Major incident pre-hospital care

Peter Lax
Kate Prior

Abstract

This article gives an overview of pre-hospital care in the context of a major incident, and how some standard operating procedures may be changed to reflect the particular challenges imposed by such an incident. With reference to recent major incidents within the UK, we aim to illustrate how patients may be managed differently and promote understanding of some of the difficulties associated with working in pre-hospital care in general, and in a major incident specifically.

Keywords BASICS; major incidents; PHEM; pre-hospital care; trauma networks; triage

Introduction

Pre-hospital care in the UK has evolved significantly over the last 30 years: from solo doctors with a predominantly general practice background providing an ad-hoc service, progressing through the creation of BASICS (the British Association of Immediate Care Schemes) and recently, pre-hospital care being recognized as the newest subspeciality Certificate of Completion of Training (CCT) by the General Medical Council. Since the creation of major trauma networks in the UK in 2012, the mortality from trauma has steadily declined by integrating all aspects of trauma care beginning with pre-hospital emergency medicine (PHEM), through initial damage control resuscitation, critical care and onwards to definitive care and rehabilitation. This is usually due to a large resource being invested in a small number of patients at any one time with good results. During day-to-day operations, the supply of healthcare delivery outstrips demand and there is a large amount of tolerance built into the trauma system. Clinical decision-making tools such as those in Figure 1 have been employed to determine which patients require transport to a specialist major trauma centre (MTC) or can be safely treated at a smaller trauma unit (TU). There are currently 26 designated MTCs in the UK and each region has at least one MTC designated to receive the sickest trauma patients. This is important in the day-to-day working as well as during major incidents because it may not be possible to move every patient to the MTC, nor would it be appropriate. The effect of saturating a single centre with multiple undifferentiated casualties would bring the entire system to an abrupt halt. We must, therefore, employ a system where patients with the greatest need for advanced medical care receive it and those who require assessment and less complex management are sent to appropriate locations to deal with their injuries. This relies on identifying those casualties who are 'time critical' (i.e. are at risk of death or serious deterioration without significant intervention in an MTC) as well as those who have conditions which can have delayed treatment. This is the principle behind triage as employed by many ambulance and pre-hospital services around the world.

Peter Lax *MB ChB (Hons.), Dip RTM, Dip IMC RCSEd, FRCA, RAF is a Squadron Leader in the Royal Air Force and an Anaesthetics and Intensive Care Registrar in the Tactical Medical Wing, RAF Brize Norton and Worcestershire Royal Hospital, UK. He works as a pre-hospital doctor for The Warwickshire and Northamptonshire Air Ambulance. Conflicts of interest: none.*

Kate Prior *MBBS, MRCS, FRCA, DipRTM is a Surgeon Commander in Royal Navy and a Consultant in Anaesthetics and Major Trauma at King's College Hospital, London, UK. Conflicts of interest: none.*

Major incidents

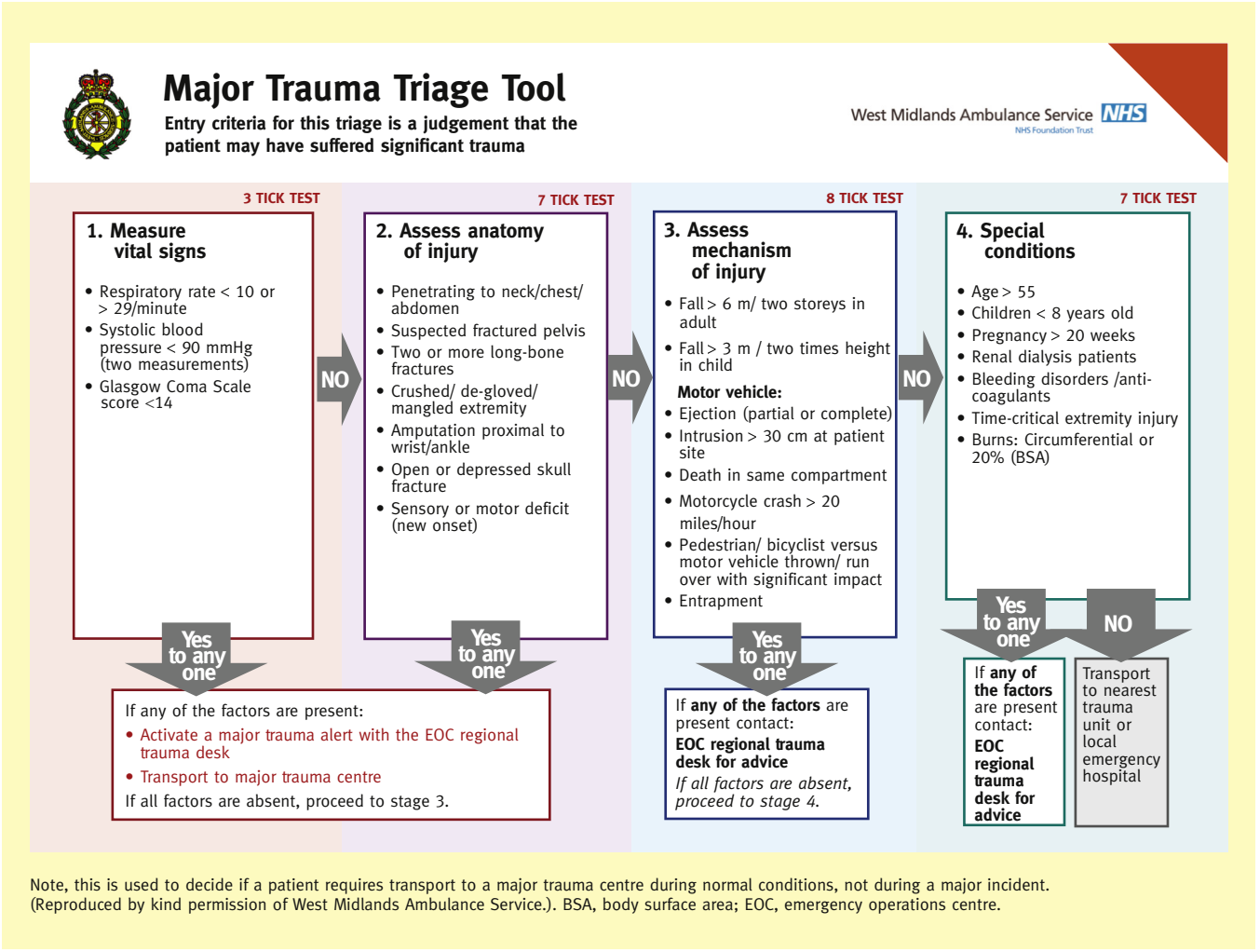
Major incidents by their very definition are rare situations which place an extraordinary burden on healthcare resources as a result of the number or type of casualties involved in an incident, which cannot be met by standard available resources. A classification of incidents is described in the overview article on pages 410–412 of this issue. It is important to reiterate that each major incident is only a major incident relative to its location and resources; i.e. a three car collision outside a remote hospital in the Outer Hebrides with only one ambulance is a major incident. The same collision in London or Birmingham is easily within the management capabilities of the existing resources locally.

This article focuses on major incidents such as the bombings in London in July 2005, where a well-resourced urban centre mobilized additional resources to cope with a large number of casualties during a man-made, simple, compensated major incident.

Triage

In the same way that trauma patients are triaged to either an MTC or a smaller TU during normal practice, the process of deciding which patient goes to which hospital and in what order is of paramount importance during a major incident.

The word 'triage' comes from the French verb 'trier' meaning to sift or sort, and was initially employed by Dominique Jean Larrey, Surgeon to Napoleon Bonaparte, during the Napoleonic Wars. In its initial form, triage was used to decide which of Napoleon's injured soldiers were fit for minor, immediate care and swift return to combat duties on the front line, and which required removal to the rear echelons for more extensive medical treatment. Modern implementation takes a contrary approach by prioritizing those who are sickest and require immediate extrication and treatment to preserve life. This is accomplished in a major incident by the use of triage *sieve* and triage *sort* tools (Figures 2 and 3). The sieve will take undifferentiated patients at the point of injury and prioritize them into patients who require treatment based on physiological scoring into five categories: immediate care (P1/T1/Red), soon (within 2 hours/P2/T2/Yellow), delayed (within 4 hours/P3/T3/Green), expectant (P4/T4/Blue) or those who have already died (P0/T0/Black). The use of the expectant category is controversial and, in the UK, requires approval at ministerial level; it implies that the patient is so severely injured that even if they were the only casualty and not in a major incident, that survival would be extremely unlikely even with maximal resources invested in them (e.g. >90% burns but still alive). It has never been employed in the UK, but has been used in major incidents abroad (e.g. the Ramstein Airshow Disaster).



Note, this is used to decide if a patient requires transport to a major trauma centre during normal conditions, not during a major incident. (Reproduced by kind permission of West Midlands Ambulance Service.). BSA, body surface area; EOC, emergency operations centre.

Figure 1 West Midlands Major Trauma Triage Tool.

The triage *sieve* (Figure 2) is a swift, reliable and reproducible tool that does not take into account likely clinical course, but gives a snapshot of a particular patient's clinical signs is at a particular time. Triage is a dynamic process because patients can change triage category as time progresses, but the key is to make early decisions, act accordingly and re-assess later on. Each patient should take no longer than 15 seconds to assess and, often, those with less medical training will make better triage decisions as they will follow guidance quickly and do not change a patient's category in line with their clinical impression (which usually results in over-triage). It is also important to note the person triaging must not become involved with delivering time consuming interventions to patients lest the triage process halt altogether. The three exceptions to this rule are applying a tourniquet, opening an airway to assess for presence of respiratory effort or rapidly repositioning a patient into the recovery position if unconscious to maintain a clear airway. Once a triage category has been assigned, the patient must be appropriately marked to ensure they are treated with the appropriate expediency and other personnel do not perform a needless duplication of initial triage. This initial decision will decide which patients are evacuated immediately and those who can wait or be treated/further assessed at a forward aid post. Marking can be achieved in several ways — writing the triage category in permanent marker on the patient, a tourniquet, opening a Cyalume or 'glow-stick' on the patient or using a bespoke kit such as a cruciform card (Figure 4) which can be attached to the patient. The latter option has the benefit of remaining with the patient until hospital arrival; it doubles as an aide-memoire, allows for recording of observations over time and has a unique identifiable number attached to each form to allow tracking of patients by multiple agencies from point of injury to hospital.

Triage *sort* takes patients who have been previously separated into immediate, soon and delayed and further quantifies the speed of their removal from the scene. This will usually take place in a forward aid post and relies on more advanced examination and clinical decision-making techniques (e.g. the patient's GCS). This must be performed by someone with a degree of medical training sufficient to be able to use the tool, though not necessarily a doctor (e.g. paramedic, nurse, military medic). Again these tools are blunt discriminators, but they can be used by clinically junior personnel with a high degree of accuracy and reproducibility. This is exactly what is needed in the major incident scenario because there is insufficient time for

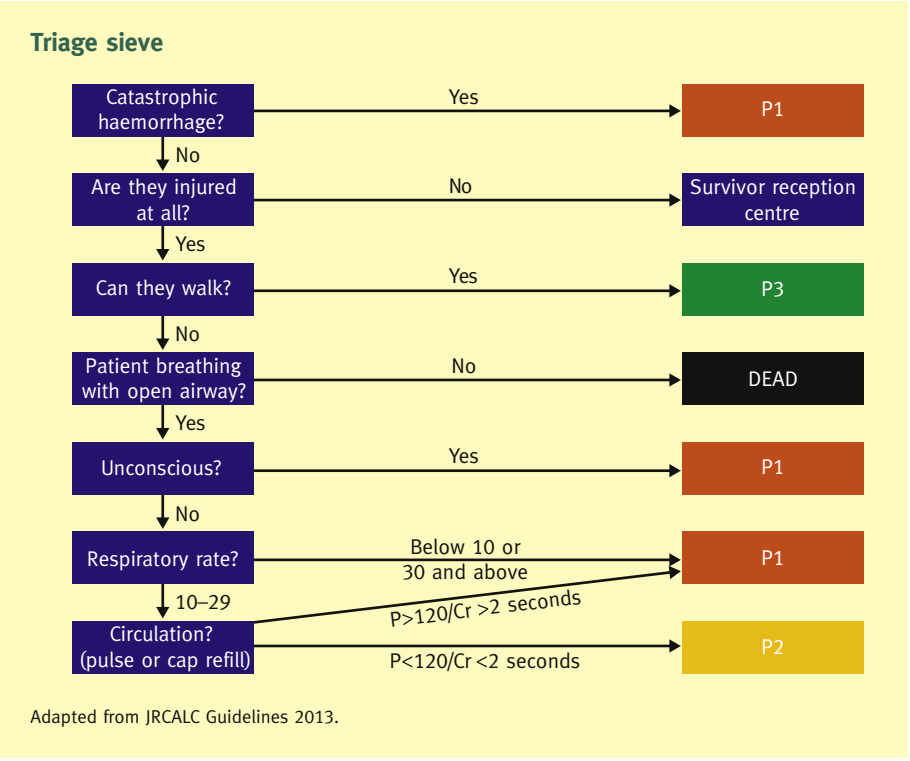


Figure 2

comprehensive history taking, thorough examination or detailed investigations in every patient.

Paediatric triage is beyond the scope of this article (see *Paediatric trauma* on pages 437–441 of this issue), other than to say separate tools exist to assess children of different ages. When adult sieves are applied to the paediatric population they tend to over triage (i.e. give the impression that children are sicker than they actually are). In this sense, they are a fail safe, because normal physiological variables for a young child (e.g. heart rate >120, respiratory rate of >30) would be triaged as P1/Immediate in an adult.

As part of its pre-hospital response plan, every ambulance organization will have the ability to set up a casualty clearing station (CCS) at the incident scene. This may be in tents or, preferably, a suitable undamaged building with a good supply of energy, water, heat and light. Triage sort takes place at the CCS, and depending on the type and duration of the incident it may be possible to bring some hospital facilities and capabilities forward to the incident. The CCS is the interface between the scene itself and the outside world; there should be a co-located ambulance loading point to allow for the quick extrication of patients to appropriate hospitals, as well as a nearby command post where fire, ambulance and police commanders should be located. A survivor reception centre should be set up for uninjured or medically cleared people involved in the incident to pass details to the police, and for relatives to use as a single point of contact at scene to avoid overrunning the incident itself.

Command and control in a major incident

Communication and teamwork are essential in a major incident, not only due to the clinical needs of multiple patients, but also because a major incident is usually a major crime scene for the police. If not a terrorist event or a man-made incident, there will at least be an inquiry into what happened, possibly many depending on the type of incident and if there were multiple deaths.

Declaring a major incident is a key step in mobilizing several resources to the scene and allowing the activation of the major incident plan. Activation can be done by any member of the emergency services but ambulance control will need certain information to start preparing a response. This is best remembered by the mnemonic '**METHANE**' **M**ajor incident declared, **E**xact location, **T**ype of incident (motorway collision, explosive, fire etc), **H**azards present (gas leaks, downed electricity pylons etc), **A**ccess to and egress from scene (i.e. which roads are open), **N**umber and type of casualties (a rough estimate is acceptable to start, e.g. 30 children on a school bus), and **E**mergency service resources already present and those required. This format of message is succinct, gives all necessary information and can also be used to update control periodically as the incident evolves.

There are three levels of control in a major incident which are mirrored across all the emergency services: Bronze (operational), Silver (tactical) and Gold (strategic). Bronze commanders are the front-line commanders who will have control over a small section of the incident, whereas Silver commanders have responsibility for multiple sectors and Gold has overall incident command.

For example, during the London bombings there were multiple explosions — the Gold commander had overall control of all four explosion sites and was responsible for coordinating the national emergency response. There were four distinct scenes (one bus and three train explosions), each with a Silver

Triage sort tool

1. Determine Glasgow Coma Scale score

A: Eyes	B: Verbal	C: Motor
4 – Open spontaneously	5 – Orientated	6 – Obeys commands
3 – Open to voice	4 – Talking, but confused	5 – Localizes to pain
2 – Open to pain	3 – Inappropriate words	4 – Withdraws from pain
1 – Do not open	2 – Incomprehensible/moans	3 – Decorticate posturing
	1 – No verbal response	2 – Decerebrate posturing
		1 – No motor response

GCS = A + B + C

2. Determine Triage Sort Score

X: GCS		Y: Respiratory rate		Z: Systolic BP	
13 – 15	4	10 – 29	4	≥ 90	4
9 – 12	3	≥ 30	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

3. Assign a triage priority

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

4. Upgrade priority at discretion of senior clinician, dependent on the anatomical injury/working diagnosis

Adapted from Major Incident Medical Management and Support Course.

Figure 3

Commander. Each individual carriage in the three trains could have a Bronze commander supervising several pre-hospital teams. Each level of command must ensure adequate communication both across services and up and down the chains of command to ensure that resources are diverted to where they are most needed and all patients are not sent to one hospital. Another factor for the Gold commander to consider is how to facilitate the smooth running of normal services whilst the incident is taking place — people still suffer heart attacks, strokes and other conditions requiring medical intervention and transport to hospital during major incidents. The Gold commander also has to consider post-incident recovery; this includes planning how to return the service to pre-incident levels weeks or months later.

Poor or difficult communication on scene is consistently highlighted as a significant issue in major incident reports; in both the 7/7 bombings and the 1987 King's Cross fire inquests, the fact that communication from below ground to above ground was difficult or impossible contributed to poor situational awareness and impaired decision-making at senior levels. In a major incident the pre-hospital communications network is largely run on wireless radio systems. It is possible (with high-level authorization) to shut down an entire mobile phone network in an area except for a few pre-authorized phones on a major incident preparedness list. However, the expectation should be that communications technology failure is likely in a major incident, whatever mitigation is in place. Written messages and runners are often used as a backup in major incidents, because this provides a documentable account of decision-making and communication without reliance upon the interpretation or memory of the runner.

Pre-hospital treatment in a major incident

Whilst current pre-hospital treatments can range from advice and reassurance with discharge at scene through to major pre-hospital surgery such as thoracotomy or amputation, the emphasis in a major incident is to 'do the most for the most'. If the number of patients outstrip the pre-hospital resources available, highly invasive interventions become impracticable as investing in one patient to that degree is at the expense of treating ten others. Although advanced interventions such as pre-hospital anaesthesia and surgery are possible in normal circumstances, they are rarely appropriate in multiple casualty situations. Quick, high-impact interventions and accurate triage and patient disposition are the hallmarks of good major incident PHEM. This includes the use of tourniquets for massive external haemorrhage, insertion of oral airways and decompression of overt

Figure 4 Cruciform triage cards. (Reproduced by kind permission of TSG Associates Ltd).

tension pneumothoraces. Thus, patients arriving in hospital during major incidents may appear to have had little in the way of interventions, but the rapid transport of the sickest casualties to hospital is to be encouraged rather than bemoaned. The rule is usually "massive haemorrhage, airway and breathing interventions on scene, everything else *en route* or in hospital". As incidents evolve and more resources are available on scene, more advanced interventions, such as intubation, are possible and favour treatment on scene before transport. Also, patients will enter the casualty system via both official emergency service routes and improvized transport. An example of this is the London bombings, where a resourceful driver loaded many patients onto his bus and then drove directly to an emergency department with over 60 undifferentiated casualties arriving at the same time! This overwhelmed the department and made it extremely difficult to coordinate a response. Evacuation of untriaged multiple casualties from the Ramstein airshow crash simply transferred the uncontrolled major incident from the airfield to the hospital. Patients will also make their own way to hospitals (e.g. most patients in the Bradford fire and Tokyo sarin attack self-presented), so it is easy to understand how even an efficient department could be overrun with patients in relatively short order.

During the early phases of such incidents and before a CCS can be set up, there exists the temptation to send all the major patients to specialist centres which can provide definitive care for all injuries. There are several competing factors which must be taken into account at this stage, as follows.

- Number and type of casualties and ambulances: a patient transport services (PTS) vehicle is essentially a minibus which cannot fit a stretcher, so although there may be several P1 patients that require transport, it may be that some P2 patients are moved first if this vehicle is all that is available and the patients can sit upright.
- Distance to the MTC: if a standard ambulance is available and the MTC is 40 miles away, but a TU is 3 miles away, it may be more prudent in the early stages to send some patients to the TU and have the ambulance return in a matter of minutes rather than 2 hours. As more resources arrive, further hospitals become more appropriate to use as there is less of a bottleneck that is dependent on number of ambulances that can return to the scene to collect more patients.
- Need for onward transfer: if there are several patients who require transport to specialized centres for neurosurgery or cardiothoracic surgery, taking them to the tertiary centre first will eliminate the need for a secondary transfer from a closer hospital. This is compatible with the ethos of delivering definitive care in the shortest time possible and would be standard procedure in a normal working environment, but in a prolonged major incident it may not be the appropriate course of action.

Reception in hospital

See also *Preparation for and organization during a major incident* on pages 413–418.

The hospital management of a major incident follows roughly a similar approach to the pre-hospital management. When a major incident is declared, the hospital's major incident plan is activated and several actions take place simultaneously. Switchboard will notify as many relevant senior clinicians as possible, a briefing will take place of the current plan and additional beds will be sourced as soon as possible. Practically this means the discharge of any patients that are well enough, emptying the emergency department (ED) of all minor ailments, cancellation of elective surgical lists and allocation of theatre teams for damage control procedures. Once this surge capacity has been generated, the hospital can feed back to ambulance control how many patients they can accept and of what type. Patients usually arrive before this has been achieved, so it is a dynamic process. All patients will be triaged again on arrival and allocated to resuscitation teams depending on type and severity of injuries. In the early stages, hospitals may receive patients who have had minimal resuscitation (e.g. tourniquet only), but as the incident evolves and the pre-hospital teams have the time and ability to provide more care for fewer patients, potentially ICU level patients who are intubated and have had many interventions may arrive. Some may even bypass the ED altogether and go straight to theatre or ICU if clinical need dictates.

Summary

Major incidents can stretch pre-hospital and emergency services to the limits of capability and a compromise must be reached between offering 'gold standard' clinical care for a select few patients or an acceptable, but under normal circumstances sub-optimal, service for many patients. There are several courses that will either exclusively (MIMMS, JESIP – Joint Emergency Services Incident Planning) or partly (ATACC – Anaesthesia, Trauma and Critical Care, PHECC – Pre-Hospital Emergency Care Course) cover major incident training and management for interested parties, however training as a team and having an awareness of local policies and capabilities is invaluable and should be encouraged.

A final, key question for readers: Do you know what you are meant to do in your hospitals major incident plan? If you do not know now, find out soon! ◆