



PRACTICE

ESSENTIALS

The trauma call

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What you need to know

- A trauma team assembles rapidly in response to a major trauma alert and has a dedicated leader, usually an emergency medicine consultant, supported by a multidisciplinary team.
- Initial rapid assessment follows the mnemonic <C>ABCD with control of catastrophic bleeding, assessment of airway, breathing, circulation, and disability.
- Initial investigations to guide early management include portable radiography for chest and pelvis, point of care testing for venous blood gas analysis, and assessment of coagulation status.
- The team leader co-ordinates care, following the principles of damage control resuscitation to control bleeding and restore tissue perfusion.

Trauma is the leading cause of death for people under 40 in the UK, and a major cause of debilitating long-term injuries.¹ Major trauma usually refers to a seriously injured patient or a patient with multiple injuries requiring a coordinated multidisciplinary approach to their care. Twenty percent of patients in the UK survive severe trauma.² An audit of the major trauma services in England identified deficiencies in care contributing to high in-hospital mortality in trauma patients.² Typically, such patients are managed in the emergency department after a trauma call is put out to assemble a trauma team. The trauma team must rapidly assess seriously injured patients and start treatment in a timely manner.

Here we aim to help clinicians familiarise themselves with the essentials of managing patients with major trauma as part of a team in an emergency department, drawing from our experience, and from 2017 guidelines from the UK's National Institute for Health and Care Excellence (NICE) for head injury and major trauma. The practice and team constitution may differ based on resources and organisation of health services in different countries, however we expect the basic principles of organising and responding as a trauma team will be relevant.

Who is involved in a trauma team?

Trauma teams are assembled rapidly by people who might work together infrequently in a time-critical situation. A dedicated leader maintains a close awareness of the situation and plans

the next steps, supported by a multidisciplinary team. [Table 1](#) outlines the members and responsibilities of a typical trauma team.

If there is more than one patient, the team leader will initially split the team. There will usually be a provision to call for additional help from multiple trauma teams from within the hospital.

When is a trauma call activated?

The hospital sets specific criteria for activation of the trauma team following an alert from the pre-hospital team or ambulance service. [Box 1](#) lists some situations when a trauma call is activated.

Box 1: Typical situations when the trauma team is activated in a major trauma centre

A set of standards for trauma team activation in adult patients (taken from Kings College Hospital, Major Trauma Service: Information for Members of the Trauma Team)

Traumatic event and any of the following:

- Oxygen saturation <90%
- Systolic arterial pressure <90 mm Hg
- Respiratory rate <9 or >29 breaths/min
- Glasgow coma scale <14

Traumatic events include:

Penetrating injury to

- head
- neck
- chest
- abdomen
- pelvis

All gunshot wounds

Fractures

- Open or depressed skull fractures
- Pelvic fracture
- Two or more proximal long bone fractures
- Flail chest

Traumatic amputation

Blast or crush injury

Major burns

- >15% total body surface area in adults but lower threshold in children (>10%) or older people
- airway burns
- combination of burns and trauma

Road traffic incident:

- high speed collision (>30 mph) or pedestrian hit by vehicle at 20 mph
- separation of rider and bike
- intrusion into passenger compartment
- ejection from vehicle
- death in the same passenger compartment
- bull's eyed windscreen
- >20 min extrication time

Falls:

- height of >3 m
- paediatrics—consider the age and height of the child in relation to the height fallen

Helicopter emergency medical service (HEMS) transfer

Drowning/submersion

written, alongside periodic training of the trauma team. Leadership, teamwork, followership, communication, decision making, and situational awareness are important.⁷ Table 2 lists communication elements in a trauma call that facilitate teamwork. Situational awareness—*the perception of the elements in the environment, their comprehension, and the projection of their status in the near future*—is important for the team leader.⁹

How does the pre-hospital team hand over the patient?

The pre-hospital team are those who respond to the patient at the site of trauma, provide initial treatment, and transfer to a major trauma centre. The team might include two paramedics or a consultant trained in pre-hospital emergency medicine. They initiate the pre-hospital alert call, which is routed through the ambulance service headquarters to the trauma centre in the vicinity.

On arrival at the hospital, if the patient has a patent airway, a central pulse, and there is no visible active bleeding, the pre-hospital team delivers a “sterile (silent) handover.” The trauma team remains silent during this handover, and a member of the pre-hospital team communicates information about the patient, usually using the AT-MIST acronym (see table 2).⁴ All members should then commence care with a common understanding of the patient's initial condition.

If the patient has an airway issue, has ongoing visible haemorrhage, or is in cardiac arrest, the trauma team leader will ask the pre-hospital member to wait while these issues are addressed by the trauma team. Information from the handover will then be delivered subsequently.

If a “code red” is called¹⁰ by the pre-hospital team then blood and blood products are ordered and made available in the emergency department even before the patient's arrival. This would occur if the patient suffered a traumatic cardiac arrest, had suspected active haemorrhage and a systolic blood pressure <90 mm Hg, visible active haemorrhage, or poor response to initial fluid resuscitation. In many trauma centres, this will be in the form of a “shock pack,” which is typically a box with packed red blood cells and fresh frozen plasma, usually Group O Rhesus Negative for universal donation. At our centre, the first shock pack is four units of universal donor packed red blood cells and four units of fresh frozen plasma. Once the patient's blood group has been determined, the transfusion laboratory will switch to “type specific blood.”

How is the patient assessed?

The primary survey is the first clinical examination of the patient and follows the mnemonic <C>ABCD,¹¹ where <C> stands for control of catastrophic haemorrhage, and ABCD assessment of airway, breathing, circulation and disability. This examination is conducted in a “horizontal fashion,”¹² where components of the <C>ABCD paradigm and initial investigations (eg, radiography of chest and pelvis plus point of care blood tests) are carried out by several people at the same time. This process is coordinated by the trauma team leader, and quickly provides the team with required clinical information⁹ (fig 1).

Further, certain checklists for trauma care, such as the WHO checklist, can be adapted locally and used to ensure complete assessment of the patient and delivery of life saving interventions.⁸

How does the trauma team organise before the patient arrives?

The trauma team assembles in the emergency department or trauma bay once they receive a message by pager. The trauma team leader briefs the team on the information they have received from the pre-hospital team, outlines what they expect to happen, and allocates roles to the team. The team then stay in the resuscitation bay until the trauma call has finished.

The trauma team must work in an unfamiliar environment under pressure, and this can lead to mistakes and near misses.³ Good technical expertise and understanding of human factors are important.^{4,5} Human factors “enhance clinical performance through an understanding of the effects of teamwork, tasks, equipment, workspace, culture, and organisation on human behaviour and abilities and application of that knowledge in clinical settings.”⁶ In major trauma, human factors are considered in the way the trauma bay is organised, the equipment designed, and the standard operating procedures are

What investigations are required?

Chest and pelvic radiography can be performed at the time of the primary survey using portable devices. Point of care blood tests for haemoglobin, venous blood gas analysis, and coagulation can further assist in decision making. Many major trauma centres now use rotational thromboelastometry (RoTEM Pentapharm, Munich, Germany), a viscoelastic assessment of coagulation, to guide resuscitation with blood product clotting factors such as fresh frozen plasma, platelets and cryoprecipitate. Once these results are available, resuscitation is no longer blinded and becomes tailored to correct deficient components.¹³ When bleeding is ongoing and massive, frequent RoTEMs plus arterial blood gases are performed to guide resuscitation.

Additional investigations, such as a computed tomography scan, might be requested based on the mechanism and severity of injury. A whole body computed tomography scan, sometimes referred to as a “pan scan,” will usually be required in complex trauma,¹⁴ for example in a patient who is extricated from a vehicle in a road traffic incident, to determine the sites of injury. NICE guidelines recommend a computed tomography scan within one hour for all suspected traumatic brain injuries.¹⁵

How is the patient managed?

Management begins with damage control resuscitation to minimise blood loss and maximise tissue perfusion and oxygenation to optimise outcome.^{16,17} The three pillars of management are permissive hypotension, haemostatic resuscitation, and damage control surgery (the latter includes interventional radiology as an alternative). The team leader decides the management and communicates this to the team. This might include time critical interventions to stabilise the patient or even save their life. [Table 3](#) indicates a typical timeline of critical decision points during a trauma call.

Care is taken to avoid the triad of acidosis, coagulopathy, and hypothermia.^{17,20,21} Evidence from a retrospective study in 1088 trauma patients showed that nearly a quarter of patients had a coagulopathy and this was associated with higher mortality.²² Resuscitation with packed red blood cells, fresh frozen plasma, and platelets is preferred as this provides clotting factors.²³ NICE guidelines recommend against use of crystalloids as resuscitation fluid in hospital¹⁹ as this would dilute clotting factors present in the patient's circulation.

The risk of re-bleeding associated with normotensive resuscitation needs to be balanced with the metabolic derangement associated with hypotensive resuscitation.²⁴ Until major bleeding has been stopped, resuscitation is aimed at maintaining a radial pulse, ie, a systolic blood pressure of 80–90 mm Hg, if no head injury is suspected. In patients with suspected traumatic brain injury, less restrictive volume resuscitation is advised to maintain cerebral perfusion.¹⁹

Trials have shown reduced mortality in trauma patients who were given tranexamic acid to control bleeding.^{25,26} An intravenous dose of tranexamic acid is recommended within three hours of trauma in patients with active bleeding or suspected internal bleeding.^{19,20}

Hypothermia is associated with worse outcomes. Monitor the patient's temperature and institute measures to minimise heat loss.¹⁹ Active warming using a device such as the BairHugger might also be considered.

What are the next steps?

Ensure that the patient's family are kept informed of what is happening. Once the assessment and initial management are completed, the trauma team leader and a senior nurse (usually the scribe) will talk with the patient's family to explain the situation. This also provides an opportunity to obtain additional information about the patient, such as their medical history.

We have focused on initial management of the trauma patient. Further handover to relevant specialties may be required for definitive treatment. Priority transfer to the operating theatre, interventional radiology, critical care, or the trauma ward may be considered, if a computed tomography scan has been performed elsewhere.

Education into practice

- If you have participated in a trauma call before, what was your experience? How does this article offer you ideas on improving your participation next time?
- Find the survival rate of patients with major trauma in your institution, and the average time for a trauma patient with a suspected head injury to receive a computed tomography scan (this data is also collected by the Trauma Audit and Research Network). What measures do you think could improve these?

Additional educational resources

For healthcare professionals

- National Institute for Health and Care Excellence. Major trauma: assessment and initial management (2016) <https://www.nice.org.uk/guidance/ng39>
This guideline covers the rapid identification and early management of major trauma in pre-hospital and hospital settings, including ambulance services, emergency departments, major trauma centres, and trauma units. It aims to reduce deaths and disabilities in people with serious injuries by improving the quality of their immediate care.
- Head injury: assessment and early management Clinical guideline (2014). Updated June 2017 <https://www.nice.org.uk/guidance/cg176>
Priorities for implementation include
 - transport to hospital
 - assessment in the emergency department
 - criteria for performing a computed tomography head scan
 - investigating injuries to the cervical spine
 - discharge and follow-up
- London Major Trauma Systems. Management of elderly major trauma patients. <http://www.c4ts.qmul.ac.uk/odn-mt-v6-print.pdf>
Clinical guidance for care of elderly trauma patients.
- Eastern Association for the Surgery of Trauma. Practice guidelines and educational resources (Free) <https://www.east.org>
- Centre for Trauma Sciences. Barts and The London School of Medicine and Dentistry. clinical policies and documents. (Free) <http://www.c4ts.qmul.ac.uk/london-trauma-system/trauma-care>
- Several high quality trauma training courses have been developed, for example the European Trauma Course²⁷ and the Anaesthesia, Trauma, and Critical Care Course (ATACC).²⁸ Such courses are leading to a wider practice of Damage Control Resuscitation.¹⁶

Information resources for patients

After trauma (<http://www.aftertrauma.org>). This website connects and supports survivors of traumatic injury and their families.

British Orthopaedic Association. Major Trauma Centres: what they mean for patients and next of kin (http://www.ukemtrauma.com/uploads/3/0/6/6/30664511/mtc-paper_26-06-14.pdf)

How patients were involved in the creation of this article

A patient representative reviewed an earlier version of this paper. He highlighted the need to keep the patient and family members informed of what happens in the trauma centre and of treatment decisions being taken. We agree this is an important responsibility of the trauma team leader, and have added it to the text.

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Tables

Table 1 | Minimum standards for a typical NHS trauma team in a major trauma centre in England (multidisciplinary consultant led care is the gold standard).

Team member	Typical UK grade	Role in the trauma team
Trauma team leader (TTL)	Consultant, usually from Emergency Medicine	Brief the team on the emergency and ensure each team member is aware of their role as listed below. Coordinate the primary survey and maintain situational awareness
Primary survey doctor	Emergency Medicine specialty trainee	Perform the primary survey
Anaesthetist	Specialty trainee 5–7, Post final FRCA	Responsible for airway management and advanced vascular access
Operator department practitioner	NHS Agenda for Change Band 5-6	Assist the anaesthetist
Scribe (Trauma Nurse Coordinator)	NHS Agenda for Change Band 7	Maintain a record of the events in the trauma bay
Emergency Medicine Nurse 1	NHS Agenda for Change Band 5	Support the trauma team with tasks such as positioning the patient, preparing an IV drip, administering medication, etc.
Emergency Medicine Nurse 2 and 3	NHS Agenda for Change Band 5	Check blood and blood products and deliver via the rapid infuser following the instructions of the trauma team leader.
Runner (health care assistant)	NHS Agenda for Change Band 2	Collect blood and blood products from the transfusion laboratory and other equipment as necessary.
Orthopaedic surgeon	Specialty trainee 4–7	Provide orthopaedic advice to the trauma team leader
General surgeon	Specialty Trainee 4–7	Provide general surgical advice to the trauma team leader
Radiographer		Undertake chest and pelvic radiographs as required

Table 2| Specific communication aspects of the trauma call (Certain aspects of this have been adapted from the Trauma WHO Check List⁸)

Communication element	Description
Team brief	Once the trauma team has assembled, the trauma team leader briefs the team with information from the pre-hospital alert and explains what they expect to happen. At this point, roles and responsibilities are determined
Handover from pre-hospital team	This is undertaken using the acronym AT-MIST ⁴ : Age Time of injury Mechanism of injury Injuries sustained Signs and symptoms Treatment given so far
Situational updates	The trauma team leader will pause activity at regular intervals (maybe every 10 minutes or so) to update the team. This ensures good situational awareness and followership among team members
Command huddle	Once the initial examination of the patient is complete, a decision on the next steps of treatment is made by senior members of the team. This is then communicated to the whole trauma team

Table 3| Trauma team timelines (adapted from reference¹⁸). This is based on a combination of guidance^{15 19} and expert opinion and experience^{8 12 18 20 21}

Time	Objectives	Intervention priorities
Pre-arrival of patient (15 minutes before arrival of patient)	<p>Introductions</p> <p>Ensure all team members assembled</p> <p>Allocation of roles</p> <p>Declare Code Red?</p> <p>Team brief discussing likely course of action</p> <p>Check equipment and drugs</p>	<p>Inform transfusion laboratory if a "shock pack" is required.</p> <p>If required, call additional consultants to trauma bay.</p> <p>Inform operating theatre that patient with major trauma to arrive soon in the emergency department</p>
Arrival of patient (Time T)	<p>Assess for immediate concerns:</p> <p>Patent airway?</p> <p>Central pulse?</p> <p>Visible catastrophic haemorrhage?</p> <p>Is it safe for a sterile handover?</p>	<p>AT-MIST handover in silence</p>
Immediate (T+0 minutes)	<p>Primary survey <C> >ABCD</p> <p>Horizontal assessment (see text for details)</p> <p>Perform an early log roll if dealing with penetrating trauma.</p>	<p>Oxygen (15 L via non re-breather mask)</p> <p>Cervical spine immobilisation if neck injury is suspected.</p> <p>Apply tourniquet to a traumatically amputated limb and pelvic binder if fracture of the pelvis is suspected, to stop ongoing bleeding.</p> <p>Securing a large bore venous access to allow rapid administration of blood and blood products, or intraosseous access. Begin transfusion via rapid infuser.</p> <p>Blood taken for</p> <ul style="list-style-type: none"> - full blood count - thromboelastometry (eg, RoTEM), - venous blood gas - blood group and save <p>- point of care international normalised ratio testing if the patient is on warfarin</p> <p>Rapid sequence induction of anaesthesia in patients with</p> <ul style="list-style-type: none"> - actual or impending airway compromise - ventilatory failure <p>- unconsciousness with an unprotected airway (Glasgow Coma Scale 8 or less)</p> <p>- patients who are unmanageable, combative, or severely agitated with a head injury</p>
T+5 minutes	<p>Review <C> - massive haemorrhage controlled?</p> <p>Review A - rapid sequence induction needed?</p> <p>Review B - chest decompression (thoracostomy or chest drain)?</p> <p>Review C - massive transfusion?</p> <p>Immediate transfer to operating theatre?</p> <p>Review D – reassess Glasgow Coma Scale</p>	<p>Consider chest and pelvic radiographs.</p> <p>Consider focused assessment with sonography for trauma (FAST scan).</p> <p>Further intravenous access.</p> <p>Analgesia (rapid sequence induction for humanitarian needs, ie, if the patient is in such severe pain and an operation is planned very soon).</p> <p>If rapid sequence induction is performed, start intravenous infusion of sedation drugs.</p> <p>Active warming measures.</p> <p>Reversal of warfarin if actively bleeding (prothrombin complex concentrate)</p> <p>Tranexamic acid (ideally initial loading dose given as early as possible, followed by an infusion)</p>
T+15 minutes	<p>Situational update by trauma team leader.</p> <p>Immediate computed tomography scan or transfer to operating theatre?</p> <p>Set goals on physiology and blood products</p> <p>Ongoing transfusion requirements?</p>	<p>Secondary survey performed if patient not requiring time-critical interventions.</p> <p>Consider splinting and apply dressings pre-transfer.</p> <p>Secure for transfer (use a vacuum mattress).</p> <p>Consider use of a pre-departure checklist:</p> <ul style="list-style-type: none"> - Computed tomography scan - Operating theatre – for surgery - Critical care – for monitoring
T+20-30 minutes	<p>Definitive plan is decided during the command huddle</p>	<p>Consider drugs: analgesia, antibiotics</p> <ul style="list-style-type: none"> - tetanus prophylaxis - calcium chloride

* Pack red blood cells contain citrate that chelates the ionised calcium and depletes it from the body; thus calcium needs replacing

Figure

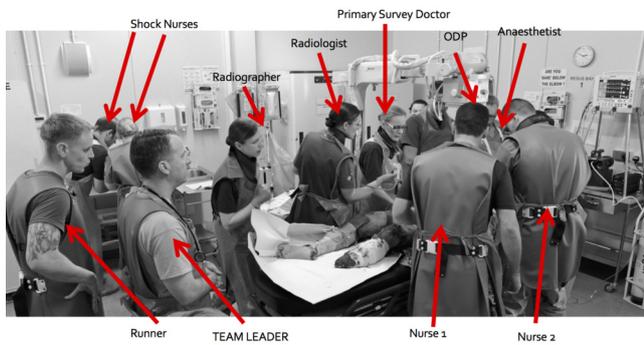


Fig 1 The complex trauma team undertaking the primary survey in a horizontal manner (Picture courtesy of Mark de Rond)