, print off the result (if possible) and insert into patient notes. **If calculator not available** use **Steps 1–3** below
- **Give single loading dose followed by maintenance doses**

STEP 1 – WEIGH PATIENT

- If unfit to be weighed, estimate weight

STEP 2 – LOADING DOSE

- **Use ACTUAL or estimated body weight –** not ideal body weight (IBW)
- Use **Table 1** to select loading dose and volume and duration of infusion
- Loading dose is independent of patient's renal function
- Prescribe on once only antimicrobial section of prescription chart

Table 1

Actual/estimated body weight	Dose	Volume of sodium chloride 0.9% or glucose 5%	Duration of infusion
<40 kg	750 mg	250 mL	1.5 hr
40–59 kg	1 g	250 mL	2 hr
60–89 kg	1.5 g	500 mL	3 hr
≥90 kg	2 g	500 mL	4 hr

STEP 3 – MAINTENANCE DOSING

- Calculate renal function using equations below. **DO NOT** use eGFR
- If patient's creatinine <60 µmol/L use 60 µmol/L as a minimum value to avoid falsely producing high creatinine clearance
- **Female: CrCl =** $\frac{1.04 \times (140 - \text{age}) \times \text{weight*}\ (\text{kg})}{\text{serum creatinine}\ (\mu\text{mol/L})}$
- **Male: CrCl =** $\frac{1.23 \times (140 - \text{age}) \times \text{weight*}\ (\text{kg})}{\text{serum creatinine}\ (\mu\text{mol/L})}$

*weight – use IDEAL body weight (IBW) *unless* patient appears underweight **–** See **Ideal body weight** guideline

- If patient appears underweight and is fit to be weighed, use **actual body weight**
- If patient appears underweight AND is unfit to be weighed, **estimate body weight**
- Based on calculated CrCl, select maintenance dose from **Table 2**
- Maintenance dose should NOT be higher than loading dose

Give first maintenance dose 12, 24 or 48 hr after start of loading dose according to dose interval in Table 2

Table 2

CrCl (mL/min)	Dose	Volume of sodium chloride 0.9% or glucose 5%	Duration of infusion	Dose interval (time since loading dose and time between maintenance doses)	Timing of samples
<10	See advice above				
10–19	500 mg	100 mL	1 hr	48 hr	Trough concentration immediately before both 1st and 2nd maintenance doses
20–29	500 mg	100 mL	1 hr	24 hr	
30–39	750 mg	250 mL	1.5 hr	24 hr	
40–54	500 mg	100 mL	1 hr	12 hr	Trough concentration immediately before 3rd or 4th maintenance dose – whichever falls before morning dose
55–74	750 mg	250 mL	1.5 hr	12 hr	
75–89	1 g	250 mL	2 hr	12 hr	
90–110	1.25 g	250 mL	2.5 hr	12 hr	
>110	1.5 g	500 mL	3 hr	12 hr	

STEP 4 – MONITORING VANCOMYCIN CONCENTRATION

Target trough concentration: 10–15 mg/L
In some serious infections the target trough concentration may be up to 20 mg/L but this is on advice only from microbiology or infectious diseases consultant

- **Microbiology laboratory will assay vancomycin samples every day 0900–1500 hr. Samples received after 1500 hr will be processed the following morning. Results available on iPortal/ICE**
- See **Table 2** for timing of samples
- Therapeutic drug monitoring is recommended to ensure adequate serum concentration
- Results are meaningless unless dose and sample time are recorded accurately
- Monitor creatinine daily
- Do not wait for result before giving dose due immediately after taking sample, unless patient has severe renal impairment (CrCl <10 mL/min) or poor urine output (<0.5 mL/kg/hr)
- **Document on prescription chart:**
- time each infusion started
- time sample taken
- **Record on blood sample request form:** (or on OrderComms)
- dose of vancomycin
- date and start time of infusion last administered to patient
- dose regimen

STEP 5 – CONCENTRATION INTERPRETATION AND ADJUSTMENT OF DOSES

- See **Table 3**
- Always check dosage history and sampling time are appropriate before interpreting result
- If necessary, request assistance in interpreting result from pharmacy
- If renal function impaired but stable, check trough concentration on alternate days
- If renal function is changing rapidly (deteriorating **or** improving), check trough concentration daily to prevent over- or under-treatment
- If dose has to be changed, take further samples for trough concentration before appropriate dose (see **Table 2**)

Table 3

Vancomycin concentration	Suggested dose change
<10 mg/L	Increase dose by approximately 50%; round doses to nearest 250 mg. If this increased dose exceeds 1.5 g 12-hrly, seek **immediate** advice from microbiology
10–15 mg/L	Maintain present dose, check renal function daily and if stable re-check trough concentration twice weekly
>15 mg/L	Stop until <15 mg/L and seek advice. Check levels daily unless advised otherwise

For further advice, contact ward pharmacist, antimicrobial pharmacist (via call centre or bleep), or Medicines information. Out-of-hours contact on-call pharmacist or microbiologist via call centre

WARFARIN INITIATION ● 1/4

Decision to anticoagulate orally, including duration and intensity of treatment, must be made by senior clinician responsible for patient. Refer inpatients to anticoagulation management service (AMS), following the referral process below. If patient not referred to AMS, follow this guideline

BEFORE STARTING TREATMENT

- Inform all patients of reason, risks and benefits of oral anticoagulation
- Provide anticoagulation information pack and counsel about bleeding risk, drug interactions (including alcohol) and need for regular INR monitoring
- Sensitivity to warfarin is increased in patients who:
- are frail, sick, have multiple comorbidity or take multiple medication
- are aged >80 yr
- are significantly underweight
- have congestive cardiac failure
- have abnormal liver function
- are receiving parenteral nutrition or drugs that potentiate warfarin significantly (see **BNF Appendix 1**)
- Once decision is made to give warfarin, review patient's medication history, including any herbal remedies, to determine any significant interactions with warfarin
- consider whether alternatives could be substituted or medications discontinued. This is particularly important for medications taken on an 'as required' basis e.g. NSAIDs, where the interaction may be inconsistent
- seek further information from medicines information or AMS where necessary

REFERRAL TO AMS

- Fax completed anticoagulant referral form (available to download from Trust intranet>Clinicians>Pathology>Anticoagulant management) to AMS. **Ensure all fields completed** and form has been signed by a consultant, SpR, non-medical prescriber, GP, staff grade or associate specialist
- In patients with VTE/mechanical heart valves, ensure a LMWH Patient Specific Directive is also completed and faxed or emailed with the warfarin referral
- Document in patient's notes that they have been informed of the indication, risks and benefits of warfarin before referral is made
- AMS will: (see also referral pathway on Trust intranet)

To be commenced as inpatient	To be commenced as outpatient
• Referrals received before 1500 hr (Mon–Fri) and 1000 hr (Sat–Sun) will be reviewed the same day • Written information, counselling and advice on dosing will be provided	• Offer outpatient appointment in appropriate clinic • for urgent appointments call AMS and fax referral • At first clinic appointment, provide written information and counselling • Warfarin TTO will be issued at first appointment

RAPID ANTICOAGULATION (WITH CONCURRENT HEPARIN)

Anticoagulation with warfarin takes effect only in 72–96 hrs after first dose. The following algorithm allows the maintenance dose of warfarin to be predicted over 4 days, by optimal interpretation of **timed** daily INR measurements. The INR is used to guide the selection of daily warfarin dose, even during concurrent anticoagulant treatment with unfractionated heparin, dalteparin or any other low-molecular-weight heparin

DOSE PREDICTION

Have you checked if patient is sensitive to warfarin? See BEFORE STARTING TREATMENT above. If patient has increased sensitivity to warfarin, use half the doses recommended below

For patients not referred to AMS proceed as follows

Day 1

- Take blood for measurement of INR
- If INR ≥1.4, this predictive method cannot be used and the choice of dose must rely on clinical judgement alone – seek advice from AMS
- If INR <1.4 and there is no reason to believe that the patient will be more than usually sensitive to warfarin, give warfarin 10 mg before evening meal between 1700 and 1800 hr

Day 2, 3 and 4

- Take blood between 0900 hr and 1000 hr (16 hr after previous dose of warfarin)
- Measure INR and use the result to select next dose from **Table 1**
- Give the dose before evening meal between 1700 hr and 1800 hr. The dose selected on day 4 is the predicted maintenance dose necessary to achieve a stable INR in the range 2–4
- Further adjustment may be necessary as INR stabilises depending on target range desired

NOTES

- Watch for INR instability due to changing/starting/stopping of interacting medication or diet (see **BNF** appendix 1)
- All warfarin tablets are scored and any doses recommended in the **Table** can be administered by appropriate use of 1 mg, 3 mg and 5 mg tablets
- **Table 1 has no predictive value beyond day 4 and should not be used**
- Dose adjustments from day 5 onward must be made intuitively
- On discharge, refer patients stabilised on warfarin to AMS for on-going monitoring (using DAWN computerised dosing system)
- Order TTO for warfarin on discharge along with other medication

Table 1: Dosage adjustment for rapid anticoagulation based on INR measurements (days 2, 3 and 4). Remember to halve doses in sensitive patients

Day 2 (16 hr after first 10 mg dose)	
INR	**Warfarin dose (mg)**
<1.8	10.0
1.8	1.0
>1.8	0.5
Day 3 (16 hr after second dose)	
INR	**Warfarin dose (mg)**
<2.0	10.0
2.0–2.1	5.0
2.2–2.3	4.5
2.4–2.5	4.0
2.6–2.7	3.5
2.8–2.9	3.0
3.0–3.1	2.5
3.2–3.3	2.0
3.4	1.5
3.5	1.0
3.6–4.0	0.5
>4.0	0
Day 4 (16 hr after third dose)	
INR	**Warfarin dose (mg)**
<1.4	>8.0
1.4	8.0
1.5	7.5
1.6–1.7	7.0
1.8	6.5
1.9	6.0
2.0–2.1	5.5
2.2–2.3	5.0
2.4–2.6	4.5
2.7–3.0	4.0
3.1–3.5	3.5
3.6–4.0	3.0
4.1–4.5	0 – give 2 mg from day 5
>4.5	0 – give 1 mg from day 6

SLOW ANTICOAGULATION

Where anticoagulation can be achieved more gradually (e.g. to prevent thromboembolism in patients with atrial fibrillation), heparin is unnecessary and warfarin can be initiated on an out-patient basis, using the methods described below

Once decision to anticoagulate made (before starting warfarin)

Refer to AMS who will either start warfarin as an inpatient or arrange an outpatient appointment

WARFARIN INITIATION ● 3/4

Referral to AMS

- Fax referral to AMS and follow-up with a telephone call to check that referral has arrived and to arrange an appointment for patient. Specify on the referral form how anticoagulation should be initiated
- slow anticoagulation: **Tait regimen** (usual) or if increased sensitivity to warfarin **OATES regimen**
- rapid anticoagulation: **Fennerty regimen** (usually reserved for VTE induction)

For any patient not referred to AMS, proceed as follows

Have you checked if patient is sensitive to warfarin? See BEFORE STARTING TREATMENT above. If patient has increased sensitivity to warfarin specifically use the OATES regimen

- Take blood for measurement of INR
- If INR ≤1.3 and increased sensitivity to warfarin (see **Before starting treatment)**, use **Slow anticoagulation OATES regimen**
- If INR <1.5 and **no** factors likely to cause increased sensitivity to warfarin present, use **Tait regimen**
- otherwise, seek senior advice

Slow anticoagulation Tait regimen

- Commence warfarin treatment 5 mg daily starting on Monday, Thursday or Friday (day 1) but not on other days of the week
- Complete referral form for AMS including a decision whether any current prescribed antiplatelet treatment is to be continued once target INR achieved
- Measure INR on days 5 and 8, and adjust daily dosage according to algorithm (see **Table 2**)
- do not measure INR or adjust warfarin dosage on any other day as this will preclude use of the algorithm (unless patients clinical condition or medication alters)

Table 2: Algorithm for dosage adjustment in slow anticoagulation Tait regimen

Day 5 INR	Dosage (mg) for days 5–7	Day 8 INR	Dosage (mg) from day 8
≤1.7	5	≤1.7 1.8–2.4 2.5–3.0 >3.0<5 >5	6 5 4 3 for 4 days Omit until INR <5
1.8–2.2	4	≤1.7 1.8–2.4 2.5–3.0 3.1–3.5 >3.5<5 >5	5 4 3.5 3 for 4 days 2.5 for 4 days Omit until INR <5
2.3–2.7	3	≤1.7 1.8–2.4 2.5–3.0 3.1–3.5 >3.5<5 >5	4 3.5 3 2.5 for 4 days 2 for 4 days Omit until INR <5
2.8–3.2	2	≤1.7 1.8–2.4 2.5–3.0 3.1–3.5 >3.5<5 >5	3 2.5 2 1.5 for 4 days 1 for 4 days Omit until INR <5
3.3–3.7	1	≤1.7 1.8–2.4 2.5–3.0 3.1–3.5 >3.5	2 1.5 1 0.5 for 4 days Omit for 4 days
>3.7	0	<2.0 2.0–2.9 3.0–3.5	1.5 for 4 days 1 for 4 days 0.5 for 4 days

- At day 15 (or day 12) check INR and make fine dose adjustment as appropriate

WARFARIN INITIATION ● 4/4

Slow anticoagulation OATES regimen

How

- If INR 0–1.3 on day 1, give 2 mg daily for 7 days, then take next INR at day 7 (not 14) but do not alter dose until day 15 unless INR at day 7 is above 3.00 when follow instructions for day 15
- If INR outside parameters of algorithm, dosing must be carried out intuitively – seek senior advice

Rules for induction algorithm – Oates et al – (depending on INR on day 15)

Female		Male	
INR between	Dose (mg)	INR between	Dose (mg)
1.00–1.10	5.00	1.00–1.00	6.00
1.20–1.30	4.00	1.10–1.20	5.00
1.40–1.90	3.00	1.30–1.50	4.00
2.00–3.00	2.00	1.60–2.10	3.00
3.10–4.00	1.00	2.20–3.00	2.00
		3.10–4.00	1.00

MANAGEMENT OF BLEEDING AND OVER-ANTICOAGULATION WITH WARFARIN ● 1/2

CAUSES

- Concurrent disease process affecting clotting factor synthesis, vitamin K availability or warfarin metabolism:
  - cardiac failure
  - gastrocolic fistula
  - liver disease
  - malnutrition
  - cholestasis
  - abrupt weight reduction
  - diarrhoea
  - renal impairment
  - thyrotoxicosis
  - fever
  - malignancy
  - aged >75 yr
- Many commonly prescribed medications including most antimicrobials interfere with warfarin metabolism. Check any such interactions in the BNF and use an alternative agent if possible
- Over dosage (accidental or deliberate)
- Concurrent anti-platelet, NSAID, SSRI or SNRI use

Such patients are at high risk of over-anticoagulation and/or bleeding while on warfarin. These patients require close INR monitoring if continuing on warfarin. Refer patients to the Staffordshire Thrombosis and Anticoagulation (STAC) team for regular monitoring and dosing during inpatient stay and post-discharge

MANAGEMENT

- Management of over-anticoagulation depends on the INR, severity of bleeding and underlying thrombotic risk (**Table 1**)

In patients with prosthetic heart valves, reversal of anticoagulation may increase the risk of valve thrombosis. Discuss management with cardiothoracic unit and haematologist in non-life, limb or sight threatening situations

Table 1: Management of over-anticoagulation with warfarin

Clinical situation	INR (and special instructions)	Management
Major haemorrhage **(life, limb or sight threatening bleeding – including high suspicion pre-imaging)**	INR unknown or any raised INR ***Includes patients with a metallic heart valve*** • Intra-cerebral bleed • Bleed with haemodynamic instability • Major trauma • Intraocular bleed (excluding subconjunctival) • Muscle bleed resulting in compartment syndrome • Pericardial bleed	• Obtain venous access • Take blood for FBC, INR, APTT, Fibrinogen, U&E, LFT, G&S/crossmatching • **STOP** warfarin and reverse anticoagulation with: 1. Immediate vitamin K (phytomenadione) 5 mg slow IV **and** 2. Octaplex® (prothrombin complex concentrate PCC) – contact blood bank with patient's weight for direct PCC access request • **Do not wait** for INR result or imaging if high clinical suspicion • Activate massive haemorrhage pathway (MHP) if required
Minor haemorrhage	INR raised	• Dose reduce or temporarily discontinue warfarin • Administer IV vitamin K (phytomenadione) 1–3 mg slow IV • Oral bleeding – consider tranexamic acid mouthwash • Epistaxis – consider cautery or nasal packing
High INR without bleeding without bleeding	INR >8.0 INR 5.0–8.0 **and** high risk of bleeding* (*aged >70 yr, hypertension, diabetes, renal failure, previous CVA, previous GI bleed, liver disease)	**Unless a patient has a prosthetic heart valve (see warning box above):** • Stop warfarin • Give 2 mg oral vitamin K (phytomenadione) • Repeat INR in 24 hr • Restart warfarin at lower dose once INR <5.0 and monitor INR until stable
	INR >5.0 but ≤8.0	• Withhold 1–2 doses of warfarin • Reduce maintenance dose • Investigate cause for elevated INR

MANAGEMENT OF BLEEDING AND OVER-ANTICOAGULATION WITH WARFARIN ● 2/2

NB

- Intracranial bleeding in association with warfarin therapy is a medical emergency and requires urgent assessment, imaging and treatment (as above)
- **Do not wait for INR result or imaging if there is a high clinical suspicion of ICH**
- Delays in management may result in major morbidity and mortality. If ICH confirmed – seek neurosurgery advice
- In addition to warfarin reversal, consider local, endoscopic, interventional radiological and surgical measures early for all bleeds

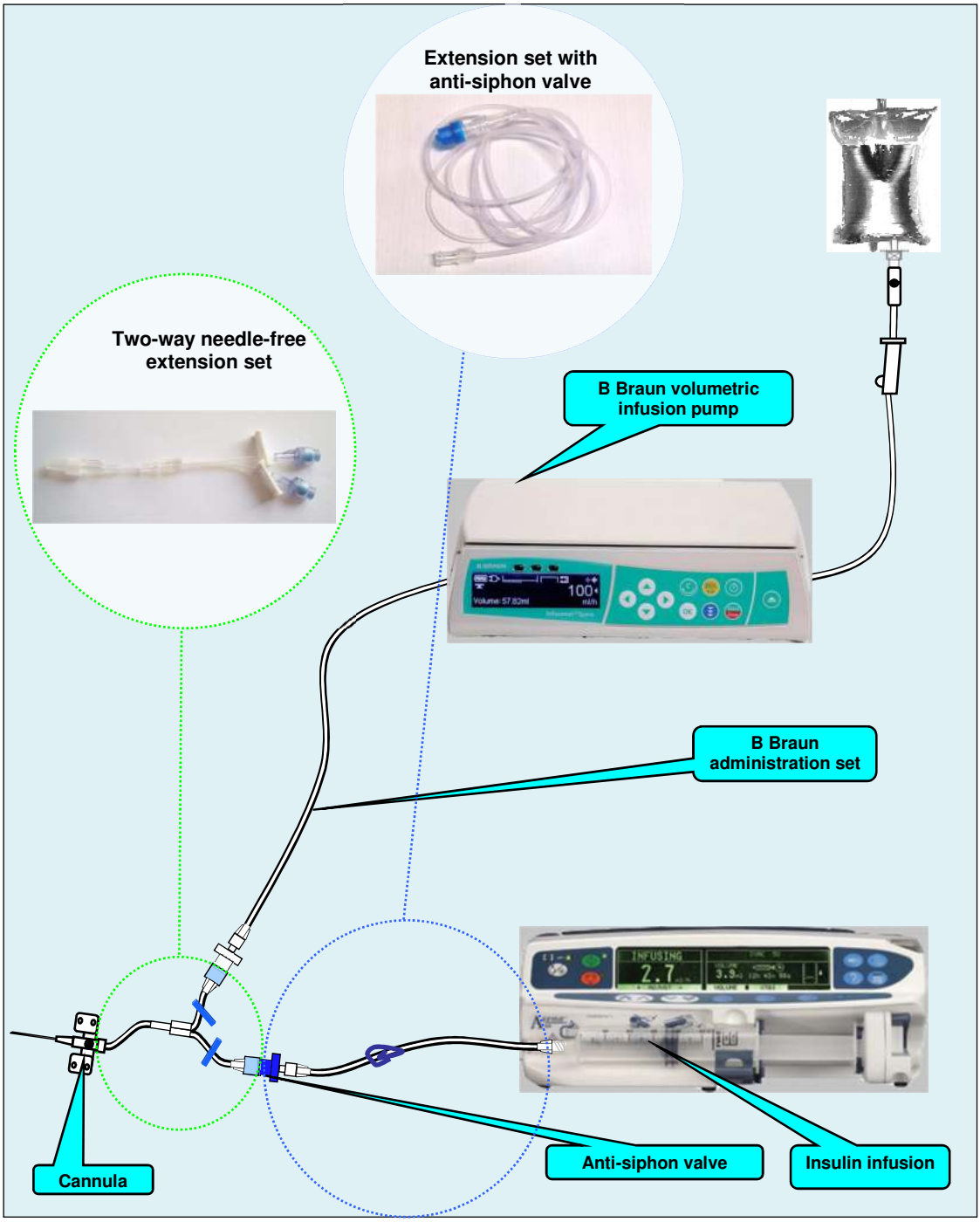
RESTARTING WARFARIN AFTER A MAJOR BLEED

- Any patient with anticoagulation associated bleeding should be reported via DATIX as an adverse event
- Review the need for anticoagulation; confirm duration, intensity and concurrent medication
- Assess bleeding risk factors and address any potential cause for re-bleeding
- Seek specialist input from relevant team e.g. neurosurgery, gastroenterology
- Discussion with the haemostasis team (SpR bleep 15458) before re-starting anticoagulation is strongly advised
- Assess suitability of alternative anticoagulants
- All cases will be reviewed by the STAC governance team

ADMINISTRATION OF IV INSULIN INFUSIONS AND FLUID INFUSIONS • 1/1

- Administer insulin and fluid (e.g. **glucose 5%/sodium chloride 0.45%/KCL 0.15%**) infusions via the same cannula to prevent inadvertent and dangerous administration of either insulin or glucose alone in the event of a blocked cannula
- Use a syringe pump (Asena) for insulin and a volumetric infusion pump (B Braun Infusomat®) for fluid
- The volumetric infusion pump must be used in order to detect and prevent reverse flow of insulin into fluid-giving set in the event of restricted or occluded flow through the cannula
- on release of such a restriction there would be a risk of inadvertent insulin bolus administration from the fluid giving set
- Connect the insulin infusion via an extension set with an anti-siphon valve and the fluid administration set to a two-way needle-free extension (**Figure 1**)

Figure 1: Connection of infusions using extension set with an anti-siphon valve to a two-way needle-free extension



ARTERIAL PUNCTURE • 1/2

Consider, in all patients, whether sufficient information could be gathered from a venous blood gas sample

INDICATIONS

- Moderate or severe respiratory failure
- Patients with severe respiratory or cardiac disease scheduled for major abdominal or thoracic surgery
- Suspected acid-base disturbance
- Suspected carbon monoxide poisoning
- Emergency blood sampling when venepuncture impossible

CONTRAINDICATIONS

- See **Table 1**
- Consider risks and benefits in patients with bleeding diathesis

EQUIPMENT

- Non-sterile disposable gloves
- Alcohol wipes or other antiseptic solution
- Lidocaine 1% plain 2 mL and 25 or 27 G needle and/or ice pack
- Blood gas syringe with 23 G needle (smaller needles have shown longer draw times, and no pain benefit)
- Plastic syringe cap
- Cotton wool balls or similar to press over site after arterial puncture

PROCEDURE

You must be supervised by a practitioner experienced in this procedure until you are familiar with it, and competent to perform it independently

Consent

- Explain procedure and reassure patient
- Obtain and record consent
- Positive Patient Identification (PPID) confirmed

Preparation

- If blood gas analysis not going to be performed within a few minutes, have an ice bag ready to cool sample
- Consider using ice (in a plastic bag) on skin for up to 3 min or cryogesic spray for additional/alternative analgesia to lidocaine
- Check concentration of oxygen patient is breathing at time arterial sample is taken and, if time permits, that it remains constant for 15 min before sampling; note it on request form, in patient notes and on results printout
- Note patient's temperature on request form

Aseptic technique and position of patient

- Select site of puncture – see **Table 1** and **Figure 1** and position patient
- Wear gloves, cleanse patient's skin

Local anaesthetic

- Palpate artery and infiltrate skin with lidocaine plain 1% 0.5–1 mL

Always aspirate before injection of local anaesthetic to prevent injection of lidocaine into the artery

Sampling

- Hold blood gas syringe with 23 G needle, bevel up; for radial (**Figure 1**) and brachial arteries at about 30° to skin surface; for femoral artery at 60°
- Advance needle towards artery; with some blood gas syringes, blood pulsates into syringe, others will need to be drawn

ARTERIAL PUNCTURE ● 2/2

If shooting pain felt, nerve may have been entered. Remove needle and redirect

- If no blood obtained, withdraw needle slowly, observing for pulsation at base of needle; arterial blood often enters during withdrawal
- If necessary, try once more. If unsuccessful, seek help
- Obtain 1.5–2 mL blood – a smaller volume may suffice for immediate analysis
- Withdraw needle
- Apply pressure to site for 5 min, or longer if site bleeds
- Dispose of needle in sharps bin
- Remove bubbles in syringe by holding hub upwards and gently tapping side and depressing plunger
- Immediately cap syringe and gently mix for 30 sec. Attach patient ID label to sample and record FiO_2 (%), patient temperature and time sample taken
- If source of blood (arterial/venous) uncertain, take heparinised venous sample for comparison

Figure 1: Needle positioning for radial artery puncture

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Table 1: Differences in technique, advantages, disadvantages and contraindications among puncture sites

Artery	Positioning of patient	Angle of needle to skin (º)	Puncture site	Important anatomical structures in proximity to puncture site	Advantages	Disadvantages	Contraindications
Radial	Arm extended and supported on pillow with wrist extended 20˚	30	Proximal to proximal transverse crease and on radial aspect of wrist		Easily accessible Easily compressible, therefore useful if there is known bleeding tendency		Buerger's disease Raynaud's disease Arteriovenous dialysis shunt present or imminent Absent ulnar collateral circulation – relative contraindication, consider Allen's test
Brachial	Arm extended and supported on pillow	30	Medial to biceps tendon in antecubital fossa	Median nerve medial	Easily accessible	Risk of ischaemia	Arteriovenous fistula in arm Elbow fractures
Femoral	Supine	60	Mid-inguinal point 2 cm below inguinal ligament	Femoral nerve lateral Femoral vein medial	May be only quickly accessible artery in shocked patient	Risk of infection and ischaemia Venous sample more likely than at other sites	Severe peripheral vascular disease Aortofemoral bypass surgery

SPECIMEN

- Take sample to nearest blood gas analyser for analysis and ensure all data fields displayed on screen are accurately completed
- Try to ensure sample is analysed within 10 min of drawing
- delay of up to 20 min will not significantly affect accuracy of results
- Clotting increases as sample ages, therefore ensure syringe is continuously and gently mixed to reduce risk of clotting, follow advice at the blood gas analyser regarding 'clot catchers'
- Do not analyse aged samples (taken >20 min before)
- Ensure printed record displays all inputted details

CO-ADMINISTRATION OF DRUG INFUSIONS AND INTRAVENOUS FLUIDS VIA SINGLE CANNULA ● 1/2

This guideline applies only to drug infusions where inadvertent administration of the drug infusion or the fluid infusion at an unintended rate would not be clinically unsafe. If that would be dangerous (e.g. insulin, vasopressors, inotropic agents) use the* Administration of IV insulin infusions and fluid infusions guideline *instead

- All infusions administered by a syringe pump must be administered via an infusion set with an anti-siphon valve to prevent inadvertent flow to patient from an unclamped or damaged syringe
- Administer maintenance fluid via a volumetric pump. If a volumetric pump is not available, an anti-reflux valve **must** be fitted to prevent reverse flow of medication into bag. Gravity sets incorporating an anti-reflux valve are available
- An anti-reflux valve is a one-way valve that prevents 'reverse flow' from syringe pump to a bag of fluid administered under gravity. Reverse flow could occur in the absence of a correctly used anti-reflux valve when cannula access is restricted or occluded, causing the drug in the syringe driver to be pumped into the fluid bag instead of the patient. Under these conditions, the syringe pump will not detect the occlusion and there is a risk of an inadvertent drug bolus from the fluid bag should the restriction/occlusion resolve
- Connect drug infusion syringe to a line with an anti-siphon valve and volumetric pump or gravity set to a two-way needle-free extension set, an 'octopus connector' – see **Figures 1 and 2**

Figure 1: Preferred method – Administration of additional fluids via a B Braun pump (not to scale)

Maintenance/keep-vein-open fluid delivered by volumetric pump (B Braun). Connect the administration set to a two-way needle-free extension set

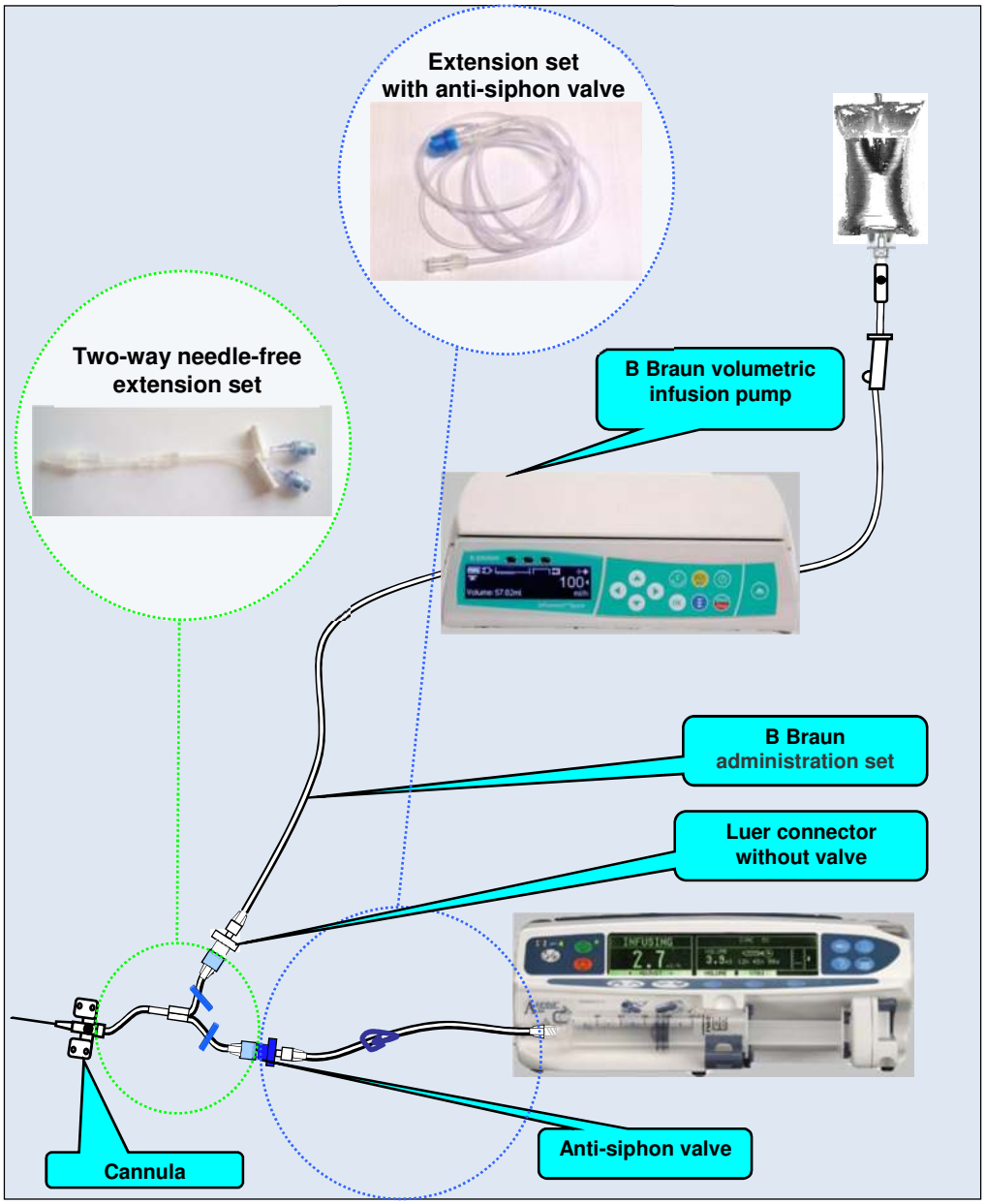
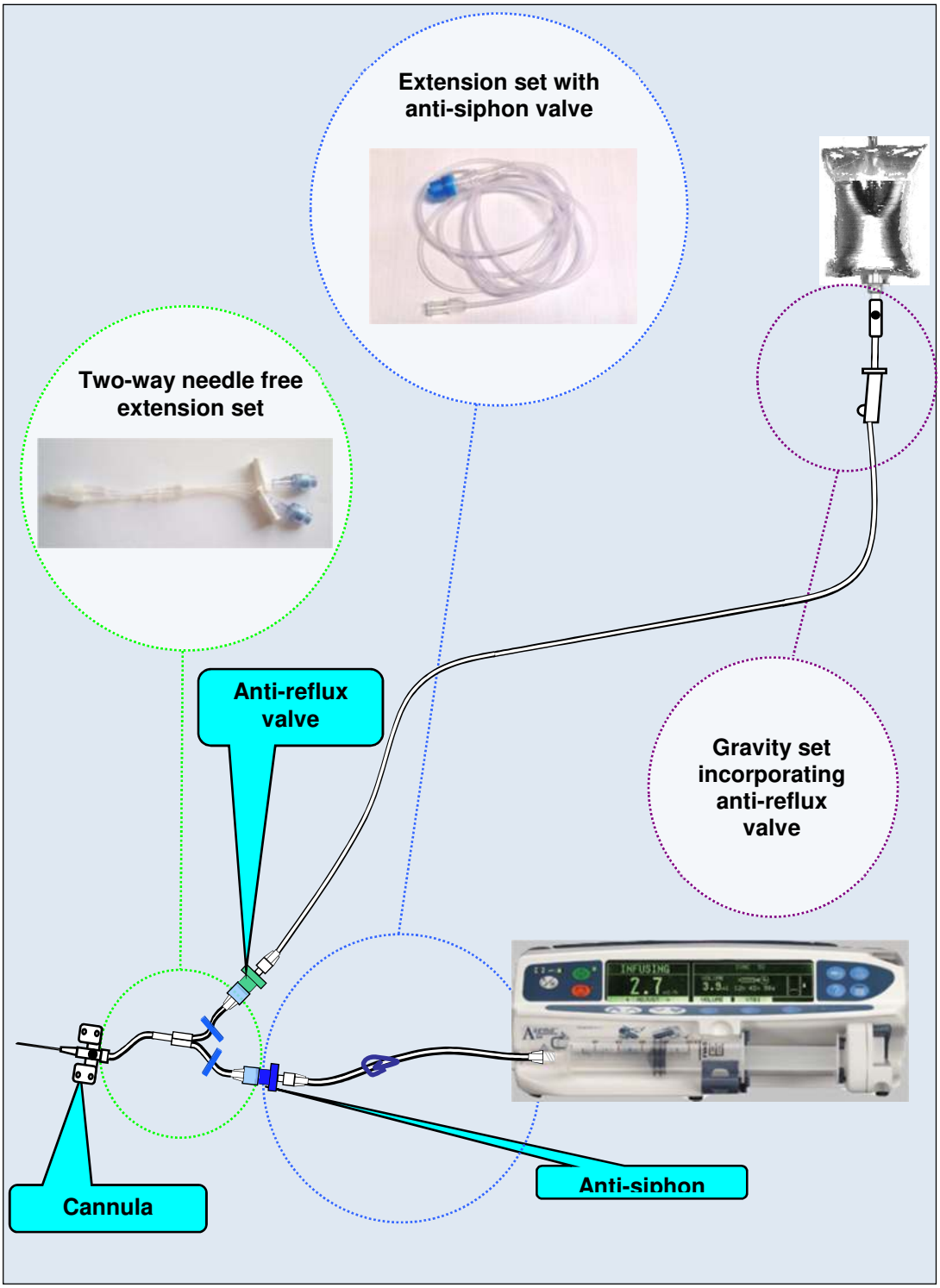


Figure 2: Alternative method of adding additional fluid via gravity bag and gravity set with anti-reflux valve. Gravity administration set with anti-reflux valve (NHS supply chain code FSB 618)

Do not use a gravity set for administration of IV fluids where administration rate is critical (e.g. glucose administered alongside insulin) use a volumetric pump as in Figure 1, see separate insulin guideline



COLLECTION OF BLOOD CULTURE SPECIMENS ● 1/3

Blood culture specimens are essential in managing patients with serious infection.
Collect blood culture specimens before starting antimicrobial drugs.
Procedure to be carried out only by trained and assessed healthcare professionals

INDICATIONS

- If systemic signs indicate blood stream infection (e.g. systemic inflammatory response syndrome, severe sepsis or septic shock, rigors or new confusion with or without evidence of localised infection), obtain blood culture specimens
- do not restrict blood culture specimens to patients who 'spike a fever' (>38°C); patients with severe sepsis, especially the elderly or immunocompromised, may not have a fever
- If secondary infection with a new pathogen suspected or if antimicrobials seem ineffective, repeat blood cultures

How many sets?

- **Sepsis –** take 2 sets of blood culture specimens in first hour before starting antimicrobials, remembering to start empiric antibiotic treatment immediately after blood cultures are taken
- **Suspected endocarditis** – collect 3 sets of blood culture specimens at different times in 24 hr, with the interval depending on the urgency to start empiric antibiotic treatment (e.g. SBE: 8 hr; acute IE: 20 min)

EQUIPMENT

- Blood culture bottles
- each set of blood cultures comprises 2 bottles – 1 aerobic and 1 anaerobic

If available, use vacuum-assisted blood collection system as it reduces risk of needle-stick injury

- Hand wash
- Disposable apron
- Gloves
- Disposable tourniquet
- Injection tray (blue plastic tray)
- 2 Clinell cleansing wipes (2% chlorhexidine in 70% isopropyl alcohol): 1 for skin and 1 for top of blood culture bottles
- One winged butterfly with extension tube to draw blood directly into blood culture bottles (remember to mark each blood culture bottle for 10 mL volume to ensure correct amount of blood goes into bottle)
- if venous access difficult, use a minimum 20 mL sterile syringe and needle to obtain sample and inoculate blood culture bottles (use the same needle)
- If IV central line present, obtain blood culture from both peripheral venous access and central line
- in rare instances, where no peripheral venous access available, sample from IV central line(s) only, using a syringe for drawing blood and attach a sterile needle to inoculate blood sample into blood culture bottles
- Sterile gauze
- Sticking plaster/tape
- Sharps bin
- Microbiology laboratory request form/Order comms form – microbiology

PREPARATION

Patient

- Consider any pre-existing medical condition and current medication

Consent

- Identify patient
- Explain procedure
- Obtain and record consent – see **Consent** guideline

Collect equipment

- Take equipment (listed above) to patient's bedside

COLLECTION OF BLOOD CULTURE SPECIMENS ● 2/3

Procedure

- Wash hands with soap and water and dry with disposable paper towel (see **Hand hygiene** guideline)
- Put on apron

Contamination with skin organisms is a significant problem when drawing blood for blood cultures. The following procedure will minimise the chance of skin contamination entering bottles with the blood

Prepare blood culture bottles

- Check expiry date
- To avoid false positive results, if using winged butterfly system mark bottles to ensure 10 mL of blood not exceeded
- Flip off plastic lids
- Use a Clinell wipe to clean septum of each bottle. **Allow alcohol to fully evaporate/dry before inoculation of blood**

Select sampling site

- Select venepuncture site – inspect and palpate
- inspection and palpation can be carried out without a tourniquet. However, if tourniquet applied, remove it and re-apply when commencing procedure
- percutaneous peripheral vein (non-cannula) blood samples are the best source of contamination-free cultures
- use femoral vein **only if** venepuncture not possible at other sites

Use cannula (e.g. arterial line, central line) samples for blood culture ONLY when no other option or for evaluation of line sepsis

Prepare skin

- Cleanse hands
- Put on gloves
- Apply disposable tourniquet
- Cleanse patient's skin with cleansing wipe (from blood culture pack) following manufacturer's instructions. Two-layer approach – up/down and side to side over intended puncture site for a minimum of 30 sec. Allow to dry for a minimum of 30 sec. Drying is necessary to kill bacteria on the skin

Do not palpate the vein again after skin cleansing

Prepare equipment

- Vacutainer® [winged needle with extension tube (butterfly)] with extension tube and vacutainer needle holder attached is the preferred and safest method. Secondary choice is syringe and needle method
- Remove sheath from needle

DRAWING/TRANSFER OF BLOOD CULTURES

Drawing blood

- Perform venepuncture using chosen method (vacutainer or syringe)

If using safety needle (straight or butterfly)

- Ensure bevel edge of needle is in upward position
- Anchor the vein by applying manual traction a few centimetres below proposed needle insertion site
- Insert needle smoothly at approximately 30° angle
- Ensure vacutainer set is stabilised and held safely
- Draw blood directly into blood culture bottles. If venepuncture difficult using vacutainer system, or sampling from a central line, use a syringe
- Collect 8–10 mL of blood into each bottle (minimum 20 mL syringe required). At this time, consider if other blood tests are required

- Fill aerobic bottle first, followed by anaerobic bottle. This avoids an exchange of air from the vacutainer extension line into the anaerobic bottle
- if sample insufficient, it is more important to obtain correct amount of blood into the aerobic bottle than the anaerobic bottle or dividing lesser amounts between two bottles
- 98% of septicaemias are caused by aerobic or anaerobic organisms that can tolerate aerobic environments. Therefore, if the anaerobic sample is insufficient most of the causative organisms of septicaemia will be detected in the aerobic sample
- to provide a more accurate result, obtain the correct amount of blood for each bottle wherever possible.
- Detection of bacteria in blood can be difficult. Therefore an inadequate sample can give a false negative result

It is essential to fill blood culture bottles first before collecting blood samples for any other tests (e.g. FBC). This reduces risk of contamination from non-sterile containers

- Remove/release tourniquet
- Apply pressure with gauze to puncture site
- If still oozing, apply hypoallergenic sticking tape over the sterile gauze

If using syringe

- Transfer blood from syringe and needle to blood culture bottles (aerobic first)
- With remaining blood sample, fill the other blood bottles for additional tests

POST COLLECTION

- Remove and safely dispose of sharps and equipment
- Remove apron and gloves. Wash hands
- Label blood culture bottles immediately **at bedside** with patient name, NHS number and/or hospital number, date of birth, date and time sample taken, ward and consultant
- Sign label
- Remove the peel-off bar code labels from blood culture bottles and affix to lab request form. These bar codes are essential for loading of bottles onto BACTEC machine in laboratory

Do not stick any labels over remaining bar codes on blood culture bottles

- Complete pathology laboratory request form (including clinical data and details of antimicrobial therapy, date, time and site of sample, patient name, NHS number and/or hospital number)
- Sign form
- Place bottles in microbiology request bag with completed laboratory request form
- Arrange transport of sample to microbiology laboratory (**do not use pneumatic tube system to send blood culture bottles**)
- if there is likely to be a delay in transporting samples, keep the bottles at room temperature
- out-of-hours – specimen reception staff will put the sample onto the system up until midnight
- samples sent to laboratory after midnight will be dealt with in the morning
- for treatment of sepsis, see **Sepsis, severe sepsis and septic shock** guideline
- for clinical advice on a septic patient, contact the on-call/duty consultant microbiologist
- Document in medical notes, indication for sample, and that blood cultures have been taken, include:
- time and date sample taken and sent
- blood culture bottle bar codes
- sample site
- name and signature of person who took sample

FLUSHING INTRAVENOUS LINES ● 1/2

Ensure aseptic technique used – follow Trust standard operating procedures for infection control

Ensure correct procedure for flushing used – follow Royal Marsden Manual of Clinical Nursing Procedures – Vascular access devices: insertion and management or local Trust policy and procedures

FLUSHING SOLUTIONS

Heparin is a potentially dangerous drug. Higher strengths given inadvertently can lead to full anticoagulation. Ensure that correct strength of heparin is prescribed and administered.
Do not use heparin in any strength as a flush without a valid prescription. Do not use if any history of adverse reaction, e.g. heparin induced thrombocytopenia (HIT)

- All flushing solutions **must** be prescribed by an authorised prescriber and administration recorded using the adult inpatient prescription chart
- sodium chloride 0.9%
- heparin 10 units/mL in sodium chloride 0.9%
- check prescriber of flushing solutions has taken into account patient's fluid and sodium allowance, multilumen catheters, and when flushing is required several times daily
- See **Table** for flushing regimen according to device type

Volume of heparin flushing solution used must be 0.5 mL greater than the volume of the catheter and any other equipment attached to it (e.g. one-way tap, short extension).
Draw up 0.5 mL more heparin solution than is required. This ensures flushing completed on the downstroke of syringe plunger.
If plunger allowed to reach the end the of the barrel it can 'bounce back' and draw blood into catheter tip

FLUSHING INTRAVENOUS LINES ● 2/2

Table: Device type and flushing regimen

Type	Continuous infusion	Intermittent administration of drugs	Intermittent blood sampling	Not in use
Peripheral IV cannulae	No flush required	• Sodium chloride 0.9% 5 mL before and after drug administration (and between drugs if more than one administered)		• Preferable to remove cannula (unless IV access genuinely required for emergency) • Sodium chloride 0.9% 5 mL every 8 hr
Peripherally inserted long venous catheter ('long line')	No flush required	**Within a 24 hr period** • Sodium chloride 0.9% 5 mL, both before and after drug administration		• Daily with sodium chloride 0.9% 5 mL followed by heparin 10 units/mL in sodium chloride 0.9% 5 mL
Short-term central venous catheters Acute care setting – single, double and triple lumen configurations	No flush required	**Within a 24 hr period** • Sodium chloride 0.9% 5 mL, both before and after drug administration	• Sodium chloride 0.9% 5 mL after blood sampling and then heparin 10 units/mL in sodium chloride 0.9% 5 mL	• Daily via appropriate injection membrane or needle-free device with sodium chloride 0.9% 5 mL followed by heparin 10 units/mL in sodium chloride 0.9% injection 5 mL
Broviac and Hickman type central venous catheters	No flush required	**Insertion flush** • Sodium chloride 0.9% 5 mL during procedure. At end of procedure, lock with heparin 10 units/mL in sodium chloride 0.9% 5 mL **Within a 24 hr period in hospital** • Sodium chloride 0.9% 5 mL, both before and after drug administration via lumen, appropriate injection membrane or needle-free device • patients with pro-coagulant condition (e.g. nephrotic syndrome), flush with sodium chloride 0.9% 5 mL, both before and after drug administration and then flush with heparin 10 units/mL in sodium chloride 0.9% injection 5 mL **Within a 24 hr period in the community** • Sodium chloride 0.9% 10 mL, both before and after drug administration and then flush with heparin 10 units/mL in sodium chloride 0.9% injection 5 mL via lumen, appropriate injection membrane or needle-free device	• Sodium chloride 0.9% 5 mL after blood sampling and then heparin 10 units/mL in sodium chloride 0.9% injection 5 mL	• Once weekly withdraw 5 mL of existing line contents then flush with heparin 10 units/mL in sodium chloride 0.9% injection 5 mL
Implantable port (e.g. portacath®)	Follow local Trust procedure			
Groshong central venous catheter	This special catheter has a slit valve at the tip to prevent backflow of blood into catheter. Heparin is not required to maintain patency. Use sodium chloride 0.9% for flushing (follow manufacturer's instructions for amount and frequency of flush)			
Central venous haemodialysis catheters	Follow local Trust procedure			

INTERCOSTAL TUBE DRAINAGE ● 1/2

All pleural procedures should be performed under ultrasound guidance by a trained operator or under the supervision of a fully competent individual

INDICATIONS

- Drainage of pneumothorax – see **Spontaneous pneumothorax** guideline for when to place chest drain
- Therapeutic drainage of fluid from pleural space

CONTRAINDICATIONS

(All relative – discuss with consultant or radiologist performing procedure)

- Impaired blood clotting
- Post-pneumonectomy space – discuss with cardiothoracic surgeon

SELDINGER CHEST DRAINS

Equipment

- Chest drain pack – 12 FG to 28 FG
- Sterile gloves
- Lidocaine 1–2% 10 mL with another 10 mL on standby in case needed
- Underwater seal drainage bottle and tubing
- Skin antiseptic solution – use 2% alcoholic chlorhexidine gluconate solution. If allergic, use povidone-iodine solution

PROCEDURE

Consent

- Explain procedure and reassure patient
- Obtain and record written consent – see **Consent** guideline
- Complete WHO surgical procedure checklist

Premedication

- Consider premedication oral morphine solution (e.g. Oramorph®) 5 mg 1 hr before procedure **or** intravenous morphine 2.5 mg given immediately before procedure
- if respiratory depression occurs, give naloxone 100 microgram IV. If response unsatisfactory or unsustained, repeat naloxone 100 microgram IV every 2 min
- If pneumothorax caused by non-surgical chest trauma, give co-amoxiclav 1.2 g IV over 3–4 min or 625 mg oral 8-hrly for total course of 5 days. If allergic to penicillin, see warning box below

Penicillin allergy should only be accepted as genuine hypersensitivity if convincing history of either rash within 72 hr of dose or anaphylactic reaction.
True penicillin allergy is rare and, in many infections, alternative antimicrobials are less effective with greater risks attached. If a patient reports penicillin allergy, it is imperative to establish, as far as possible, the nature of the reported allergy. In patients able to provide a history, the nature of the penicillin allergy must be recorded on admission. If any doubt about whether patient truly allergic to penicillin, seek advice from a microbiologist or consultant in infectious diseases

Site of insertion and position of patient

- Check correct site on most recent chest X-ray – for simple pneumothorax, usual site fourth or fifth intercostal space (ICS), mid-axillary line which is within 'safe triangle', bordered by anterior border of latissimus dorsi, lateral border of the pectoralis major, a line superior to the horizontal level of the nipple and apex below axilla
- site must be just above rib
- Support patient with head of bed elevated to about 30°, arm behind head
- Mark site (ultrasound guidance for pleural effusion)

Aseptic technique and local anaesthesia

- Wash hands and wear sterile gloves, mask and gown
- Clean patient's skin over a wide area with skin antiseptic
- Check all equipment fits adequately
- Palpate intercostal space, infiltrate with 10–20 mL of lidocaine to parietal pleura and periosteum of lower rib, and into pleural space once fluid/air can be aspirated (see box above)

Insertion of drain

- Prefer Seldinger technique, which avoids need for blunt dissection
- use a needle and syringe to localise position by identification of air or fluid. Pass guidewire down hub of needle, remove needle and enlarge track with a dilator. Pass drain into thoracic cavity along the wire
- never use a trocar to dissect tissues during chest drain insertion
- tie securing suture – 1 loop through skin and at least 4 ties on tube
- loop tube and secure with adhesive plaster. If there is a poor seal around drain, insert further vertical suture near drain and tie to partially close incision

AFTERCARE

- Adequate analgesia for pleuritic pain – paracetamol alone is unlikely to be adequate
- if well hydrated and eGFR ≥30 mL/min, ibuprofen 400 mg oral 8-hrly
- in dehydrated patient or if eGFR <30 mL/min, to prevent renal damage, prefer morphine sulphate 10 mg oral 4-hrly – ibuprofen may be substituted once adequate fluid replacement achieved if eGFR ≥30 mL/min
- replacement achieved if eGFR ≥30 mL/min
- Repeat chest X-ray within 2 hr
- For care of intercostal tube and underwater seal – see **Spontaneous pneumothorax** guideline
- Remove only 1–1.5 L of fluid at any one time due to danger of re-expansion pulmonary oedema

REMOVAL OF DRAIN

- Once bubbling from pneumothorax (see **Spontaneous pneumothorax** guideline) or drainage of fluid has stopped for at least 24 hr, cut drain-securing suture, withdraw tube while patient holds breath in expiration, and close wound with sutures (sutures will be required if large wound or if ≥18F drain has been used)
- if malignant effusion, attempt talc pleurodesis before removal, to reduce rate of recurrence – see **Medical pleurodesis** guideline

KNEE ASPIRATION • 1/2

Knowledge of knee anatomy is essential

INDICATIONS

- Diagnosis:
- an acute hot joint of uncertain origin **must** be aspirated (before starting any antimicrobials)
- often used in diagnosis of chronic and subacute articular pathologies
- Treatments:
- recurrent aspiration in management of septic arthritis
- aspiration of tense effusions of any cause
- before therapeutic intra-articular corticosteroid injection

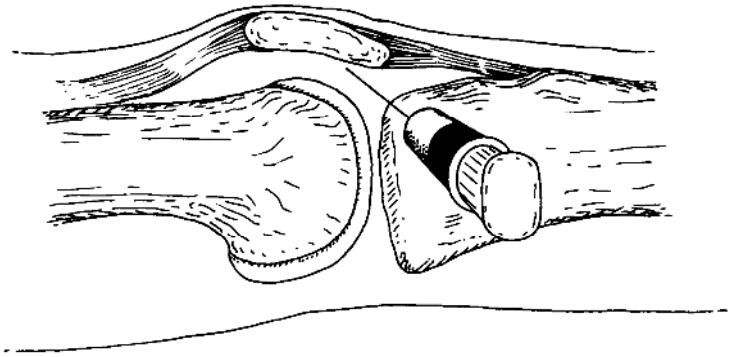


Figure 1: **Arthrocentesis of the knee. Medial approach**

CONTRAINDICATIONS

- No absolute contraindications to joint aspiration
- Caution in patient with clotting disorder/taking anticoagulants (discuss with consultant)
- Caution in patient with prosthetic joint (discuss with orthopaedic surgeon)
- Avoid passing needle into joint through skin lesion (e.g. psoriasis), as this can lead to joint sepsis

EQUIPMENT

- Sterile dressing pack
- Gloves
- Skin antiseptic
- 20, 10 and 2 mL syringes, green and orange needles
- Lidocaine 1% plain

SPECIMEN BOTTLES

- Blood culture bottles – for aerobic and anaerobic culture of synovial fluid
- 2 plain sterile universal containers:
- 1 for Gram staining
- 1 for crystals
- Heparin tube – for white cell count (orange top)

PROCEDURE

Consent

- Explain procedure and reassure patient
- Obtain and record consent

Position of patient and site of insertion

- Ask patient to lie supine
- Make sure muscles around joint are relaxed to minimise any discomfort from procedure. Putting pillow under knee may help to relax it
- Identify margins of knee joint and patella
- Mark a point (e.g. with thumbnail) 1 cm deep to mid-point of medial aspect of patella

KNEE ASPIRATION ● 2/2

Aseptic technique and premedication

- Wash your hands, don gloves, prepare skin around knee
- Infiltrate skin with lidocaine 1% using an orange needle

Sampling

- Using no-touch technique, insert green needle with 10 or 20 mL syringe horizontally at previously marked point into gap between patella and femur and slightly upward towards suprapatellar pouch. If there is only a small effusion, it can help to displace patella medially to increase gap between patella and femur (**Figure 1**)
- Aspirate while advancing needle and stop advancing if synovial fluid aspirated. Once fluid begins to appear, it can be 'milked down' by pressure with one hand over suprapatellar pouch
- Once syringe full, detach from needle, leaving needle in joint. Empty syringe into specimen bottles
- Re-attach syringe to needle and re-aspirate. Aspirate joint to dryness
- When aspiration complete, withdraw needle
- An adhesive plaster or Micropore dressing to skin is sufficient

Documentation

- Record procedure in notes. Take care to document exact joint aspirated, volume, macroscopic appearance ('frank pus', 'turbid straw-coloured fluid', 'frank blood', 'blood-stained synovial fluid', etc.) and viscosity ('viscous' or 'thin') of fluid

SPECIMENS

- Send synovial fluid in blood culture bottle and one plain sterile universal container to microbiology
- request urgent Gram stain

LUMBAR PUNCTURE ● 1/3

INDICATIONS

- Diagnosis (see **Table**)
  - in suspected subarachnoid haemorrhage (SAH), perform lumbar puncture (LP) only if scan negative in face of reasonable clinical suspicion, and **at least 12 hr** after onset of symptoms (e.g. headache)
- Introduction of contrast media – see **Prevention of contrast induced acute kidney injury** guideline
- Introduction of chemotherapeutic agents (e.g. in leukaemia)

CONTRAINDICATIONS

- Raised intracranial pressure (indicated by morning or postural headache, vomiting, and papilloedema) – request CT scan
  - in patients with acute headache and reduced conscious level, a normal CT scan result can be falsely reassuring – see **Community-acquired meningitis** guideline
  - danger is of fatal transtentorial or cerebellar 'coning'
- Suspected spinal cord compression – diagnostic LP does not distinguish intrinsic lesion (e.g. multiple sclerosis) from extrinsic compression by disc or tumour; MR scan is investigation of choice
- Local sepsis – puncture through infected skin carries risk of meningitis
- Coagulopathy

Table: Indications for diagnostic LP

Indications	Tests
Suspected SAH	CSF xanthochromia, glucose and protein **plus** Blood test for LFT's, glucose and protein
Myelopathies and suspected multiple sclerosis (but not if spinal cord compression suspected)	Protein, IgG or gammaglobulin, oligoclonal bands (N.B. take paired blood sample)
Acute or demyelinating peripheral neuropathies (e.g. Guillain-Barré syndrome)	Cells, protein
Infections of CNS (e.g. bacterial meningitis, tuberculosis, acute and subacute encephalitides, neurosyphilis, viral, fungal, and protozoal meningitis)	Gram stain, cells, protein, treponemal serology, glucose, culture, special stains, and antibodies
Meningeal infiltration	Cytology
Suspected idiopathic (formerly 'benign') intracranial hypertension	Opening CSF pressure

EQUIPMENT

- Sterile gloves
- Green sterile towel and drapes
- Dressing pack with cotton balls, gauze swabs, gallipot
- Skin antiseptic
- Lidocaine 2% plain injection in 5 mL syringe with orange (25 G) and green (21 G) needles
- LP needles (22 G): 3 and 3.5 inches long
  - prefer atraumatic needle for elective LP
- Manometer
- Specimen containers (3 clear glass, 1 grey top plastic) for microscopy/culture, protein, other tests (if indicated), and glucose, respectively. If further investigations may be required over the next few days, take an extra container(s) to send to microbiology and virology with a request to 'please store sample'
- Adhesive dressing

PROCEDURE

Preparation

- Appoint and brief assistant
- Number the 3 (or more, see above) clear glass bottles (1, 2, 3)

LUMBAR PUNCTURE ● 2/3

Consent

- Explain procedure, inform patient of symptoms that may follow procedure, and reassure
- Obtain and record written consent – see **Consent** guideline

Position of patient and puncture

- Place patient on left side with back against edge of bed, neck slightly flexed, and both legs drawn up towards chest. Consider placing pillow between patient's legs to ensure that back is perpendicular to bed, and raise bed to comfortable height
- Palpate anterior superior iliac crest. L3–4 interspace is apparent as a palpable gap lying perpendicularly beneath it, but L2–3 or L4–5 are equally acceptable sites. Mark skin over chosen interspace about 1 cm inferior to tip of adjacent spinous process

Aseptic technique

- Wash hands and put on gloves
- Cleanse patient's skin and position sterile drapes
- Assistant opens all packs including syringes and needle, shaking sterile contents on to sterile towel
- Check all equipment fits
- Draw up lidocaine while assistant holds lidocaine bottle
- Stretch patient's skin evenly over interspace, infiltrate skin and deeper tissues with lidocaine (orange needle for skin and green needle for deeper tissues), and allow at least 1 min for lidocaine to work
- Introduce LP needle at 90° to back, with bevel in sagittal plane (to minimise size of hole) and pointing slightly towards head. Push through resistance of superficial supraspinous ligament and negotiate interspinous ligament to meet firmer resistance of ligamentum flavum at about 4–7 cm, when an extra push results in a popping sensation as dura is breached and needle enters subarachnoid space. Withdraw stylet and clear colourless fluid should drip out
- Measure CSF pressure, then collect CSF specimens (see below) with assistant holding CSF bottles
- After CSF collected and while still sterile, replace LP stylet into introducer and withdraw LP needle

Dry tap

- If no fluid emerges or fluid does not flow easily, rotate needle – a flap of dura may be lying against bevel. If there is still no fluid, reinsert stylet and cautiously advance, withdrawing stylet after each movement. Pain radiating down either leg indicates that needle is too lateral and has hit nerve roots. Withdraw needle almost completely, check patient's position, and reinsert in midline
- If needle meets total obstruction, do not force it: it may be lying against an intervertebral disc and could damage it. Again, withdraw, check position, and reinsert. If there is complete failure, move one space up or down depending upon original position. Procedure may be easier if patient is sitting up, although this would preclude measurement of CSF pressure
- Dry tap usually results from faulty technique. After 2 or 3 attempts ask someone more experienced for help. Rare causes of genuine dry tap are arachnoiditis, meningeal infiltration and true low CSF pressure

Manometry

- When CSF flows freely, measure pressure. Connect manometer to needle hub. Ask assistant to hold top and record pressure (normal 80–180 mm CSF). Height of meniscus should change with respiration. Most common cause of low pressure is poor needle placement, but if genuine do not try to aspirate as CSF flow may be obstructed by cerebellar tonsil herniation or spinal block. In either case, seek a neurological opinion
- slightly raised CSF pressure in very anxious or obese patient may be ignored. Pressures >250 mm are abnormal and should be investigated. If greatly raised pressure is discovered in clear fluid, collect CSF from the manometer to provide specimens. Ask patient to 'uncurl' to see if pressure falls once abdominal compression relieved
- if still raised despite this manoeuvre, withdraw needle immediately and seek neurological opinion

Bloodstained tap

- Collect bloodstained fluid in 3 tubes. In traumatic tap, blood forms streams in otherwise clear CSF; the first 3 consecutive specimens show clearing of blood and usually become less obviously coloured, with a corresponding fall of the red cell count. In subarachnoid bleeding, CSF is usually diffusely bloodstained in all 3 tubes, but the 3-tube test should not be relied upon to exclude SAH

SPECIMENS

- Requests depend on clinical problem (**Table**)

If taking CSF samples for both diagnostic microbiology and suspected SAH, take samples for microbiology first

For diagnostic microbiology

- For routine bacterial culture, **always** obtain 1 mL in sterile container
- if TB meningitis suspected, obtain **additional** ≥5 mL for TB culture
- if pre-treated with antimicrobials and meningococcal meningitis suspected, obtain **additional** 1 mL in separate sterile container for meningococcal PCR
- if herpes simplex virus meningo-encephalitis suspected, obtain **additional** 1 mL in separate sterile container for HSV PCR
- request other CSF PCR tests according to suspected pathogen(s)
- If further investigations may be required over the next few days, take an extra container(s) and send to virology and microbiology with a request to 'please store sample'

Suspected SAH

- For diagnosis of SAH:
- CSF into fluoride oxalate bottle for glucose and send to clinical biochemistry
- CSF into plain bottle for xanthochromia and protein determination (minimum volume 1 mL). **Place last of 3 plain bottles to be filled in dark container (protected from light) and send** to clinical biochemistry (do not use pneumatic tube system)
- Provide following information with sample:
- time between onset of symptoms and LP
- results of CT scan – xanthochromia screening will normally be performed only where CT scan is negative
- date of any previous LP – xanthochromia screening misleading after recent LP
- contact clinical biochemistry, ask for senior member of staff or bleep duty biochemist (via call centre if after 1900 hr or the weekend) and explain that CSF sample is being sent for xanthochromia screening

When taking samples of CSF for suspected SAH, also obtain a blood sample 5–7 mL in serum separator tube (gold top) for determination of total protein and bilirubin concentrations – send to clinical biochemistry

AFTERCARE

- Lying down after LP does not reduce the incidence of headache, which is best prevented by careful technique, use of a small gauge needle and ensuring adequate fluid intake for first 24 hr
- postural headache (significantly worsened by sitting +/or standing from supine position and improved by lying) occurs in about 20–30% of patients, may be accompanied by vomiting, and may not occur for 3–4 days – manage by laying patient flat, bed tilted head down, and liberal use of analgesics (paracetamol or codeine phosphate) with anti-emetics – metoclopramide (duration max 5 day) or domperidone (duration max 7 day). It usually lasts 36–72 hr, but can occasionally persist for a week

MEDICAL PLEURODESIS ● 1/2

If no intercostal tube* in situ*, insert one. Use small (12–14 FG) tube – see* Intercostal tube drainage *guideline

INDICATIONS

- Malignant pleural effusions
- Benign recurrent pleural effusion
- Recurrent pneumothorax

CONTRAINDICATIONS

- Frail and/or terminally-ill patients. Perform therapeutic aspiration as required – see **Pleural aspiration of fluid** guideline

Presence of continuing air leak is not a contraindication to pleurodesis provided lung has expanded

EQUIPMENT

- Check drain size is at least 10 F
- Check if chest drain interface is luer lock or bladder wash connection
- Three 50 mL plastic syringes with interface compatible with inserted chest drain (bladder wash or luer lock)
- Plastic syringe (50 mL) with luer lock
- Asbestos-free talc 4 g – available from pharmacy dispensary during opening hours
- Sodium chloride 0.9% 50 mL IV infusion bag
- Lidocaine 2% (20 mg/mL) 10 mL injection
- Sodium chloride 0.9% 200 mL intravenous infusion bag
- Morphine 10 mg in 1 mL injection and naloxone 400 microgram in 1 mL injection

PROCEDURE

Preparation

- If safe, omit corticosteroids, COX-2 inhibitors and NSAIDs 48 hr before pleurodesis and until 5 days post-pleurodesis
- Review chest X-ray (PA or AP)
- in case of pleural effusion, the lung must be fully re-expanded with no significant residual fluid and fluid drainage through intercostal tube must be <150 mL/day; ensure the tube is not blocked or kinked. If only partial pleural apposition achieved and patient unsuitable for surgery, attempt medical pleurodesis as this may provide symptomatic relief
- in case of pneumothorax, confirm full lung expansion and position of the intercostal tube
- Prepare 2 chest drain compatible 50 mL syringes:
- mix lidocaine 2% 3 mg/kg (maximum 10 mL) with sodium chloride 0.9% 25 mL in 50 mL luer lock syringe. Transfer mixture to a bladder wash syringe if required
- place sodium chloride 0.9% 50 mL into a chest drain compatible syringe (to use for final flush)
- Check asbestos-free graded talc supplied from pharmacy has been dispensed and on the ward. This requires suspension in sodium chloride 0.9% 40 mL in a luer lock syringe to be prepared during procedure

Consent

- Explain procedure including small risk of failure
- Obtain and record consent
- Complete WHO surgical procedure checklist

Procedure

- Clamp catheter section of intercostal tube and disconnect chest tube bottle
- Connect syringe containing lidocaine to end of catheter
- Unclamp catheter and inject lidocaine solution into pleural space through end of catheter. Reclamp catheter for approximately 10 min

- Meanwhile, prepare talc slurry:
- draw up sodium chloride 0.9% 40 mL in 50 mL luer lock syringe. Inject into talc vial using either a needle or dispensing pin and shake to gradually suspend the talc in the sodium chloride 0.9%
- Withdraw talc slurry from vial into luer lock syringe and cap
- Approximately 10 min after lidocaine has been injected connect syringe containing talc (or transfer to bladder wash syringe if required) to end of catheter
- Unclamp catheter, inject required volume of talc into pleural space, followed by pre-prepared syringe of sodium chloride 0.9% 50 mL to clear agent as final flush
- Reclamp catheter for 2 hr
- Post-pleurodesis patient rotation is not required

AFTERCARE

- Prescribe adequate analgesia – start with paracetamol 1 g oral 6-hrly and codeine phosphate 30–60 mg oral 6-hrly for first 24–48 hr, then give as needed; if ineffective, substitute morphine sulphate solution 10 mg oral 4-hrly for codeine phosphate

Pyrexia up to 38°C can occur for 48 hr, and does not necessarily imply infection

- If fluid persistently drains >250 mL/24 hr, seek senior respiratory advice

Removal of drain

- Repeat chest X-ray to check lung fully expanded and there is no significant pleural fluid
- Cut drain-securing suture, withdraw tube while patient holds breath in expiration, and close wound with remaining sutures

Restarting medicines

- Restart corticosteroids, COX-2 inhibitors and NSAIDs 5 days after pleurodesis, early if indicated clinically

MIDLINE CATHETER INSERTION ● 1/2

DEFINITION

- Midline catheter: a venous access device that sits within an axillary vein; most common veins used are cephalic or basilic vein
- Can be inserted using either ultrasound guidance or palpation and visual guidance
- For short-term use to provide venous access (<30 days, refer to manufacturer's instructions) and, depending on the type of midline catheter used, it can be used for blood sampling
- Tip of midline catheter resides within the peripheral venous system, and does not advance into superior vena cava (SVC) or any central vein

CONTRAINDICATIONS

- Presence of device-related infection, bacteria, or if septicaemia is known/suspected
- Patient's body size insufficient to accommodate size of implanted device
- Patient is known/suspected to be allergic to materials contained in the device
- Local tissue factors and/past treatment will prevent proper device stabilisation and/or access
- Planned drug infusion not compatible with peripheral administration

EQUIPMENT

- BARD PowerGlide insertion set if using PowerGlide Pro midline catheter
- Skin prep: chlorhexidine gluconate 2% and isopropyl alcohol 70% cleaning solution or if chlorhexidine sensitivity suspected povidone-iodine 10% aqueous solution
- Topical anaesthetic cream or lidocaine 1% or 2% 10 mL ampoule
- Sterile gloves
- Tourniquet
- Flush solution: sodium chloride 0.9% 10 mL
- Ultrasound device

If using Vygon leaderflex 22G line 80 mm or 200 mm

- Vascular access pack from HSDU if using Vygon line midline
- Leaderflex midline catheter (22G 80 mm or 200 mm)
- Skin prep: chlorhexidine gluconate 2% and isopropyl alcohol 70% cleaning solution, if chlorhexidine sensitivity suspected – povidone-iodine 10% aqueous solution
- Sterile gloves
- Tourniquet
- Flush solution: sodium chloride 0.9% (10 mL)
- 10 mL syringe
- Injectable bung
- Sterile semi-permeable transparent dressing (Tegaderm®)
- Sterile ultrasound probe cover and sterile gel
- Ultrasound device
- If clinically indicated that patient requires local anaesthetic: topical anaesthetic cream or lidocaine hydrochloride 1% or 2% 10 mL ampoule
- 1 × 22G orange needle
- 5 mL syringe
- 1 drawing up blunt needle

PROCEDURE

Preparation

- Check patient's notes for
  - clinical indication for line insertion
  - previous line insertions – some veins can be particularly difficult and patient can often provide guidance
- Assess whether patient will need sedation and arrange appropriate person to administer. Rarely, patients with needle phobia will need general anaesthetic
- Apply topical anaesthetic cream to specified veins at 3 different sites at least 20 min before starting procedure – median basilic vein is usually best (avoid femoral if possible due to higher infection risk)
- If necessary, shave patient's arm to avoid hair plucking when dressing removed
- Gather all necessary equipment including a spare line (unopened)

MIDLINE CATHETER INSERTION ● 2/2

Consent

- Explain procedure and reassure patient
- Obtain verbal consent and document it in patient's notes

Premedication and position of patient

- Position patient seated in chair or lying with his/her arm stretched out and supported by table or bed (on utility drape)
- Ensure patient in position and comfortable, and lighting optimal

Sterile technique

- Wash hands, and put on sterile gloves
- Place patients arm on a sterile drape
- Clean patient's skin thoroughly with chlorhexidine gluconate 2% and isopropyl alcohol 70% cleaning solution, if chlorhexidine sensitivity suspected – povidone-iodine 10% aqueous solution, in area of planned insertion for at 30 seconds and allow to dry for 30 seconds
- Drape patient's arm with fenestrated drape over insertion site sterile sheet to expose only chosen vein and cover surrounding areas to provide working room and a flat surface on which to rest line

BARD PowerGlide Pro

- Ask assistant to apply tourniquet
- Image vein using ultrasound device or visualise and palpate vein
- Use the integrated BARD placement device to cannulate vein, advance integrated guidewire and deploy midline catheter (Seldinger technique)
- Remove deployment device
- Flush midline catheter with sodium chloride 0.9% 10 mL using a push-pause technique
- Apply BARD's fixation device to midline
- Cover site with a Biopatch Dressing®
- It is not necessary to verify position of midline radiologically

Vygon Leaderflex lines

- Ask assistant to apply tourniquet
- Image vein using ultrasound device or visualise and palpate vein
- Insert using Seldinger technique
- Cannulate target vein with either needle provided or blue cannula
- Feed guidewire into vein through cannula sheath and remove sheath leaving wire *in situ*
- Feed line over guidewire but before line enters skin ensure wire can be grasped at hub. A gentle twisting action may help line into vein
- Remove guidewire and secure line in place
- It is not necessary to verify position of midline radiologically

AFTERCARE

Use an ANTT technique when accessing the system or for dressing changes

If using a Vygon midline

- Place a folded half gauze swab under blue hub before taping down with adhesive, then cover with transparent dressing, minimising contact between gauze and transparent dressing in case removal is required for troubleshooting

BARD and Vygon midlines

- Flush after each use with sodium chloride 0.9% 10 mL with a 10 mL syringe (or bigger) using a pulsed, push-pause technique, and clamped whilst flushing to create a positive pressure in the line
- Change dressings and bungs every 7 days (sooner if visibly soiled or coming away)
- Maintain aseptic technique for accessing system and dressing changes. Before accessing system, disinfect hub and ports with disinfectant compatible with catheter (e.g. alcohol or povidone-iodine)
- Assess site at least daily for any signs of infection – if signs of infection are present, remove line
- Assess need for device daily and remove as soon as possible
- Document insertion and all interventions in patient notes

NASOGASTRIC TUBE (NGT) INSERTION ● 1/2

Also refer to Trust intranet>clinicians>medical-and-nursing>nursing-essentials> pathways,-guidelines-pgds/

INDICATIONS

- To provide a means of temporary nutrition where loss of swallow reflex has occurred or to supplement an inadequate oral diet
- To allow aspiration of stomach contents

CONTRAINDICATIONS

- Base of skull fracture
- Uncorrected coagulopathy
- Recent oesophageal surgery
- Oesophageal varices
- Unstable cervical spine injuries (these patients may still require NG tube – contact anaesthetist)

EQUIPMENT

- Nasogastric tube polyurethane (PUR) 8 Fr for enteral feeding (guide wire assisted)
- Nasogastric tube PUR 14/16 Fr for aspiration/free drainage of gastric contents (not guide wire assisted)
- Enteral/purple syringe 50 mL
- pH indicator paper
- Naso-fix adhesive patches and occlusive dressing
- Disposable gloves
- Apron
- Lubricant gel
- Receiver
- Fresh tap water

CONSENT

- Explain procedure and reassure patient
- Obtain and record consent

PROCEDURE

Preparation

- If verbal communication not possible, arrange a signal by which the patient can communicate to nurse/clinician to stop, e.g. by raising his/her hand
- Sit patient in a semi-upright position in bed or chair and support patient's head with pillows. Do not tilt head forward or backward
- Determine length of tube to be inserted
- extend tip (end which will be inserted into patient) of tube from patient's ear lobe to bridge of the nose. From bridge of the nose, extend remainder of tube to bottom of xiphisternum. Note mark on the point of the tube next to the bottom of xiphisternum
- Wash hands and put on disposable gloves and apron
- Assemble equipment
- Check nostrils and determine which is more patent
- ask patient to blow his/her nose
- Check guide wire moves freely in NGT

Insertion

- Insert end of NGT into water for lubrication or add a small amount of lubrication gel to the tip
- Insert rounded tip into nostril of choice and slide it backwards and inwards along floor of the nose to the nasopharynx. If any obstruction felt, withdraw tube and try again in a slightly different direction. If patient starts coughing, withdraw slightly and wait for coughing to stop then proceed as above
- if swallowing reflex is present, ask patient to swallow, and/or sip water as tube passes down into nasopharynx, to aid passage
- Advance tube through nasopharynx, oropharynx and oesophagus until required pre-measured depth reached
- if patient shows any sign of distress, e.g. gasping or cyanosis, remove tube immediately
- Secure tube to nostril and cheek with adhesive patch
- Complete the nasogastric tube placement bedside checklist (available on Trust intranet) before administration of artificial nutrition or medication via the NGT

NASOGASTRIC TUBE (NGT) INSERTION ● 2/2

Checking feeding tube position

- Do not administer drugs, feed or fluid via tube until position has been satisfactorily checked
- Wait at least 1 hr after feeding or medication and flush tube with 5 mL air to displace from gastric lining
- Aspirate 2 mL of stomach contents with 50 mL syringe and test for acid response using testing pH strips
- a pH level of ≤5.5 will indicate gastric placement
- If a pH of ≥6.0, **do not use NGT.** Request chest X-ray
- If no aspirate obtained, attempt re-aspirating after each of the following:
- nurse patient in left lateral position
- inject 10–20 mL of air using a 50 mL syringe, wait 15–30 min and re-aspirate
- advance tube 10–20 cm
- patient who can safely swallow has sipped a coloured drink to determine if it can be aspirated back
- if still no aspirate **do not use NGT**. Request chest X-ray
- If correct position confirmed, introduce 10 mL of fresh tap water into tube to activate the internal lubrication and remove guide wire
- Check **pre-measured markings of NGT at nostrils** remain the same
- Complete and insert "NG insertion sticker" in patient's hospital notes

Never reintroduce a guide wire back into a nasogastric tube once it has been removed

- If tube has been placed in theatre, carry out checks listed in '**Checking feeding tube position'** before using tube
- **Never use the following methods to confirm NGT position before feeding or administering nasogastric drugs:**
- auscultation
- use of ordinary litmus paper
- absence of respiratory distress

Documentation

- Record procedure in nursing record and, if undertaken by a doctor, medical record noting size of tube, length passed and which nostril used

ENTERAL FEEDING

- Once correct position confirmed, NGT can be used immediately

ASPIRATION OF GASTRIC CONTENTS

- Refer to UHNS trust clinical procedure for advice on aspiration/free drainage of gastric contents – Trust intranet>clinicians>medical-and-nursing>nursing-essentials>pathways,-guidelines-pgds/

NGT CARE

- Check position by measuring aspirate pH (see **Checking tube position** above) and record on NGT placement checklist:
- after initial insertion and subsequent reinsertions
- before administering each feed
- before giving medication
- after vomiting, retching or coughing (absence of coughing does not rule out misplacement or migration)
- if evidence of tube displacement (e.g. if tape loose or visible tube appears longer or kinked)
- Check position when chest X-ray taken for another reason

FURTHER MANAGEMENT

Monitoring

- Check integrity of skin around nostril at frequent intervals for signs of deterioration
- If signs of pressure appear, reposition tube and/or tape, or re-pass NGT via opposite nostril

If patient has recently undergone facial, airway or upper gastrointestinal surgery, do not remove NGT but discuss with operating surgeon

Changing nasogastric tube

- When changing NGT, follow manufacturer's recommendations, PUR tubes can be used for 60 days before replacing
- Pass new NGT via opposite nostril wherever possible

PERCUTANEOUS CENTRAL VENOUS CANNULATION • 1/4

Central venous cannulation can cause serious morbidity and must only be performed by those who have appropriate training and experience in the technique or who are appropriately supervised. Failure to use full sterile technique can lead to life-threatening infection.
When inserting CVC into internal jugular vein in an elective situation, use 2-dimensional (2D) imaging ultrasound guidance. Consider dynamic (realtime) 2D ultrasound for subclavian vein CVC insertion as it has been shown to result in fewer complications and a higher success rate than landmark techniques. 2D imaging ultrasound must be available in areas where central line cannulation is carried out on a regular basis. Equipment and assistance to place line under 2D imaging ultrasound guidance is present in theatres and critical care for those trained in its use

INDICATIONS

- Infusion of drugs irritant to veins
- Long-term IV feeding, antimicrobials, chemotherapy (especially tunnelled catheters)
- Persistently difficult peripheral venous access
- Insertion of Swan-Ganz catheter or intracardiac pacing device
- Use of invasive cardiac output monitoring device that requires CVC

CONTRAINDICATIONS

- Sepsis at cannulation site
- Carotid artery aneurysm (precludes use of internal jugular vein on same side)
- Coagulopathy – hypo and hypercoagulation states

EQUIPMENT

Perform procedure using full sterile technique, considering the environment in which line is placed. Placement in critical care or theatres may facilitate sterile technique

- Sterile gloves, hat, mask, gown and full sterile drapes
- Dressing pack with gauze swabs, gallipots
- Scalpel holder with blade size 11
- Skin antiseptic. If not allergic to alcoholic chlorhexidine gluconate use 2% solution. If allergic (but not to iodine) use alcoholic povidone-iodine solution
- Lidocaine 1% plain in a 5 mL syringe fitted with an orange (25 G) needle
- Sodium chloride 0.9% in a 20 mL syringe
- Heparinised saline 10 units/mL in a 5 mL syringe (for catheters which require heparin lock)
- 0 or 1 silk or nylon suture
- Tourniquet (for peripherally inserted catheters)
- Pressure transducer set
- Sodium chloride 0.9% (500 mL bag)
- Central venous catheter – see **Selection of catheter type**
- Bionector® (Vygon) hubs for three-way taps prevent repeated unscrewing of ports for access to line and, if cleaned with each use, reduce infection
- Sterile clear semi-permeable occlusive dressing, or antimicrobial CVC dressing

Selection of catheter type

If patient has chlorhexidine allergy, do not use chlorhexidine impregnated cannula or dressings

- Use single-lumen catheter unless multiple ports are essential for patient management
- If administering total parenteral nutrition, use single-lumen catheter or designate one port exclusively for this purpose
- For patients in whom long-term (>3–4 weeks) vascular access is likely, use tunnelled catheter or implantable vascular access device
- For adult inpatients who require short-term (1–3 weeks) central venous catheterisation and who are at high risk of catheter-related bloodstream infection, use antimicrobial impregnated central venous access device (CVAD)

Selection of catheter insertion site

- Before assessing site for catheter insertion, consider procedure related risks:
- patient-specific factors (e.g. pre-existing catheters, anatomical deformity, bleeding diathesis, some types of positive pressure ventilation)
- relative risk of mechanical complications (e.g. bleeding, pneumothorax, thrombosis)
- To reduce risk of infection, consider peripherally inserted (arm) catheter
- Use of catheters impregnated with antimicrobial agents will reduce infection if all other aseptic precautions are instituted

Choice of vein and appropriate catheter

- **Table 1** lists approaches and catheters in order according to infection risk. In selecting appropriate insertion site, compare risks of infection against risks of mechanical complications

Table 1: Selection of cannula and catheter

Route of insertion	Infection risk	Minimum length of catheter (mm)
Arm vein	Low	600
External jugular vein	Medium	200
Subclavian vein	Medium	150
Internal jugular vein	High	150

PROCEDURE

Consent

- Explain procedure and reassure patient
- check patient not allergic to skin antiseptic
- Obtain and record consent

Position of patient and site of insertion

- Place patient into correct position for chosen approach – see **Position and technique**
- Check site of introduction

Aseptic technique and local anaesthetic

- Maintenance of sterility is essential and can be achieved by:
- performing technique in a sterile environment (e.g. treatment room or theatre suite) where possible
- using correct equipment
- ongoing attention to sterility of line and dressings by all users
- removal of line when no longer required
- Scrub up using full sterile technique
- don gown, gloves, hat, mask and face and eye protection
- Prepare skin with antiseptic
- Drape operative field
- When using local anaesthetic, attempt aspiration on syringe before injection to ensure needle is not intravascular. Local anaesthetic may not be necessary in anaesthetised patients

Insertion of CVC

- Check fit and function of equipment
- Proceed with chosen approach – see **Position and technique**
- Aspirate blood on all lumens to check catheter position before injecting fluid
- On connection to pressure transducer CVP waveform should be visible, not arterial
- Ensure insertion site is covered by a clear sterile dressing
- Chest X-ray to look for pneumothorax and confirm tip of catheter lies above pericardial reflection by checking tip is at or above the level of the carina

POSITION AND TECHNIQUE

Whichever vein used, avoid air embolism by maintaining venous pressure above atmospheric by correct position or tourniquet on limb

PERCUTANEOUS CENTRAL VENOUS CANNULATION ● 3/4

Antecubital fossa – median (basilic) or cephalic veins

- Distend veins by tourniquet
- Turn head to same side to compress neck veins
- Abduct arm
- Partially insert catheter then release tourniquet
- before releasing tourniquet, position proximal end of catheter below level of patient's elbow to avoid air embolus
- advance catheter to predetermined length

Catheter passage through cephalic vein may be impeded by fascia deep to axillary vein

External jugular vein

- Place patient at 20° head down
- Vein runs from angle of mandible to behind middle of clavicle
- Choose most prominent of the right or left veins
- **STOP** if no vein visible or palpable
- Turn patient's head to contralateral side
- Insert catheter >200 mm length

In 50% of patients, catheter cannot be threaded into an intrathoracic vein. If so, try finger pressure above clavicle, depressing shoulder, or flushing catheter. Use of Seldinger or a spiral J-shaped wire may help. DO NOT use excessive force

Internal jugular vein (Figure 1)

All practitioners involved in placement of CVCs into internal jugular vein must be trained in using 2-D imaging ultrasound

- Place patient at 20° head down with head turned to contralateral side
- Preferentially use right (not left – to avoid injury to thoracic duct) jugular vein running behind sternomastoid close to lateral border of carotid artery
- Use 2-D imaging ultrasound guidance to identify vein and correct placement of guidewire
- Insert cannula

Operators of limited experience can try cannulation with the smaller locator needle/catheter to locate vein first and then use that as guide. If artery is punctured, compress firmly for ≥5 min

Ultrasound guided CVC placement: internal jugular vein

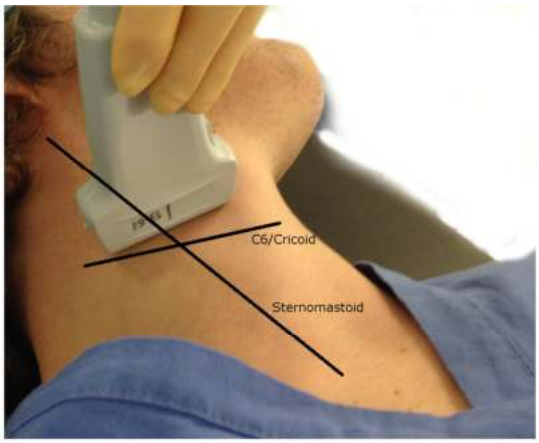


Figure 1: Anatomical landmarks for probe placement – internal jugular vein

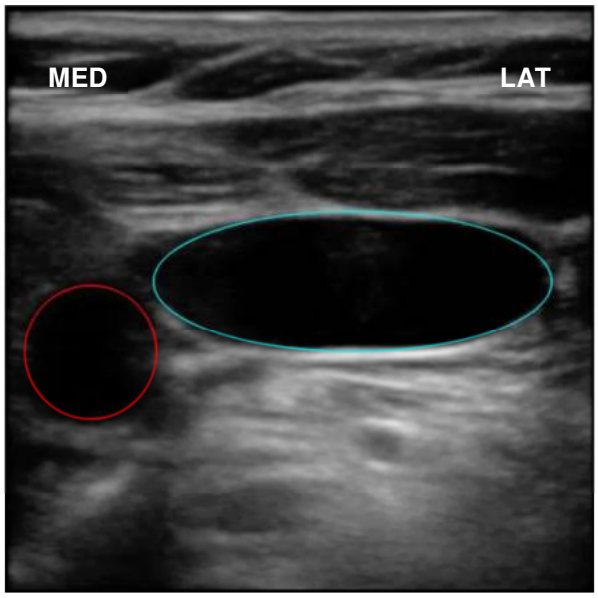


Figure 2: Cross sectional US scan of internal jugular vein (blue), and carotid artery (red)

PERCUTANEOUS CENTRAL VENOUS CANNULATION ● 4/4

AFTERCARE

Strict asepsis at all times to avoid infection

- Fix catheter with suture at clip site and securing holes at hub for internal jugular lines
- Cover with clear sterile semi-permeable dressing
- Change IV giving set as per **hospital protocols** using aseptic technique
- Do not inject drugs into venous catheter or take blood samples through rubber bungs if possible, use needleless connectors where available
- Monitor venepuncture site for infection daily
- Watch out for catheter-related infections. If an infection occurs see **Management of central catheter-related sepsis** in **Artificial nutritional support** in **Surgical guidelines**
- Maintain continuous flow through catheter to prevent clotting; if clotting occurs, try to clear by injecting 2–5 mL heparinised sodium chloride 0.9% 10 units/mL under pressure

COMPLICATIONS

- Injury to vital structure, pneumo- or haemothorax, arterial puncture, damage to thoracic duct or phrenic nerve
- Arterial insertion – confirm by placing a small gauge cannula over guide wire and into vessel and transducing pressure before dilation
- Tear of vein – avoid by inserting dilator no more than a few cm
- Kinking of guide wire – avoid a perpendicular approach into vein
- Infection, local or systemic sepsis
- Air or guidewire embolus
  - place patient in head-down position during insertion of line
  - ensure all ports closed and clamped if not in use
  - be mindful not to lose sight of guidewire externally at any time
- Cardiac arrhythmias – usually stop spontaneously
  - if persistent, withdraw catheter into SVC
  - if severe – treat
- Perforation of myocardium, mediastinum or pericardium
  - ensure free aspiration of each lumen
  - transduce main lumen and check position on X-ray
  - if suspected withdraw catheter and stop infusion
- Avoid arrhythmias and perforation by taking a chest X-ray and ensuring a right-sided line lies at or above the carina
- A left-sided line should ideally lie above the carina but it is preferable to have the line in the SVC lying parallel to the vein (e.g. in a vertical position) rather than abutting against the wall of the SVC or lying high in the innominate vein

PERIPHERALLY INSERTED CENTRAL CATHETERS (PICC) ● 1/2

DEFINITION

- Peripheral central catheter (PICC): inserted into cephalic or basilic vein (usually above the antecubital fossa) by staff specifically trained in the procedure
- PICC lines can remain in place from 3 months–1 yr (longer if clinically required), refer to manufacturer's instructions

Do not attempt insertion unless you are fully trained, use whichever line you have been trained to use

CONTRAINDICATIONS

- Presence of device-related infection, bacteria, or if septicaemia is known/suspected
- Patient's body size insufficient to accommodate size of implanted device
- Patient is known/suspected to be allergic to materials contained in the device
- Local tissue factors and/past treatment will prevent proper device stabilisation and/or access
- Presence of upper extremity/subclavian thrombosis
- Profound thrombocytopenia
- Implanted cardiac pacemaker or ICD on side of planned insertion
- Patients that may require future dialysis fistulas forming

EQUIPMENT

- BARD Power PICC insertion set if using Power PICC (operator selects suitable PICC line, single/dual/triple lumen)
- Skin prep: chlorhexidine gluconate 2% and isopropyl alcohol 70% cleaning solution or if chlorhexidine sensitivity suspected povidone-iodine 10% aqueous solution
- Topical anaesthetic cream or lidocaine hydrochloride 1% or 2% 10 mL ampoule
- Sterile gloves
- Tourniquet
- Flush solution: sodium chloride 0.9% 20 mL
- Ultrasound device

If BARD Groshong single lumen or Vygon PICC used

- Vascular access pack
- Skin prep: 2% chlorhexidine gluconate and 70% isopropyl alcohol cleaning solution or if chlorhexidine sensitivity suspected povidone-iodine 10% aqueous solution
- Sterile gloves
- Tourniquet
- Flush solution: sodium chloride 0.9% 10 mL
- 2 × 10 mL syringe
- Injectable bung
- Sterile semi-permeable transparent dressing (Tegaderm®)
- Sterile ultrasound probe cover and sterile gel
- Ultrasound device
- If clinically indicated that patient requires local anaesthetic: topical anaesthetic cream or lidocaine hydrochloride 1% or 2% 10 mL ampoule
- 1 × 22G orange needle
- 5 mL syringe
- 1 drawing up blunt needle

PROCEDURE

Preparation

- Check patient's notes for
  - clinical indication for line insertion
  - previous line insertions – some veins can be particularly difficult and patient can often provide guidance
- Assess whether patient will need sedation and arrange appropriate person to administer. Rarely, patients with needle phobia will need general anaesthetic
- Apply topical anaesthetic cream to specified veins at 3 different sites at least 20 min before starting procedure – median basilic vein is usually best (avoid femoral if possible due to higher infection risk)
- If necessary, shave patient's arm to avoid hair plucking when dressing removed
- Gather all necessary equipment including a spare line (unopened)

PERIPHERALLY INSERTED CENTRAL CATHETERS (PICC) ● 2/2

Consent

- Explain procedure and reassure patient
- Obtain verbal consent and document it in patient's notes

Premedication and position of patient

- Position patient seated in chair or lying with his/her arm stretched out and supported by table or bed (on utility drape)
- Ensure patient in position and comfortable, and lighting optimal
- Measure the distance for the insertion point to the cavoatrial junction

Sterile technique

- Wash hands and put on sterile gloves
- Place patient's arm on a sterile drape
- Clean patient's skin thoroughly with chlorhexidine gluconate 2% and isopropyl alcohol 70% cleaning solution, if chlorhexidine sensitivity suspected – povidone-iodine 10% aqueous solution, in area of planned insertion for at 30 seconds and allow to dry for 30 seconds
- Drape patient's arm with fenestrated drape over insertion site sterile sheet to expose only chosen vein and cover surrounding areas to provide working room and a flat surface on which to rest guidewire
- If required, cut PICC to correct length
- Ask assistant to apply tourniquet
- Image vein using ultrasound device or visualise and palpate the vein
- Insert using Seldinger technique
- Cannulate target vein with either needle provided
- Feed guidewire into vein through cannula sheath and remove sheath leaving wire *in situ*
- Use scalpel to make a small cut alongside of the guidewire, to facilitate access for the introducer sheath.
- Insert introducer sheath over the guidewire, to increase size of access to the vein
- Withdraw dilator and guidewire, leaving introducer sheath in place
- Slowly advance PICC into the introducer sheath
- Before advancing PICC past introducer sheath lay patient flat and rotate their head towards you, asking them to place their chin on their shoulder, to prevent PICC entering jugular vein
- Advance catheter to pre-measured length
- Separate introducer sheath
- Apply gentle pressure and slowly withdraw internal guidewire. Removing the guidewire too fast can damage the catheter
- Aspirate blood from the catheter and flush catheter with sodium chloride 0.9% 20 mL using a pulsed technique
- Apply steri-strips to insertion site to facilitate healing of the scalpel cut
- Secure PICC with fixation method of choice
- It is necessary to verify position of the PICC radiologically and ensure tip positioned at lower third of the SVC

AFTERCARE

Use an ANTT technique when accessing the system or for dressing changes

BARD and Vygons PICC

- Flush after each use with sodium chloride 0.9% 20 mL with a 20 mL syringe using a pulsed, push-pause technique, and clamped whilst flushing to create a positive pressure in the line
- Change dressings and bungs every 7 days (sooner if visibly soiled or coming away)
- Maintain aseptic technique for accessing system and dressing changes. Before accessing system, disinfect hub and ports with disinfectant compatible with catheter (e.g. alcohol or povidone-iodine)
- Assess site at least daily for any signs of infection. If signs of infection are present, remove line
- Assess need for device daily and remove as soon as possible
- Document insertion and all interventions in patient notes

PLEURAL ASPIRATION OF AIR ● 1/1

INDICATIONS

- Treatment of pneumothorax – see **Spontaneous pneumothorax** guideline for when to use technique

EQUIPMENT

- **Pleural aspiration pack** (if available) otherwise use cannula with 3-way tap and 50 mL syringe plus:
- cleansing pack
- gloves
- gown
- lidocaine 1–2% plain maximum 10 mL

PROCEDURE

Consent

- Explain procedure and reassure patient
- Obtain and record written consent
- Complete WHO surgical procedure checklist

Site of insertion and position of patient

- Check site of entry on most recent chest X-ray
- If no adhesions, use second intercostal space in mid-clavicular line (axillary approach is an alternative)
- Support patient with head of bed elevated to about 30° (arm behind head if axillary approach chosen)

Aseptic technique and local anaesthesia

- Scrub up and prepare patient's skin
- Infiltrate local anaesthetic down to pleura
- Aspiration of air confirms pneumothorax

Insertion of cannula

- Enter pleural cavity with cannula attached to a 10 mL syringe
- Withdraw needle from cannula when air is freely aspirated
- Connect cannula via plastic tube to 3-way tap and a 50 or 60 mL syringe or use needle aspiration kit
- Withdraw air until no more can be aspirated or to a maximum of 2.5 L (50 mL × 50) whichever is achieved first
- **STOP** if resistance is felt or patient coughs excessively
- If resistance is felt when only a small amount of air has been aspirated, cannula may be kinked: remove it and repeat procedure

AFTERCARE

- Apply small adhesive dressing over puncture site
- Repeat chest X-ray – aspiration successful if pneumothorax smaller or resolved
- If unsuccessful consider chest drain

PLEURAL ASPIRATION OF FLUID ● 1/2

All pleural procedures should be performed under ultrasound guidance by a trained operator or under the supervision of a fully competent individual

INDICATIONS

- Diagnosis
- To relieve symptoms

CONTRAINDICATIONS

(All relative – discuss with consultant)

- Severe bullous emphysema or chronic obstructive pulmonary disease (COPD)
- Impaired blood clotting

EQUIPMENT

- **Pleural aspiration pack** (if available) otherwise use cannula with 3-way tap and 50 mL syringe – for relief of symptoms (removal of large amounts of fluid)
- **For diagnostic aspiration only, use green needle and 50 mL syringe**
- Plus for both:
- cleansing pack
- gloves
- gown
- lidocaine 1% plain maximum 20 mL
- 5 mL and 10 mL plastic syringes

SPECIMEN BOTTLES

- **Fluid:**
- 3 sterile bottles (20 mL) for microbiology, biochemistry and cytology
- oxalate bottle for glucose
- 2 blood culture bottles
- **Blood:**
- SST bottle (yellow top) for serum LDH and protein
- fluoride/oxalate bottle (grey top) for glucose
- **For pH measurement**:
- plastic syringe cap as used for blood gases and unfractionated heparin 1000 units/mL
- wash 5 mL syringe with unfractionated heparin. Expel unfractionated heparin, leaving unfractionated heparin-coated syringe. Cap syringe

PROCEDURE

- Review chest X-ray (PA +/- lateral if available)
- Take blood specimens

Consent

- Explain procedure and reassure patient
- Obtain and record **written consent for therapeutic aspiration**
- Complete WHO surgical procedure checklist

Site of insertion and position of patient

- Seat patient on bed or chair leaning slightly forward with arms folded and resting on a pillow placed on a support such as a bed table
- Perform chest ultrasound and mark site

Avoid site where pyoderma or Herpes zoster present

Aseptic technique and local anaesthetic

- Scrub up and prepare patient's skin
- Check pleural aspiration set ensuring that all parts fit tightly together
- Infiltrate skin with lidocaine using orange needle
- Palpate intercostal space, infiltrate (using green needle) 3 mg/kg (maximum 20 mL) of lidocaine 1% plain to parietal pleura, periosteum of lower rib and into pleural space once fluid aspirated

Avoid inferior border of upper rib

PLEURAL ASPIRATION OF FLUID ● 2/2

Pleural aspiration

- **For diagnostic aspiration only,** use a green needle and 50 mL syringe. Aspirate 20–50 mL of fluid and expel into specimen bottles
- put 3–5 mL fluid from large syringe or biochemistry bottle into 5 mL pre-heparinised syringe for pH measurement (to prevent ward blood gas analyser dysfunction, perform wash procedure on analyser after pH measurement)
- **For relief of symptoms:**
- connect 3-way tap with 50 mL syringe attached (already connected in pack) to one end of plastic tubing available in pack or insert pleural aspiration kit needle through chest wall maintaining negative suction. As soon as fluid aspirated, pull needle out approximately 1 cm and push cannula in further. Completely remove needle
- connect other end of plastic tubing to cannula/aspiration kit via 3-way tap
- withdraw fluid
- if diagnostic sample is needed, aspirate 20–50 mL of fluid into 50 mL syringe and expel into specimen bottles. Connect 5 mL pre-heparinised syringe to 3-way tap. Aspirate 3–5 mL of fluid, expel bubbles from syringe and cap it ready for pH analysis (to prevent ward blood gas analyser dysfunction, perform wash procedure on analyser after pH measurement). Do not send purulent samples for pH analysis

Do not aspirate more than 1 L of fluid at one time to avoid re-expansion pulmonary oedema

TROUBLESHOOTING

- **Failure to obtain any fluid:**
- needle inserted too low down or too far in – choose more appropriate site, re-anaesthetise and try again
- needle in diaphragm (pleura feels unusually thick and needle moves widely with respiration) withdraw and adjust angle of approach
- fluid viscous – use wider bore needle
- no fluid present – consider CT to clarify the pleural findings
- **Aspiration of blood (heavily blood stained fluid can be seen in malignancy and trauma)**
- if any concerns stop procedure and seek senior advice
- **Lung unable to re-expand:**
- will show as increased pull on syringe plunger
- stop aspirating. If patient distressed, let air into pleural space

SPECIMENS

- Pleural fluid in capped heparinised syringe for pH measurement in blood gas analyser
- Send to laboratory as soon as possible
- **Biochemistry:**
- send in same sample bag
- 20 mL sterile bottle, and oxalate bottle
- blood in SST bottle (yellow top) and fluoride/oxalate bottle (grey top)
- use biochemistry form to request pleural fluid profile (ratios of pleural fluid/serum for protein, LDH and glucose)
- obtain pleural pH using blood gas analyser
- **Histopathology:**
- pleural fluid in sterile bottle
- send as much fluid as possible, up to 50 mL
- **Microbiology:**
- send in separate sample bags
- one sterile bottle (20 mL) each for Gram stain, AAFB and TB culture
- two inoculated blood culture bottles for MC&S
- **Additional pleural fluid tests:**
- if chylothorax suspected – cholesterol and triglyceride to biochemistry
- if acute pancreatitis or rupture of the oesophagus suspected – amylase (pleural and blood) to biochemistry
- if haemothorax suspected – haematocrit (purple top); haematocrit in pleural space: peripheral blood haematocrit >0.5 confirms haemothorax to haematology
- if rheumatoid disease suspected – complement to immunology
- these can be sent in the same bag

AFTERCARE

- Apply small adhesive dressing over puncture site
- Chest X-ray following therapeutic pleural tap – check for pneumothorax. If present – see **Spontaneous pneumothorax** guideline

TAPPING ASCITES AND PARACENTESIS • 1/2

INDICATIONS

- To investigate cause (**Table 1**)
- To examine ascitic fluid for bacterial infection
- To treat, by removing fluid to relieve abdominal discomfort or severe dyspnoea, or by introducing chemotherapeutic agents

Caution: If malignant ascites suspected, discuss with relevant on-call specialist to determine risk of potential local seeding

Table 1: Causes of ascites

Common	Rare
• Cirrhosis • Abdominal cancer, especially ovarian and lymphoma • Heart disease (especially constrictive pericarditis)	• Tuberculous peritonitis • Non-cirrhotic portal hypertension • Hepatic vein occlusion • Severe hepatitis • Chronic pancreatic disease • Myxoedema • Chronic renal disease • Polyserositis (e.g. SLE) • Severe hypoproteinaemia of any cause • Benign ovarian disease

RELATIVE CONTRAINDICATIONS

Paracentesis only

- Bleeding disorder suggested by unexpected bleeding (spontaneous or from venepuncture sites)
- Coagulopathy or thrombocytopenia (no absolute cut-off, generally safe to perform paracentesis with or without image guidance with no bleeding risk, unless clear evidence of spontaneous bleeding disorder) no absolute cut off for INR due to liver disease if platelets <50 consider platelet transfusion. Consider withholding new agent antiplatelets (e.g. clopidogrel) for 5 days or DOACs 24–48 hr and warfarin 5 days before procedure
- Infected ascites <48 hr after starting treatment with antimicrobials
- Previous abdominal surgery, pregnancy, overlying infection and acute abdomen

EQUIPMENT

- Dressing pack and sterile gloves
- Skin antiseptic
- Specimen containers:
  - for ascitic WBC: either 4 mL EDTA tube to haematology or 10 mL sterile pot to microbiology
  - for biochemistry: 10 mL in plain container
  - for cytology: 10–20 mL in universal container with citrate anticoagulant (if unavailable, use clotting studies bottle)
  - for microbiology, 10 mL in sterile universal container and blood culture bottles (aerobic and anaerobic)
- **Diagnostic sample:**
  - syringe (20 mL) with green (21 G) needle
- **Aspiration of ≥50 mL:**
  - selection of needles: 19–21 G
  - selection of syringes: 5 mL for local anaesthetic; 50–100 mL for aspiration
  - lidocaine 1% plain 5 mL
- If paracentesis planned: peritoneal type catheter and fluid collection system for catheter

PROCEDURE

- Explain procedure and reassure patient
- Obtain and record written consent
- Complete WHO surgical procedure checklist
- Ensure patient's bladder is empty (if in doubt, catheterise)

TAPPING ASCITES AND PARACENTESIS ● 2/2

Tapping ascites

- Lay patient supine
- Re-examine abdomen and select site where there is shifting dullness but no solid organs: preferred sites are iliac fossae (rough guide – lateral to mid-clavicular line at level of umbilicus), away from inferior epigastric blood vessels and scars, or suprapubic area
- Don mask and sterile gloves
- Cleanse skin and infiltrate 5 mL of lidocaine into anterior abdominal wall down to parietal peritoneum (lidocaine may not be required for ascitic aspirate)
- Attach long, fine needle (19–21 G) to large syringe and introduce needle into abdominal cavity. Keep puncture in abdominal wall as small as possible (Z technique helps prevent oozing from site: stretch skin 2 cm caudal to needle insertion and maintain tension until collecting fluid, remove needle rapidly and allow skin to resume its natural position)
- Aspirate gently – if tip of needle correctly placed, fluid will flow easily into syringe; if no fluid obtained, reposition either patient or needle
- Remove up to 50 mL of fluid, withdraw needle, and apply simple dressing (in patients with suspected TB, take much larger quantities of fluid and use centrifuged deposit to isolate causative organism)

Paracentesis

- Follow tapping ascites procedure then:
- introduce catheter (recommended catheter is Safe-T-Centesis® kit) – only if you are trained to do so
- allow free drainage in sterile collecting system
- drain to dryness or remove catheter after 6–8 hr free drainage (do not leave drain >8 hr unless specifically instructed)
- immediately infuse intravenously – albumin 20% 100 mL, over 1 hr, and give further doses for every 3 L of fluid drained (not needed for malignant ascites)

Troubleshooting

- If no fluid aspirated (failure to enter peritoneal cavity, perforation of a viscus, or occlusion of the end of the needle by a piece of omentum), reposition tip of needle and continue to aspirate while withdrawing needle slowly. It is reasonable to make 2 attempts on each side of the abdomen
- If no fluid obtained after these manoeuvres, request ultrasound scan to confirm presence of ascites, and ask radiologist to aspirate sample under direct scan guidance

SPECIMENS

- Note appearance of fluid. Cloudy fluid often signifies peritonitis; uniform blood staining is most often found in patients who have a cancer or who have suffered abdominal trauma; milky fluid indicates chylous ascites: check triglyceride levels of fluid
- Send samples for cytology, cell count (inform microbiology), protein concentration, and, in selected cases (if clinical suspicion of infection), enzyme estimations [lactate dehydrogenase for infection and amylase for pancreatic damage (amylase not routinely offered – request selectively)] and bacteriological culture

AFTERCARE

- If several litres of fluid have been removed, record pulse and BP hourly for 4 hr
- Stop diuretics for 24–48 hr
- Persistent leakage through puncture wounds is sometimes a problem. A stitch may be needed. Keep puncture in abdominal wall as small as possible and remove sufficient fluid to reduce pressure in abdominal cavity

URETHRAL CATHETERISATION • 1/3

If patient has previously undergone a radical prostatectomy, he must be catheterised by a urologist as urethral damage can easily occur

INDICATIONS

- **Temporary catheterisation:**
- to relieve acute retention of urine
- to improve pelvic access during surgery
- to measure urine output during and after major surgery and during major illnesses
- following major trauma – unless there is blood at the tip of the penis or significant pelvic fracture where urology opinion is required first
- **Long-term catheterisation:**
- male patients with urinary retention and prostatic hypertrophy who are unfit for prostatectomy
- some patients with neurological problems (e.g. multiple sclerosis, myelodysplasia or spinal cord injury, where intermittent self-catheterisation not feasible)
- in elderly or severely incapacitated incontinent patients as a last resort

CONTRAINDICATIONS

- Suspected urethral injury after pelvic trauma (refer to urologist)
- Blood at the tip of the penis – seek urology advice
- Urinary tract infection (avoid catheter if possible)

EQUIPMENT

- Sterile gloves, and sheet of water-repellent paper with hole cut in centre
- Dressing pack with cotton balls, gauze swabs, gallipots
- Skin antiseptic
- Tube of lidocaine/chlorhexidine gel
- Appropriate urethral catheter (see **Choice of catheter**)
- 10 mL syringe filled with sterile water
- Kidney dish
- Measuring jug
- Drainage bag

Choice of catheter

Use catheter appropriate to task for which it is required.
NB: Female catheters exist that are shorter than standard catheters. They must not be used in men as balloon will damage urethra

- Short-term (no more than 14 days) – use ordinary latex catheter
- Longer term (more than 14 days) – use silicone (Silastic) catheter with inflatable balloon
- 12F or 14F usually suitable for women
- 14F or 16F usually suitable for men
- Use silver-coated catheters for short period of catheterisation **only** (not effective after approximately 5–7 days). Consider for:
- critical care patients
- renal patients
- patients colonised with multi-resistant organism
- patients for whom infection prevention and control team has recommended this choice

PROCEDURE

Consent

- Explain procedure and reassure patient
- Obtain and record consent

URETHRAL CATHETERISATION ● 2/3

Male catheterisation

Preparation

- Lay patient supine
- Open sterile pack
- Don sterile gloves
- Assistant should open catheter, syringe, and antiseptic/sodium chloride 0.9% onto pack. Unless using pre-filled syringe, operator then draws up water into syringe and keeps sterile
- Place sterile towel to protect area
- Use left hand to hold penis and right hand to insert catheter
- Clean penis with swab soaked in sodium chloride 0.9% or antiseptic. Retract prepuce as necessary and clean glans
- Massage lidocaine/chlorhexidine gel carefully down urethra to sphincter. Gently compress distal urethra to prevent gel escaping
- Allow **at least 5 min** to elapse (in a conscious patient) before proceeding to catheterisation

Procedure

- Hold penis vertically at commencement of catheterisation
- As catheter advanced into bladder, gradually pull penis downwards to straighten urethra and to align catheter with prostatic urethra. Urine will begin to drain if present
- If procedure difficult or painful, or bleeding occurs, abandon procedure
- Advance catheter another 4 cm after urine starts to drain
- Inflate catheter balloon with 5–10 mL water. This should not cause any pain or bleeding
- Connect catheter bag
- Gently withdraw catheter until there is resistance
- **Replace prepuce (if present) to avoid danger of paraphimosis**

Female catheterisation

Preparation

- Lay patient supine
- Place patient's thighs apart, knees flexed and feet together
- Open sterile pack
- Don sterile gloves
- Assistant should open catheter, syringe, and antiseptic/sodium chloride 0.9% onto pack. Unless using pre-filled syringe, operator draws up water into syringe and keeps sterile
- Place sterile towel to protect area
- Part labia to reveal urethral meatus, disinfect meatus with an antiseptic swab
- As female urethra is short, expect to use one third as much anaesthetic gel as would be required in a male patient
- Insert nozzle of lidocaine/chlorhexidine gel into meatus and instil 4–5 mL of gel
- Allow **at least 5 min** to elapse (in a conscious patient) before proceeding to catheterisation

Procedure

- Part labia to reveal meatus and insert catheter until urine clearly draining. Catheter will usually pass without difficulty
- Inflate balloon with 5–10 mL water
- Connect catheter bag

COMPLICATIONS

Urethral

- Failure of catheter to reach bladder – obtain specialist help. Do not make further attempts
- Bacteraemia or septicaemia, which may be caused by overmanipulation. As soon as suspected, give broad spectrum antimicrobial (must be effective against Gram-negative organisms) and fluids IV – see **Antimicrobial guidelines** on Trust intranet>Clinical guidance>Clinical guidelines>Antimicrobial
- Bleeding can occur, particularly if catheter inflated in urethra. Remove catheter, obtain specialist help

SPECIMENS

- Record volume of urine that drains after catheter inserted
- Unless patient has evidence of sepsis, do not send any urine to microbiology as they will not process it without a strong indication

AFTERCARE

- Connect catheter to a closed drainage bag that is emptied as necessary
- If system has to be opened (e.g. to change bag or to wash out clots occluding catheter), full sterile precautions essential

Patients who have had chronic retention of urine sometimes have obstructive renal failure. Catheterisation can be followed by a spectacular post-obstructive diuresis with profound metabolic consequences. Be prepared to start an IV infusion in these patients, who may not be able to drink enough to replace their fluid losses. They are best managed by urology team as inpatients

Remove catheter as soon as possible to minimise risk of infection, especially with extended spectrum beta-lactamase producing Gram-negative bacilli (ESBL)

- An indwelling catheter almost always leads to bacteriuria within 2 weeks. When bacteriuria established, even the most intensive antimicrobial treatment is unlikely to make urine sterile until catheter removed or replaced

Bacteriuria associated with an indwelling catheter without clinical evidence of infection does not require antimicrobial treatment

- Bladder irritation can produce severe and painful bladder spasms, and can cause bypassing of urine alongside the catheter. Try reducing amount of fluid in balloon, or use smaller or less rigid catheter
- If there is leakage around catheter it is futile to replace with a larger one. This simply commits patient to a spiral of increasing catheter size. Urethra becomes steadily more dilated until it can retain no catheter

Suspected blocked catheter

- Use a 50 mL catheter syringe to pass 20–30 mL water or sodium chloride 0.9%. If catheter drainage not achieved, refer to urology team

Effective bladder washout for blood clots is a specialised technique. Refer to urology team

Removal of catheter

- If catheter balloon fails to deflate when the time comes to remove it, do not try to burst it by overdistension, as bladder may burst first. Refer to urology team
- **Do not cut catheter**

MEDICAL GUIDELINES 2019-20

These guidelines are advisory, not mandatory. Every effort has been made to ensure accuracy. The authors cannot accept any responsibility for adverse outcomes.

Suggestions for improvement and additional guidelines would be most welcome by Bedside Clinical Guidelines Partnership, please contact via e-mail: bedsideclinicalguidelines@uhns.nhs.uk

ISSUE 24

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