

# Major trauma: assessment and initial management

NICE guideline

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## Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

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This guideline is the basis of QS166.

## Overview

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. It does not cover care for people with burns.

The guideline should be read alongside the NICE guidelines on [major trauma: service delivery](#), [spinal injury](#), [complex fractures](#) and [fractures](#).

NHS England's clinical reference group (CRG) produce the service specification for major trauma. The CRG intends to consider the NICE guidelines on major trauma, major trauma: service delivery, spinal injury and complex fractures in future updates to the service specification which are planned for 2017.

## Who is it for?

- Healthcare professionals and practitioners who provide care for people with major trauma in pre-hospital and hospital settings
- People with major trauma, their families and carers

## Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in [your care](#).

[Making decisions using NICE guidelines](#) explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

Recommendations apply to both children (under 16s) and adults (16 or over) unless otherwise specified.

### 1.1 *Immediate destination after injury*

- 1.1.1 Be aware that the optimal destination for patients with major trauma is usually a major trauma centre. In some locations or circumstances intermediate care in a trauma unit might be needed for urgent treatment, in line with agreed practice within the regional trauma network.

### 1.2 *Airway management in pre-hospital and hospital settings*

The NICE guideline on [major trauma: service delivery](#) contains a recommendation for ambulance and hospital trust boards, medical directors and senior managers on drug-assisted rapid sequence induction of anaesthesia and intubation.

- 1.2.1 Use drug-assisted rapid sequence induction (RSI) of anaesthesia and intubation as the definitive method of securing the airway in patients with major trauma who cannot maintain their airway and/or ventilation.
- 1.2.2 If RSI fails, use basic airway manoeuvres and adjuncts and/or a supraglottic device until a surgical airway or assisted tracheal placement is performed.

#### **Airway management in pre-hospital settings**

- 1.2.3 Aim to perform RSI as soon as possible and within 45 minutes of the initial call to the emergency services, preferably at the scene of the incident.

If RSI cannot be performed at the scene:

- consider using a supraglottic device if the patient's airway reflexes are absent
- use basic airway manoeuvres and adjuncts if the patient's airway reflexes are present or supraglottic device placement is not possible
- transport the patient to a major trauma centre for RSI provided the journey time is 60 minutes or less
- only divert to a trauma unit for RSI before onward transfer if a patent airway cannot be maintained or the journey time to a major trauma centre is more than 60 minutes.

### 1.3 *Management of chest trauma in pre-hospital settings*

- 1.3.1 Use clinical assessment to diagnose pneumothorax for the purpose of triage or intervention.
- 1.3.2 Consider using eFAST (extended focused assessment with sonography for trauma) to augment clinical assessment only if a specialist team equipped with ultrasound is immediately available and onward transfer will not be delayed.
- 1.3.3 Be aware that a negative eFAST of the chest does not exclude a pneumothorax.
- 1.3.4 Only perform chest decompression in a patient with suspected tension pneumothorax if there is haemodynamic instability or severe respiratory compromise.
- 1.3.5 Use open thoracostomy instead of needle decompression if the expertise is available, followed by a chest drain via the thoracostomy in patients who are breathing spontaneously.
- 1.3.6 Observe patients after chest decompression for signs of recurrence of the tension pneumothorax.
- 1.3.7 In patients with an open pneumothorax:
- cover the open pneumothorax with a simple occlusive dressing **and**
  - observe for the development of a tension pneumothorax.

## 1.4 *Management of chest trauma in hospital settings*

### Chest decompression of tension pneumothorax

- 1.4.1 In patients with tension pneumothorax, perform chest decompression before imaging only if they have either haemodynamic instability or severe respiratory compromise.
- 1.4.2 Perform chest decompression using open thoracostomy followed by a chest drain in patients with tension pneumothorax.

### Imaging to assess chest trauma

- 1.4.3 Imaging for chest trauma in patients with suspected chest trauma should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area.
- 1.4.4 Consider immediate chest X-ray and/or eFAST (extended focused assessment with sonography for trauma) as part of the primary survey to assess chest trauma in adults (16 or over) with severe respiratory compromise.
- 1.4.5 Consider immediate CT for adults (16 or over) with suspected chest trauma without severe respiratory compromise who are responding to resuscitation or whose haemodynamic status is normal (see also [recommendation 1.5.34](#) on whole-body CT).
- 1.4.6 Consider chest X-ray and/or ultrasound for first-line imaging to assess chest trauma in children (under 16s).
- 1.4.7 Do not routinely use CT for first-line imaging to assess chest trauma in children (under 16s).

## 1.5 *Management of haemorrhage in pre-hospital and hospital settings*

### Dressings and tourniquets in pre-hospital and hospital settings

- 1.5.1 Use simple dressings with direct pressure to control external haemorrhage.

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

### **Pelvic binders in pre-hospital settings**

- 1.5.3 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.

### **Haemostatic agents in pre-hospital and hospital settings**

- 1.5.4 Use intravenous tranexamic acid<sup>[1]</sup> as soon as possible in patients with major trauma and active or suspected active bleeding.
- 1.5.5 Do not use intravenous tranexamic acid<sup>[2]</sup> more than 3 hours after injury in patients with major trauma unless there is evidence of hyperfibrinolysis.

### **Anticoagulant reversal in hospital settings**

- 1.5.6 Rapidly reverse anticoagulation in patients who have major trauma with haemorrhage.
- 1.5.7 Hospital trusts that admit patients with major trauma should have a protocol for the rapid identification of patients who are taking anticoagulants and the reversal of anticoagulation agents.
- 1.5.8 Use prothrombin complex concentrate immediately in adults (16 or over) with major trauma who have active bleeding and need emergency reversal of a vitamin K antagonist.
- 1.5.9 Do not use plasma to reverse a vitamin K antagonist in patients with major trauma.
- 1.5.10 Consult a haematologist immediately for advice on adults (16 or over) who have active bleeding and need reversal of any anticoagulant agent other than a vitamin K antagonist.



- 1.5.11 Consult a haematologist immediately for advice on children (under 16s) with major trauma who have active bleeding and may need reversal of any anticoagulant agent.
- 1.5.12 Do not reverse anticoagulation in patients who do not have active or suspected bleeding.

### Activating major haemorrhage protocols in hospital settings

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

### Circulatory access in pre-hospital settings

- 1.5.15 For circulatory access in patients with major trauma in pre-hospital settings:
- use peripheral intravenous access or
  - if peripheral intravenous access fails, consider intra-osseous access.
- 1.5.16 For circulatory access in children (under 16s) with major trauma, consider intra-osseous access as first-line access if peripheral access is anticipated to be difficult.

### Circulatory access in hospital settings

- 1.5.17 For circulatory access in patients with major trauma in hospital settings:
- use peripheral intravenous access or
  - if peripheral intravenous access fails, consider intra-osseous access while central access is being achieved.

## Volume resuscitation in pre-hospital and hospital settings

- 1.5.18 For patients with active bleeding use a restrictive approach to volume resuscitation until definitive early control of bleeding has been achieved.
- 1.5.19 In pre-hospital settings, titrate volume resuscitation to maintain a palpable central pulse (carotid or femoral).
- 1.5.20 In hospital settings, move rapidly to haemorrhage control, titrating volume resuscitation to maintain central circulation until control is achieved.
- 1.5.21 For patients who have haemorrhagic shock and a traumatic brain injury:
- if haemorrhagic shock is the dominant condition, continue restrictive volume resuscitation or
  - if traumatic brain injury is the dominant condition, use a less restrictive volume resuscitation approach to maintain cerebral perfusion.

## Fluid replacement in pre-hospital and hospital settings

- 1.5.22 In pre-hospital settings only use crystalloids to replace fluid volume in patients with active bleeding if blood components are not available.
- 1.5.23 In hospital settings do not use crystalloids for patients with active bleeding. See the section on [resuscitation](#) in the NICE guideline 'Intravenous fluid therapy in adults in hospital' and the section on [fluid resuscitation](#) in the NICE guideline 'Intravenous fluid therapy in children and young people in hospital' for advice on tetrastarches.
- 1.5.24 For adults (16 or over) use a ratio of 1 unit of plasma to 1 unit of red blood cells to replace fluid volume.
- 1.5.25 For children (under 16s) use a ratio of 1 part plasma to 1 part red blood cells, and base the volume on the child's weight.

## Haemorrhage protocols in hospital settings

- 1.5.26 Hospital trusts should have specific major haemorrhage protocols for adults (16 or over) and children (under 16s).

- 1.5.27 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.

### Haemorrhage imaging in hospital settings

- 1.5.28 Imaging for haemorrhage in patients with suspected haemorrhage should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area.
- 1.5.29 Limit diagnostic imaging (such as chest and pelvis X-rays or FAST [focused assessment with sonography for trauma]) to the minimum needed to direct intervention in patients with suspected haemorrhage and haemodynamic instability who are not responding to volume resuscitation.
- 1.5.30 Be aware that a negative FAST does not exclude intraperitoneal or retroperitoneal haemorrhage.
- 1.5.31 Consider immediate CT for patients with suspected haemorrhage if they are responding to resuscitation or if their haemodynamic status is normal.
- 1.5.32 Do not use FAST or other diagnostic imaging before immediate CT in patients with major trauma.
- 1.5.33 Do not use FAST as a screening modality to determine the need for CT in patients with major trauma.

### Whole-body CT of multiple injuries

- 1.5.34 Use whole-body CT (consisting of a vertex-to-toes scanogram followed by a CT from vertex to mid-thigh) in adults (16 or over) with blunt major trauma and suspected multiple injuries. Patients should not be repositioned during whole-body CT.
- 1.5.35 Use clinical findings and the scanogram to direct CT of the limbs in adults (16 or over) with limb trauma.
- 1.5.36 Do not routinely use whole-body CT to image children (under 16s). Use clinical judgement to limit CT to the body areas where assessment is needed.

## Damage control surgery

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

## Interventional radiology

The NICE guideline on [major trauma: service delivery](#) contains a recommendation for ambulance and hospital trust boards, medical directors and senior managers on interventional radiology and definitive open surgery.

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

## 1.6 *Reducing heat loss in pre-hospital and hospital settings*

- 1.6.1 Minimise ongoing heat loss in patients with major trauma.

## 1.7 *Pain management in pre-hospital and hospital settings*

### Pain assessment

- 1.7.1 See the NICE guideline on [patient experience in adult NHS services](#) for advice on assessing pain in adults.

1.7.2 Assess pain regularly in patients with major trauma using a pain assessment scale suitable for the patient's age, developmental stage and cognitive function.

1.7.3 Continue to assess pain in hospital using the same pain assessment scale that was used in the pre-hospital setting.

## Pain relief

1.7.4 For patients with major trauma, use intravenous morphine as the first-line analgesic and adjust the dose as needed to achieve adequate pain relief.

1.7.5 If intravenous access has not been established, consider the intranasal route for atomised delivery of diamorphine or ketamine<sup>[3]</sup>.

1.7.6 Consider ketamine in analgesic doses as a second-line agent.

## 1.8 *Documentation in pre-hospital and hospital settings*

The NICE guideline on [major trauma: service delivery](#) contains recommendations for ambulance and hospital trust boards, senior managers and commissioners on documentation within a trauma network.

### Recording information in pre-hospital settings

1.8.1 Record the following in patients with major trauma in pre-hospital settings:

- catastrophic haemorrhage
- airway with in line spinal immobilisation
- breathing
- circulation
- disability (neurological)
- exposure and environment

(<C>ABCDE).

- 1.8.2 If possible, record information on whether the assessments show that the patient's condition is improving or deteriorating.
- 1.8.3 Record pre-alert information using a structured system and include all of the following:
- the patient's age and sex
  - time of incident
  - mechanism of injury
  - injuries suspected
  - signs, including vital signs and Glasgow Coma Scale
  - treatment so far
  - estimated time of arrival at emergency department
  - special requirements
  - the ambulance call sign, name of the person taking the call and time of call.

### Receiving information in hospital settings

- 1.8.4 A senior nurse or trauma team leader in the emergency department should receive the pre-alert information and determine the level of trauma team response according to agreed and written local guidelines.
- 1.8.5 The trauma team leader should be easily identifiable to receive the handover and the trauma team ready to receive the information.
- 1.8.6 The pre-hospital documentation, including the recorded pre-alert information, should be quickly available to the trauma team and placed in the patient's hospital notes.

### Recording information in hospital settings

- 1.8.7 Record the items listed in recommendation 1.8.1, as a minimum, for the primary survey.

- 1.8.8 One member of the trauma team should be designated to record all trauma team findings and interventions as they occur (take 'contemporaneous notes').
- 1.8.9 The trauma team leader should be responsible for checking the information recorded to ensure that it is complete.

### Sharing information in hospital settings

- 1.8.10 Follow a structured process when handing over care within the emergency department (including shift changes) and to other departments. Ensure that the handover is documented.
- 1.8.11 Ensure that all patient documentation, including images and reports, goes with patients when they are transferred to other departments or centres.
- 1.8.12 Produce a written summary, which gives the diagnosis, management plan and expected outcome, and:
- is aimed at and sent to the patient's GP within 24 hours of admission
  - includes a summary written in plain English that is understandable by patients, family members and carers
  - is readily available in the patient's records.

## 1.9 *Information and support for patients, family members and carers*

The NICE guideline on [major trauma: service delivery](#) contains recommendations for ambulance and hospital trust boards, senior managers and commissioners on information and support for patients, family members and carers.

### Providing support

- 1.9.1 When communicating with patients, family members and carers:
- manage expectations and avoid misinformation
  - answer questions and provide information honestly, within the limits of your knowledge

- do not speculate and avoid being overly optimistic or pessimistic when discussing information on further investigations, diagnosis or prognosis
- ask if there are any other questions.

1.9.2 The trauma team structure should include a clear point of contact for providing information to patients, family members and carers.

1.9.3 If possible, ask the patient if they want someone (a family member, carer or friend) with them.

1.9.4 If the patient agrees, invite their family member, carer or friend into the resuscitation room. Ensure that they are accompanied by a member of staff and their presence does not affect assessment, diagnosis or treatment.

### Support for children and vulnerable adults

1.9.5 Allocate a dedicated member of staff to contact the next of kin and provide support for unaccompanied children and vulnerable adults.

1.9.6 Contact the mental health team as soon as possible for patients who have a pre-existing psychological or psychiatric condition that might have contributed to their injury, or a mental health problem that might affect their wellbeing or care in hospital.

1.9.7 For a child or vulnerable adult with major trauma, enable their family members or carers to remain within eyesight if appropriate.

1.9.8 Work with family members and carers of children and vulnerable adults to provide information and support. Take into account the age, developmental stage and cognitive function of the child or vulnerable adult.

1.9.9 Include siblings of an injured child when offering support to family members and carers.

### Providing information

1.9.10 Explain to patients, family members and carers what is happening and why it is happening. Provide:



- information on known injuries
- details of immediate investigations and treatment, and if possible include time schedules
- information about expected outcomes of treatment, including time to returning to usual activities and the likelihood of permanent effects on quality of life, such as pain, loss of function or psychological effects.

1.9.11 Provide information at each stage of management (including the results of imaging) in face-to-face consultations.

1.9.12 Document all key communications with patients, family members and carers about the management plan.

### Providing information about transfer from an emergency department

1.9.13 For patients who are being transferred from an emergency department to another centre, provide verbal and written information that includes:

- the reason for the transfer
- the location of the receiving centre and the patient's destination within the receiving centre
- the name and contact details of the person responsible for the patient's care at the receiving centre
- the name and contact details of the person who was responsible for the patient's care at the initial hospital.

## 1.10 *Training and skills*

### Recommendations for ambulance and hospital trust boards, medical directors and senior managers within trauma networks

1.10.1 Ensure that each healthcare professional within the trauma service has the training and skills to deliver, safely and effectively, the interventions they are required to give, in line with this guideline and the NICE guidelines on [non-complex fractures](#), [complex fractures](#) and [spinal injury](#).

1.10.2 Enable each healthcare professional who delivers care to patients with trauma to have up-to-date training in the interventions they are required to give.

1.10.3 Provide education and training courses for healthcare professionals who deliver care to children with major trauma that include the following components:

- safeguarding
- taking into account the radiation risk of CT to children when discussing imaging for them
- the importance of the major trauma team, the roles of team members and the team leader, and working effectively in a major trauma team
- managing the distress families and carers may experience and breaking bad news
- the importance of clinical audit and case review.

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<sup>[1]</sup> At the time of publication (February 2016), tranexamic acid did not have a UK marketing authorisation for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's [Prescribing guidance: prescribing unlicensed medicines](#) for further information.

<sup>[2]</sup> At the time of publication (February 2016), tranexamic acid did not have a UK marketing authorisation for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's [Prescribing guidance: prescribing unlicensed medicines](#) for further information.

<sup>[3]</sup> At the time of publication (February 2016), neither intranasal diamorphine nor intranasal ketamine had a UK marketing authorisation for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's [Prescribing guidance: prescribing unlicensed medicines](#) for further information.

## Context

In its 2010 report [Major trauma care in England](#) the National Audit Office estimated that there are 20,000 cases of major trauma per year in England. Each year 5400 people die of their injuries and many others sustain permanent disability. Every trauma death costs the nation in excess of £0.75 million and every major injury £50,000.

Regional trauma networks were developed across England from April 2012. Within these networks major trauma centres provide specialised care for patients with multiple, complex and serious major trauma injuries, working closely with local trauma units.

The initial assessment of a patient with major trauma is directed at rapid identification of life-threatening or life-changing injuries. Clinicians conduct a rapid primary survey using a prioritising sequence, such as <C>ABCDE (catastrophic haemorrhage, airway with spinal protection, breathing, circulation, disability [neurological] and exposure and environment). People with suspected major trauma are usually taken to the nearest major trauma centre for management.

This guideline covers the initial assessment and management of major trauma, including airway, breathing and ventilation, circulation, haemorrhage and temperature control. It provides recommendations on:

- airway management
- management of chest trauma
- management of haemorrhage
- imaging
- documentation
- information and support for patients with major trauma and their families and carers.

## *More information*

You can also see this guideline in the NICE pathway on [trauma](#).

To find out what NICE has said on topics related to this guideline, see our web page on [injuries, accidents and wounds](#).

See also the guideline committee's discussion and the evidence reviews (in the [full guideline](#)), and information about [how the guideline was developed](#), including details of the committee.

## Recommendations for research

The guideline committee has made the following recommendations for research.

### *1 Point-of-care coagulation testing*

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?

#### **Why this is important**

More rapid treatment of coagulopathy could reduce mortality from haemorrhage, which is the main cause of death in patients with major trauma. Point-of-care ROTEM and TEG are complex diagnostic tools used to detect coagulopathy. They are used successfully in surgery and intensive care settings. It is thought they might also be effective in targeting treatment for coagulopathy in the resuscitation room.

Point-of-care ROTEM and TEG are faster to perform than standard laboratory tests and enable an earlier transition from an initial fixed-ratio protocol to a protocol guided by laboratory coagulation results. These results can be updated as often as every 15 minutes, which could enable treatment to be adjusted rapidly and targeted effectively. This could result in reduced use of blood components and other treatments for coagulopathy.

The costs of point-of-care ROTEM and TEG could be offset by the changes in management they lead to, which could be life-saving, and by avoidance of unnecessary transfusions.

### *2 Lactate level for monitoring severity of shock*

Is lactate monitoring in patients with major trauma clinically and cost effective?

#### **Why this is important**

In current practice, treatment for hypovolaemic shock is guided by the patient's haemodynamic levels, including heart rate and blood pressure. However, haemodynamic levels such as blood pressure tend to change late and correct early, so may not accurately indicate continuing shock. Research has found a strong correlation between lactate levels and the presence of shock. Lactate level may therefore be a more responsive indicator of shock that could be used to guide treatment.

### *3 Morphine compared with ketamine for first-line management of pain*

Is morphine clinically and cost effective compared with ketamine for first-line pharmacological pain management (in both pre-hospital and hospital settings) in patients with major trauma?

#### **Why this is important**

The use of opioids as first-line analgesics after major trauma is well established but has been associated with negative side effects. Consequently, intravenous ketamine in sub-anaesthetic doses is often used for analgesia in pre-hospital and hospital settings. Some studies have suggested that intravenous morphine in combination with ketamine provides more effective analgesia than morphine alone. However, there is little evidence from well-controlled trials that directly compares the effectiveness and side effects of morphine and ketamine.

### *4 Warming 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?

#### **Why this is important**

After major trauma, patients are often exposed to adverse weather conditions and are at risk of developing hypothermia, which is associated with worse outcomes including higher mortality. However, there is uncertainty about the clinical benefit of warming patients and whether all groups of patients would benefit from warming. In addition, there is a wide range of methods used for warming and little evidence showing their comparative effectiveness, particularly in pre-hospital settings.

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## Accreditation

