

PRACTICE



GUIDELINES

Assessment and initial management of major trauma: summary of NICE guidance

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Trauma is a major contributor to the global burden of disease. Those who experience major trauma have serious and often multiple injuries associated with a strong possibility of death or disability. Nationally there are around 20 000 cases of major trauma per year in England, and over a quarter of these result in deaths.¹ Trauma care is a developing field, and recent civilian and military research has led to changes in the assessment and management of severely injured patients. This article summarises the most recent recommendations from the National Institute for Health and Care Excellence (NICE) on the assessment and initial management of major trauma. These guidelines sit as part of a suite of trauma guidelines²⁻⁶ and alongside the previously published guidelines on head injury.⁷ They are written in the context of the NHS, where trauma care was reorganised into major trauma networks in 2012. Here we focus on two central themes of the guidelines—the assessment of a patient with major trauma and the management of patients who are actively bleeding.

Recommendations

NICE recommendations are based on systematic reviews of best available evidence and explicit consideration of cost effectiveness. When minimal evidence is available, recommendations are based on the Guideline Development Group's experience and opinion of what constitutes good practice.

Assessment of the trauma patient in the hospital setting

The immediate assessment of trauma patients must be rapid and effective in identifying life threatening or life changing injuries. Diagnostic modalities such as emergency department ultrasound and computed tomography (CT) have the potential to streamline the assessment process. If used effectively within their diagnostic capabilities, they may provide faster, more accurate

diagnoses to target lifesaving interventions. However, inappropriate use of these modalities may slow the assessment process and may lead to delays or in some cases inappropriate diagnoses. The guidelines use contemporary evidence and build on existing assessment frameworks (such as the primary and secondary surveys of the Advanced Trauma Life Support (ATLS) course⁸) to direct the appropriate use of these imaging modalities during the immediate assessment of trauma patients. The ATLS course is a global training programme for trauma care that is updated every four years. The ATLS UK Steering Group will consider how the NICE guidelines inform their 10th edition due in summer 2017.

The guidelines make recommendations on immediate imaging for patients with suspected major haemorrhage and chest trauma, as well as the use of whole body CT in the assessment of patients with multiple injuries. Immediate imaging is focused on identifying the site of active bleeding to direct haemorrhage control, and the identification of other life threatening conditions.

Imaging for major haemorrhage

- Consider immediate CT for patients with suspected haemorrhage if they are responding to resuscitation or if their haemodynamic status is normal.
- Limit diagnostic imaging such as chest and pelvis x rays or focused assessment with sonography for trauma (FAST) to the minimum needed to direct intervention in patients with suspected haemorrhage and haemodynamic instability who are not responding to volume resuscitation.
- Be aware that a negative FAST result does not exclude intraperitoneal or retroperitoneal haemorrhage.
- Do not use FAST or other diagnostic imaging before immediate CT in patients with major trauma.

What you need to know

- Use direct pressure dressings, tourniquets, and pelvic binders and move rapidly to damage control surgery or interventional radiology
- With actively bleeding patients, allow permissive hypotension and use blood rather than clear intravenous fluids
- Use whole body computed tomography (CT) in adults with blunt trauma and multiple injuries, but avoid unnecessary CT use, especially in children

What's new in this guidance?

- The immediate use of CT differs by groups and ages of trauma patients
- Avoid preliminary imaging when patients will undergo an immediate CT scan
- Transfusion targets, blood product ratios, and avoidance of crystalloids during active bleeding

Other topics covered in the NICE major trauma guideline

While this article summarises the two central themes of the guideline (streamlined assessment of the major trauma patient in hospital and the management of patients who are actively bleeding), the guideline also provides recommendations on the following topics in the pre-hospital and hospital settings:

- Airway management (including drug assisted rapid sequence induction)
- Management of chest trauma (including open thoracostomy)
- Anticoagulation reversal
- Circulatory access
- Damage control surgery
- Reducing heat loss
- Pain management
- Documentation
- Information and support for patients, family members, and carers
- Training and skills of healthcare professionals within trauma networks

- Do not use FAST as a screening modality to determine the need for a CT in patients with major trauma.

[Based on low to very low quality diagnostic observational studies, and the experience and opinion of the Guideline Development Group (GDG)]

Imaging for chest trauma

- Consider immediate chest x ray and/or extended focused assessment with sonography for trauma (eFAST) as part of the primary survey to assess chest trauma in adults (≥ 16 years old) with severe respiratory compromise.
- Consider immediate CT for adults with suspected chest trauma without severe respiratory compromise who are responding to resuscitation or whose haemodynamic status is normal.

[Based on low to very low quality diagnostic observational studies, and the experience and opinion of the GDG]

- Consider chest x ray and/or ultrasound for first line imaging to assess chest trauma in children (< 16 years old).
- Do not routinely use CT for first line imaging to assess chest trauma in children.

[Based on low quality diagnostic observational studies, and the experience and opinion of the GDG]

Whole body CT of multiple injuries

- Use whole-body CT (consisting of a vertex-to-toes scanogram followed by a CT from vertex to mid-thigh) in adults (≥ 16 years) with blunt trauma and suspected multiple injuries. Patients should not be repositioned during whole body CT.

- Use clinical findings and the scanogram to direct CT of the limbs in adults with limb trauma.
- Do not routinely use whole body CT to image children (< 16 years old). Use clinical judgement to limit CT to the body areas where assessment is needed.

[Based on very low quality diagnostic observational studies, and the experience and opinion of the GDG]

Management of major haemorrhage in the hospital setting

Massive bleeding accounts for over a quarter of trauma deaths each year in England and Wales.⁹ Deaths from haemorrhage occur rapidly, and teams must be focused on the early identification of bleeding and rapid effective haemostasis. Modern resuscitation focuses on providing volume resuscitation while protecting the body's ability to form stable blood clots. The guidelines focus on the assessment and management of those who are suspected of having active ongoing bleeding, either visible external bleeding or suspected or known internal bleeding, which constitutes a threat to life.

Dressings, tourniquets and pelvic binders

- Use simple dressings with direct pressure to control external haemorrhage.
- In patients with major limb trauma use a tourniquet if direct pressure has failed to control life threatening haemorrhage.

[Based on the experience and opinion of the GDG]

- In the pre-hospital setting, if active bleeding is suspected from a pelvic fracture after blunt high-energy trauma:
 - apply a purpose-made pelvic binder or

- consider an improvised pelvic binder, but only if a purpose-made binder does not fit.

[Based on very low quality observational cohort studies and the experience and opinion of the GDG]

Haemorrhage protocols

Major haemorrhage (or transfusion) protocols aim to rapidly and consistently deliver blood components to bleeding trauma patients.

- Hospital trusts should have specific major haemorrhage protocols for adults (≥ 16 years) and children (< 16).
- For patients with active bleeding, start with a fixed ratio protocol for blood components and change to a protocol guided by laboratory coagulation results at the earliest opportunity.

[Based on a high quality randomised controlled trial, and the experience and opinion of the GDG]

- Use physiological criteria that include the patient's haemodynamic status and his or her response to immediate volume resuscitation to activate the major haemorrhage protocol.
- Do not rely on a haemorrhagic risk tool applied at a single time point to determine the need for major haemorrhage protocol activation.

[Based on very low quality observational cohort studies]

Haemostatic agents

Haemostatic agents may have a role to reduce or control bleeding. Tranexamic acid works by directly inhibiting clot breakdown, and its delayed use may be beneficial if there is evidence of hyperfibrinolysis (abnormally rapid clot breakdown), supported by blood tests such as D dimer and fibrinogen products.

- Use intravenous tranexamic acid as soon as possible in patients with major trauma and active or suspected active bleeding.
- Do not use intravenous tranexamic acid more than 3 hours after injury in patients with major trauma unless there is evidence of hyperfibrinolysis.

[Based on high to low quality evidence from randomised controlled trials and economic evidence with potentially serious limitations and direct to partial applicability]

Volume resuscitation

These guidelines suggest high volume blood product resuscitation, avoiding the use of crystalloids and colloids in hospital. A restricted, or permissive approach to volume resuscitation involves accepting a lower blood pressure during active bleeding to reduce bleeding; and restricting fluid administration to avoid diluting the blood's clotting ability.

- For patients with active bleeding, use a restrictive approach to volume resuscitation until definitive early control of bleeding has been achieved.
- In hospital settings move rapidly to haemorrhage control, titrating volume resuscitation to maintain central circulation (central pulse or mean arterial pressure of 50 mm Hg) until control is achieved.
- For patients who have haemorrhagic shock and a traumatic brain injury:

- If haemorrhagic shock is the dominant condition, continue restrictive volume resuscitation

- If traumatic brain injury is the dominant condition, use a less restrictive volume resuscitation approach to maintain cerebral perfusion.

[Based on low quality randomised controlled trials, and the experience and opinion of the GDG]

- In hospital settings do not use crystalloids for patients with active bleeding. See NICE guideline *Intravenous fluid therapy in adults in hospital* (www.nice.org.uk/guidance/CG174) and the section on fluid resuscitation in the NICE guideline *Intravenous fluid therapy in children and young people in hospital* (www.nice.org.uk/guidance/ng29) for advice on tetrastarches.
- For adults (≥ 16 years old) use a ratio of 1 unit of plasma to 1 unit of red blood cells to replace fluid volume.
- For children (< 16 years old) use a ratio of 1 part plasma to 1 part red blood cells and base the volume on the child's weight.

[Based on high quality randomised controlled trials and low quality observational cohort studies]

Damage control surgery

Damage control surgery deals with the most life threatening aspects of patients' injuries, often temporary bleeding control. Once haemorrhage control is achieved and normal homeostasis restored, further, definitive surgeries may be carried out.

- Use damage control surgery in patients with haemodynamic instability who are not responding to volume resuscitation.
- Consider definitive surgery in patients with haemodynamic instability who are responding to volume resuscitation.
- Use definitive surgery in patients whose haemodynamic status is normal.

[Based on the experience and opinion of the GDG]

Interventional radiology

- Use interventional radiology techniques in patients with active arterial pelvic haemorrhage unless immediate open surgery is needed to control bleeding from other injuries.
- Consider interventional radiology techniques in patients with solid organ (spleen, liver, or kidney) arterial haemorrhage.
- Consider a joint interventional radiology and surgery strategy for arterial haemorrhage that extends to surgically inaccessible regions.
- Use endovascular stent grafts in patients with blunt thoracic aortic injury.

[Based on low quality evidence from observational cohort studies]

Implementation

Major trauma systems around the world regionalise care into major trauma networks that include specialist major trauma centres for the most severely injured patients, trauma units (or a tiered system of lower level trauma centres) for all except the most severe trauma patients, and prehospital providers. Many of the recommendations in this NICE guidance are already established practice and, as such, the facilities, resources, and expertise are already available. Work may be needed to ensure

consistent practices for all patients, across all providers, at all times of day and night.

Transfusion practice is already part of many major haemorrhage protocols, but it can be delivered inconsistently.

Multidisciplinary groups meeting together and reviewing cases may ensure that blood products are delivered rapidly and consistently, while avoiding waste and over-transfusion.

These guidelines confirm the place of interventional radiology services as integral to haemorrhage control for some injuries, such as pelvic trauma. In the UK, such services are part of the national service specification for major trauma, but there is variation in their provision, and between in-hours and out-of-hours services. Trusts and providers might consider the same standards as emergency surgery in terms of access and provision.

Further information on implementation tools provided by NICE can be found at www.nice.org.uk/guidance/ng39/resources and www.nice.org.uk/guidance/ng40/resources

The members of the Guideline Development Group were: Karim Brohi (chair), Chris Fitzsimmons, Simon Hughes, Heather Jarman, Richard Lee, Simon McPherson, Kevin Morris, James Piercy, David Skinner, Graham Stiff, Paul Wellman, and Nick Welch. Expert group members were: David Christmas, Judith Foster, Nathan Griffiths, Jennifer Hough, Michael Ingram, Gabrielle Lomas, Madeleine Sampson, Beverly Snaith, Thirumoorthy Samy Suresh Kumar, Laura Toplis, and Steve Wiltshire. Project executive team members overlooking all five guidelines in the trauma suite were: John Borthwick, Karim Brohi, Lynda Brown, Chris Fitzsimmons, Bob Handley, Simon Hughes, Heather Jarman, Fiona Lecky, Richard Lee, Iain McFadyen, David Skinner (chair), Graham Stiff, and Nick Todd. The technical team at the National Guideline Centre included Alex Allen, Nina Balachander, Ian Bullock, Peter Cain, Margaret Constanti, Caroline Farmer, Jessica Glen, Rhosyn Harris, Kate Kelley,

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How patients were involved in the creation of this article

Committee members involved in this guideline included lay members who contributed to the formulation of the recommendations summarised here. Patient organisations were among the registered stakeholders who were consulted at both scoping and development stages.

Guidelines into practice

- Is the time to use of imaging modalities (plain x rays, ultrasound, FAST, and CT) in major trauma in accordance with these recommendations?
- Is the time taken for emergency definitive reports and subsequent time to definitive decision making in accordance with these guidelines?
- Are blood products transfused in a timely and appropriate manner, avoiding waste?
- Is use of crystalloids avoided during active bleeding?
- Is access to emergency surgery and interventional radiology consistent and timely for all trauma patients?

Further information on the guidance

Methods

The Guideline Development Group comprised a consultant trauma and vascular surgeon (chair), a consultant in paediatric emergency medicine, a consultant anaesthetist, a consultant nurse in emergency care, a head of clinical services (ambulance), a consultant vascular and interventional radiologist, a consultant in paediatric intensive care, two patient members, a consultant in emergency medicine, a GP and pre-hospital emergency physician, and an emeritus consultant in emergency medicine. Additional expert members included a consultant liaison psychiatrist, two consultant radiologists (including one paediatric), two consultant radiographers (including one paediatric), a nurse consultant in paediatric emergency medicine, a consultant anaesthetist, a matron of emergency medicine, an emergency medicine consultant, a clinical psychologist, and a transfusion practitioner. As this guideline was part of a suite related to the management of people with major trauma (comprising four clinical guidelines and one service delivery guideline), a Project Executive Team (PET) of clinical experts was recruited from across the five guidelines to ensure coherence and avoid duplication. As well as representation from the major trauma guideline, the PET included two consultant trauma and orthopaedic surgeons, a consultant anaesthetist, a consultant neurosurgeon, an honorary consultant in emergency medicine, and two patient members.

The guideline was developed using standard National Institute for Health and Care Excellence (NICE) guideline methodology (www.nice.org.uk/article/pmg20/chapter/1%20introduction%20and%20overview). The GDG developed clinical questions, collected and appraised clinical evidence, and evaluated the cost effectiveness of proposed interventions and management strategies through literature review and economic analysis. Quality ratings of the evidence were based on GRADE methodology (www.gradeworkinggroup.org). These relate to the quality of the available evidence for assessed outcomes rather than the quality of the clinical study. Where standard methods could not be applied, a customised quality assessment was done. These were either presented as a narrative summary of the evidence or in customised GRADE tables (for example, for observational studies). Customised quality assessment was done for the diagnostic meta-analysis conducted on the accuracy of imaging tests for chest trauma and haemorrhage; for the prognostic reviews on risk prediction rules/tools; and for the meta-synthesis undertaken on qualitative studies for the chapter on the information and support requirements of people with major trauma and their patients and carers.

The draft guideline went through a rigorous review process, in which stakeholder organisations were invited to comment; the GDG took all comments into consideration when producing the final version of the guideline.

NICE has produced three different versions of the guidance: a full version; a summary version known as the "NICE guidance"; and a version for people using NHS services, their families and carers, and the public (www.nice.org.uk/guidance/NG39/ifp/chapter/about-this-information). A formal review of the need to update a guideline is usually undertaken by NICE after guideline publication.

Cost effectiveness

The GDG felt that an important change to current practice would be represented by better access to imaging, not just in major trauma centres but more local hospitals. As this has large service delivery implications, it was necessary to look at whether early imaging is cost effective.

We attempted to use data from the Trauma Research and Audit Network (TARN) database. This is a large, up to date, British observational dataset. Unfortunately this was not able to provide reliable effectiveness inputs to the economic model due to unacceptable residual confounding. Therefore no modelling evidence was produced to support a specific timeframe being included in the recommendations.

Future research

- What is the clinical and cost effectiveness of point-of-care coagulation testing using rotational thromboelastometry (ROTEM) or thromboelastography (TEG) to target treatment, compared with standard laboratory coagulation testing?
- Is lactate monitoring in patients with major trauma clinically and cost effective to guide management of hypovolaemic shock and its clinical consequences?
- Is morphine clinically and cost effective compared with ketamine for first line pharmacological pain management (in both prehospital and hospital settings) in patients with major trauma?
- Is warming clinically and cost effective in patients with major trauma? If so, which groups of patients will benefit from warming and what is the best method of warming?