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Prehospital organization and management of a mass casualty incident

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Key points

- A major incident is an incident where the location, number, severity, or type of live casualties requires extraordinary resources.
- The declaration of a major incident results in the implementation of a multi-service structured response based on key principles: command and control, safety, communications.
- Three tiers of command are recognized: operational (previously known as bronze) and tactical (silver) are located at the scene. Strategic (previously called gold) support is provided distant to the scene often at regional police headquarters.
- Healthcare support at a major incident involves the hierarchy of triage, treatment, and transportation.
- Problems commonly encountered at a major incident in the prehospital setting include issues with communication and over-triage.

The last two decades have seen healthcare systems increasingly involved in the management of mass casualties with an incidence of 3–4 major incidents per year previously cited as the UK mean and including transportation incidents, terrorism, infectious diseases, and natural disasters.[1] Increasing media coverage and the prevalence of terrorist activity and infectious disease (e.g. Ebola) has also resulted in raised general awareness. Additionally, the recent Hillsborough Inquest (relating to a sports stadium disaster in Sheffield, UK, in 1989) demonstrates how emergency services and others can be placed under significant scrutiny years after the event.

Timelines for major incidents are frequently divided into four distinct stages: initial response, consolidation phase, recovery phase, and restoration of normality, with the duration of individual components being largely determined by the nature of the incident. These are then followed by the process of Coroners' Inquests, civil/criminal trials, and public enquiries. Acute hospitals in the UK are legally bound under the Civil Contingencies Act 2004 to have a level of preparedness for major incidents, but knowledge of responsibilities and roles is often limited.[2] This article therefore deals with an overview of what constitutes a major incident and how the initial prehospital response is (in general terms) organized in a civilian setting outside the environment of significant chemical, biological, radiological, or nuclear contamination. Its intention is to provide hospital staff in anaesthesia and intensive care medicine (often the forefront of a hospital response) with a working knowledge of how emergency services work on-scene.

Major incidents

A mass casualty major incident is defined as any incident where the location, number, severity, or type of live casualties requires extraordinary resources. They tend to be classified in three ways:

1. natural or man-made,
2. simple or compound,
3. compensated or uncompensated.

Natural major incidents result from severe natural events, e.g. floods, fires, tsunamis, earthquakes, or volcanic eruptions and in addition to illness and injury frequently have the added complication of homelessness, limited food and water, and

vulnerability to infectious diseases. Man-made incidents occur whenever large groups of people are in close proximity (e.g. work, travel, leisure) and cover incidents involving transport (most common), industry, mass gatherings (defined by convention as a crowd in excess of 1000), and terrorism.

The complexity of incidents is described using the terms simple, compound, compensated, and uncompensated. A simple incident describes a major incident where infrastructure remains intact; a compound incident involves damage to infrastructure, e.g. transportation, lines/methods of communication, health services, etc. Compensated major incidents include those where 'the load is less than the extraordinary capacity', i.e. live casualties can be dealt with by mobilizing additional resources. In uncompensated incidents (frequently associated with natural disasters), the load placed on services exceeds even an 'extraordinary' capacity whereby the additional mobilization of medical resources through major incident plans are unable to cope with the number of casualties. Within high-income/high-resource countries, the majority of major incidents encountered by health services are simple, man-made, and compensated. Recent exceptions include Hurricane Katrina in New Orleans, the Chilean Earthquake, and the Japanese Tsunami.

Declaration of a major incident

Any member of the emergency services can declare a major incident using the METHANE mnemonic (Fig. 1) if they consider criteria within the above definition have been met, noting that a major incident for one emergency service does not automatically constitute a collective major incident. If doubt exists, personnel (and hospitals) can be placed on stand-by.

Response to a major incident

When a major incident is declared, emergency services and other providers have a designated set of priorities that are intended to be life-saving and enable a rapid restoration of normality in the aftermath of the event. Interventions are applied at the scene (operational and tactical) and beyond (strategic) at a designated location distant to the event (gold command). In summary, initial priorities are to save life, relieve suffering, and prevent escalation of the incident followed by protection of the environment, preservation of infrastructure, and property with a subsequent restoration of normality and facilitation of enquiries.

The process has previously been summarized in the MIMMS (Major Incident Medical Management and Support) system and in the UK is now described via JESIP (Joint Emergency Services Intra-operability Programme) via the acronym CSCATTT (Fig. 2)

Command and control

Initial emergency vehicles leave their blue lights on as the focus for an incident control point and personnel begin an initial assessment. Subsequent vehicles extinguish their lights and a predetermined command structure is then established within each emergency service: operational (bronze), tactical (silver), and strategic (gold). Commanders at the scene are described as operational commanders and the healthcare response is led by a medical and ambulance commander. One service (usually the police in the UK) assumes overall responsibility.

Two main cordons are established to ensure safety and security at the scene and support movement to and from the incident. An inner cordon covers the incident site, enclosing the operational zone and has restricted access under fire/police control. An outer cordon is physically established by the police to prevent unauthorized access to areas used by the emergency services.

With respect to zones of command, operational commanders work at the site of the incident and support personnel within that area. Depending on the nature of the incident, there may be multiple operational areas each requiring its own commander, e.g. multiple train carriages. Tactical command is usually enclosed by the outer cordon and under the responsibility of the service commanders. They co-locate at the command vehicle (JESCC or Joint Emergency Services Control Centre) where they plan and co-ordinate the response to the incident for each service and direct resource to the bronze zone as information

M: My call-sign/ Major Incident Declared

E: Exact location of the incident

T: Type of incident with brief details re vehicles, buildings etc.

H: Hazards present and potential

A: Access routes to the incident and potential rendezvous points (RVPs)

N: Approximate Number and nature of casualties

E: Emergency services: present and those required including specialist input e.g. Air Ambulance, MERIT teams

Fig 1 The METHANE mnemonic.

(e.g. number of casualties) is brought to them. Strategic command exists distant to the scene and supports tactical commanders. It also liaises with other organizations whose resources may be required, e.g. local NHS Trusts, Public Health, and Local and National Government.

Within the outer cordon and in addition to the JESCC, commanders must establish a casualty clearing station (CCS), suitable access and exit points from the site for ambulances, and a safe route of evacuation for non-injured survivors. Designated non-command personnel are required to log communications received including those made between commanders and those containing information relayed from the scene of the incident.

Safety: self, scene, survivors

Safety at the scene has individual and collective aspects. Each rescuer is required to have appropriate personal protective equipment in order to enable access to the incident site. Collectively (applying principles of distributive justice), the scene should also be secured and made safe in order to prevent rescuers becoming casualties. This principle was outlined during the London 7/7 inquest where rescue personnel had to ensure that there were no secondary devices.[3] The command and control overlay continues and at this juncture is the responsibility of fire and rescue services, although if the incident is a major crime or security alert, the police may assume command.

Communication

Poor communications are repeatedly identified as problematic. They include lack of information, failure to confirm information, and lack of coordination of information and resources between individuals and emergency services. With respect to devices, radios (with specified, secure talk-groups with recording) are the mainstay of communication within and across services. Telephone networks can rapidly become overloaded (in the 7/7 bombings: 42 000 calls inside 1 h) necessitating more basic methods of communication, for example, runners with written instructions, loud-hailers, hand signals.[4] For public information, radio and television networks can be utilized.

C: Command and Control

S: Safety of self (rescuers), the scene and survivors

C: Communications

A: Assessment of the scene

T: Triage

T: Treatment

T: Transport

Fig 2 Management process for a major incident (MIMMS and JESIP).

Medical support (triage, treatment, and transport)

Primary triage or triage sieve

The aim is to deliver the 'right patient to the right place at the right time' which, in the first instance (Fig. 3), is a very basic process based again on distributive justice. It is a continuous process repeated at multiple stages to varying levels of complexity between primary triage and arrival at hospital. Primary triage is usually performed by trained ambulance crew and has four levels of priority: P1–3 reflect reducing severity of injury (immediate, urgent, delayed), the fourth category (P4) is dead. Labels are colour-coded: red, yellow, and green for P1–3, respectively, and black or white for P4.

The process is basic with limited immediately life-saving interventions based on C-ABC approach, i.e. the triage teams will attempt to stop catastrophic haemorrhage (tourniquets, dressings, etc.) and maintain airways with basic adjuncts, an addition highlighted after 7/7. Its purpose is to move the uninjured and minor injuries to a place of safety for further assessment, while the more severely injured can be triaged and evacuated for treatment at the CCS. Personnel are provided with guidance in the form of body-length tape for paediatric cases and have colour-coded cards to record the number and type of casualty for subsequent relay to bronze commanders.

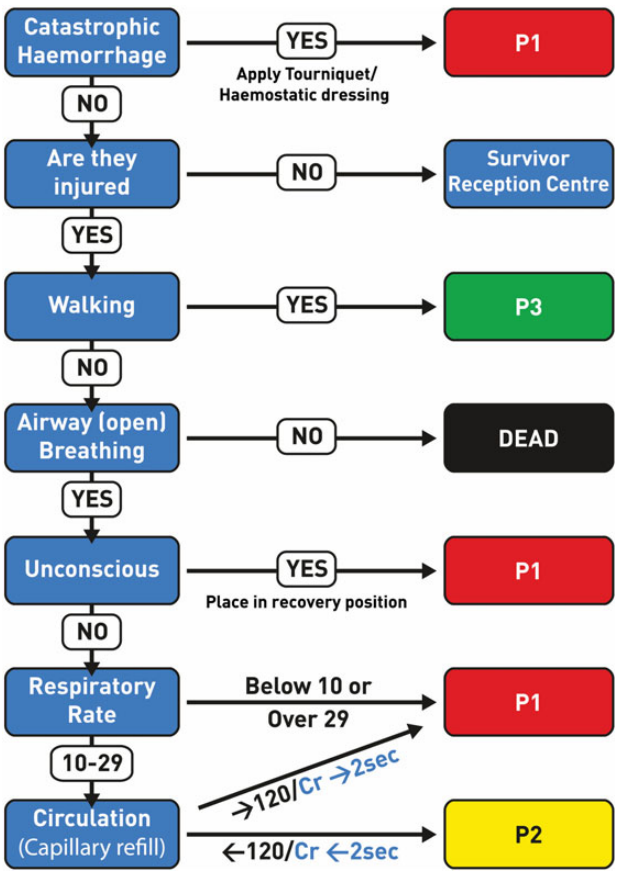

Fig 3 Triage sieve algorithm (National Ambulance Resilience Unit).

Secondary triage or triage sort

At the CCS, further triage occurs via the Triage Revised Trauma Score (TRTS) which grades severity via respiratory rate, systolic arterial pressure, and Glasgow coma scale (GCS) and assigns a maximum score of 12. Similar priorities (P1–4) and colour coding are applied, with P1 having a score of 1–10, P2 a score of 11, and P3 of 12 (Figs 4 and 5). Dead patients score 0. This once again allows rapid assessment and prioritization but should be supplemented with as much anatomical information as possible.

Over-triage

Over-triage occurs when casualties' conditions are unintentionally overestimated, i.e. non-critically ill casualties are assigned P1 or P2 categories and treatments are prioritized over casualties with more urgent needs. Typically, trauma centres will allow a triage rate (number of P1 and P2 casualties) of up to 50% under 'normal circumstances' to allow the capture of all patients with severe injury, that is, prevent undertriage.[5] However, in a mass casualty disaster, the allowable over-triage rate remains controversial as there is an association with increased mortality rates through a potential to overwhelm hospital resources diverting attention from actual critically injured patients.[6] Prevention can occur via trained personnel performing triage sieve in the first instance and by the subsequent use of physiological and anatomical data, e.g. the injury severity score.[7–9]

Treatment and transport

The organization and provision of equipment for the treatment of casualties is the responsibility of the ambulance service supported by prehospital medical staff. Some treatments may occur within the inner cordon (usually first aid: bystanders and emergency services). There may also be the facility to provide advanced treatment (such as surgery) within the CCS. Practically,

STEP 1: Calculate the **GLASGOW COMA SCORE** (GCS)

A: Eye opening:		B: Verbal response:		C: Motor response:	
Spontaneous	4	Orientated	5	Follows command	6
To Voice	3	Confused	4	Localise Pain	5
To Pain	2	Inappropriate	3	Withdrawal to pain	4
None	1	Incomprehensible	2	Flexion to pain	3
		No Response	1	Extension to pain	2
				No Response	1

Glasgow Coma Score (GCS) = A + B + C

STEP 2: Calculate the **TRIAGE SORT SCORE**

X: Convert Glasgow Coma Scale		Y: Respiratory Rate		Z: Systolic Blood Pressure	
13 – 15	4	10 – 29	4	≥ 90	4
9 – 12	3	> 29	3	76 – 89	3
6 – 8	2	6 – 9	2	50 – 75	2
4 – 5	1	1 – 5	1	1 – 49	1
3	0	0	0	0	0

Triage Sort Score = X + Y + Z

STEP 3: Assign a triage **PRIORITY**

12	=	Priority 3
11	=	Priority 2
≤ 10	=	Priority 1
0	=	Dead

STEP 4: Upgrade PRIORITY, dependent on the injury/ diagnosis

Fig 4 Triage sort and the TRTS (National Ambulance Resilience Unit).

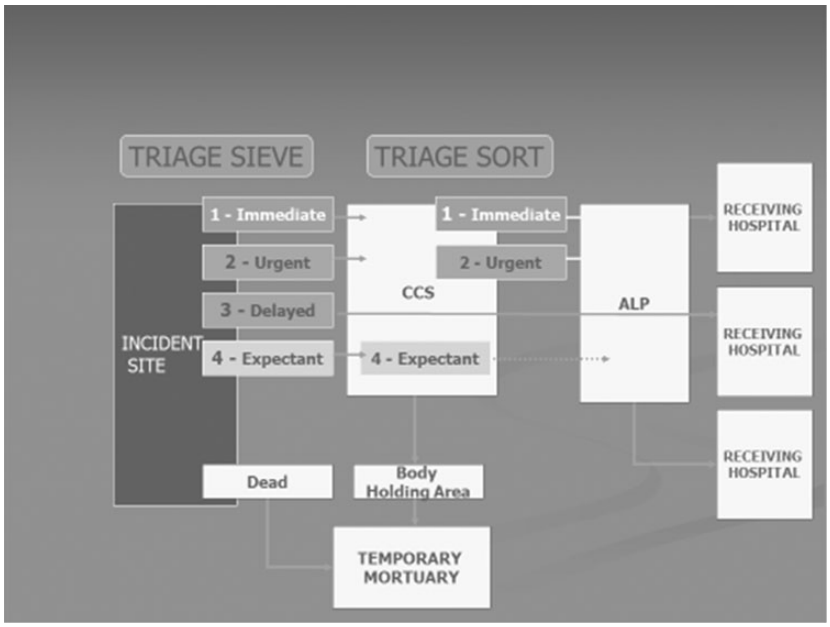

Fig 5 Basic layout of the rescue scene. CCS, casualty clearing station; ALP, ambulance loading point. Text adapted from Advanced Life Support Group.[11]

many treatments can be provided in the prehospital setting, but care is directed towards the management of airway, breathing, and circulatory problems due to time constraints and potential numbers requiring definitive treatment. The main aim of any treatment provided is to ensure patients are stable for safe transfer to an appropriate hospital facility.

With respect to transport, three key principles are required: priority (triage sort), amount of stabilization treatment priorities before transfer, and patients' destinations. In most circumstances, the priority of evacuation will match the triage priority; however, capacity, availability, and suitability of transport has to be considered when determining the order of evacuation, e.g. air evacuation for severely injured casualties. Failure to use such a process can result in multiple un-triaged patients arriving at and overwhelming hospitals' emergency departments. Such an event occurred during the Ramstein Airshow in 1988 where no form of triage was formally instituted after an airplane crashed into the spectator enclosure resulting in ambulances instantly evacuating people to hospital.[10] Similarly, during the aftermath of the 7/7 bombs, the commandeering of buses for transporting P3 casualties to hospital had the potential to overwhelm emergency departments. The input of experienced health service commanders is therefore vital at this juncture and only through working closely within the JESCC can they ensure that transport vehicles are deployed and despatched to and from the scene appropriately. Working closely with police and fire and rescue ensures safe access and egress into and from the outer cordon via an access point, ambulance parking point, ambulance loading point, and exit site. Constant logging of casualty numbers and conveying the information to local hospitals via gold command can enhance the delivery of care.

Transportation of the dead

The scene of a major incident is also a potential crime scene and therefore, the dead should not be moved without appropriate documentation and police authorization. This is with the exception of either aiding rescue of the living or preventing destruction from fire or chemicals. While the evacuation of live casualties takes priority, the command and control structure has to factor in the requirement for a temporary mortuary, respect for the dead, and their eventual transport and identification.

Summary

Major incidents are rare but have potentially devastating short- and long-term consequences on health and infrastructure. Understanding of their nature and the management systems used in the initial prehospital setting can enable hospital staff to comprehend the problems faced by emergency services and develop their own plans to deal with casualties.

Declaration of interest

In 2015 Dr Cosgrove received a grant of £5000 from the Hillsborough Family Support Group to develop guidance pertaining to the provision of Events Medicine Services. This includes major incident contingency planning.

MCQs

The associated MCQs (to support CME/CPD activity) can be accessed at https://access.oxfordjournals.org by subscribers to *BJA Education*.

Podcasts

This article has an associated podcast which can be accessed at http://www.oxfordjournals.org/podcasts/bjaed_Prehospital and Hospital Major Incident Management_Dr Cosgrove_BJAEducation_Oct2016.mp3

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