EAST MIDLANDS REGIONAL TRAUMA NETWORK

ROLE OF THE EMERGENCY DEPARTMENT IN MAJOR TRAUMA
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INTRODUCTION

This document is aimed at emergency department staff to outline principles of trauma care relevant to Nottingham University Hospitals NHS Trust; this guidance will usually be relevant to regional emergency departments and trauma units.

This document is to be used in conjunction with the Major Trauma Clinical Guidelines, 2011 and the Roles and Responsibilities of the trauma team, 2011, both available through the NUH Queens Medical Centre emergency department website: http://www.nuh.nhs.uk/ed/majortrauma.aspx.

The content reflects anaesthetic, orthopaedic and surgical speciality major trauma guidelines which have been disseminated to speciality trainees regionally and are available on the NUH Trauma website at http://nuhnet/majortrauma/Pages/default.aspx.

Where drug or fluid doses are quoted they are for adults unless specified for paediatric patients.

Major Trauma within the UK trauma network is defined as a patient with an injury severity score (ISS) of 12 or greater (Appendix A). This is impossible to ascertain at point of injury and only becomes apparent after full assessment and investigation over hours if not days post injury.

For that reason we will often over-estimate patients needing to transfer to the Major Trauma Centre and will activate the trauma team more often than, in retrospect, necessary. This will be audited but will be inevitable in order to give the best care to all injured patients in the East Midlands region.

Follow the guidelines for activation of trauma calls which are evidence-based and internationally accepted (Appendix B). Do not worry about calling a trauma call wrongly – the team can be stood down quickly once the patient is assessed in ED. Be especially cautious in the elderly and those with multiple co-morbidities.

Pre-hospital guidelines for transfer from point of wounding to either the Trauma Units around the region or direct to the Trauma Centre at QMC are attached at Appendix C for information. Local trauma unit guidelines should be consulted with regards to turn-around at Trauma Units and ongoing referral and transfer to QMC.
Trauma patients are complex and by definition will involve multidisciplinary teams. The care of the patient will not be defined by location but by the treatment needed at that time so surgery may be a part of resuscitation and the team should move with the patient as required.

The factors most commonly causing clinical problems are poor decision-making and lack of effective communication within and between teams. *Particular attention needs to be paid to full documentation of decisions, interventions and times.* The role of the scribe is pivotal to good documentation.

Involve consultants early. Do not be afraid to suggest that trainees from other specialties call their consultant.

Ensure you feedback any significant issues to the Major Trauma Consultant or ED Consultant to enable assessments and changes to practice to be made.

**TRAUMA TEAM**

A Trauma call will be led by an ED consultant or registrar and occasionally by other speciality leads especially in the case of multiple casualties.

The call will aim to go out 10 minutes before the expected time of arrival of the patient.

All information passed to ED on the ‘red phone’ will be transcribed onto the whiteboard by the person taking the call. As team members arrive they should
book in with the scribe to document their name and speciality / grade then consult the white board for background on the expected casualty.

Roles should be allocated before the patient arrives and it is the team leader’s job to ensure all wear personal protective equipment including lead and aprons.

<table>
<thead>
<tr>
<th>Trauma bleeps are held by:</th>
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<tbody>
<tr>
<td>• Emergency Department Registrar</td>
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<tr>
<td>• Emergency Department Assistant</td>
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<tr>
<td>• ED Nurse in charge</td>
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<tr>
<td>• Surgical Registrar</td>
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<tr>
<td>• Surgical SHO</td>
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<tr>
<td>• Orthopaedic Registrar (until midnight)</td>
</tr>
<tr>
<td>• Orthopaedic SHO</td>
</tr>
<tr>
<td>• 3rd on call Anaesthetist</td>
</tr>
<tr>
<td>• ODP</td>
</tr>
<tr>
<td>• Radiology Registrar for MSK</td>
</tr>
<tr>
<td>• Theatre Coordinator</td>
</tr>
</tbody>
</table>

The Nurse in Charge of Area 1 notifies ED consultant on call.

Nurse ordering of blood tests, x-rays and trauma CT scans can be done under the MAJOR TRAUMA NURSE ORDER Set on Notis to facilitate administrative tasks. Doctor’s Notis order sets are available to cover primary survey x-rays and blood tests and a separate set for major Trauma CT scans.

**If neither surgical registrar can attend because of ongoing theatre work or critically ill patients, the on call surgical consultant must be called for major trauma**.

After midnight the ortho SHO holds the trauma bleep on the current rota. The registrar or consultant should be called for all unstable patients with likely pelvic injuries as a cause of unstable clinical condition.

Currently the following personnel are on individual bleeps to be called when appropriate:

• Radiographer
• CT radiographer
• Radiology registrar for head CT
• Radiology registrar for body CT
• Blood bank / massive transfusion activation:784-1342
• Critical care
• Labs
• Speciality consultants as needed including paediatrics / PICU / Paediatric surgeons, interventional radiology

Paediatric trauma teams should be available during 2011/12 who attend in addition to the adult trauma team for a child with traumatic injury.
TRAUMA MANAGEMENT – AN OVERVIEW

ATLS principles are broadly followed in management of trauma at Nottingham University Hospitals BUT a few key differences should be observed:

<C>ABC

<C>  This recognises that exsanguinating haemorrhage kills and should be immediately managed:

Massive Haemorrhage protocol can be activated on 784-1342 state ‘CODE 911’ and give appropriate patient details.

<table>
<thead>
<tr>
<th>Massive Haemorrhage protocol indications:</th>
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<tbody>
<tr>
<td>Adult or child &gt; 50KG AND</td>
</tr>
<tr>
<td>Severe traumatic haemorrhagic shock</td>
</tr>
<tr>
<td>eg SBP&lt;80 on arrival or SBP&lt;90 after fluid resuscitation</td>
</tr>
</tbody>
</table>

External bleeding:
- In the limbs, apply direct pressure and elevate.
- For continuing bleeding use indirect pressure and apply a CAT tourniquet. More than one can be used but in the event haemorrhage continues a pneumatic tourniquet will usually work.
- Write the tourniquet time on the patient in indelible ink.
- Call the on-call speciality consultant as the patient will need to go to theatre rapidly.
- Inform the theatre team so that they can be prepared.
- QUIKCLOT topical haemostatic agent is available in ED and theatres 1 and 7

PELVIC BINDER T-POD

Beware! – Severe trauma patients are not always tachycardic at presentation

<table>
<thead>
<tr>
<th>Indications:</th>
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<tbody>
<tr>
<td>Any suspicion of pelvic injury, or</td>
</tr>
<tr>
<td>Blunt Trauma + SBP &lt;110 mmHg</td>
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</tbody>
</table>

- Apply pelvic binder -
DO NOT WAIT FOR THE XRAY!!
The initial management aims to:

1. Splint the pelvis to provide tamponade and prevent movement protecting blood clots that have already formed
2. Detect the presence of a pelvic fracture with an early x-ray
3. Differentiate between pelvic and intra-abdominal bleeding or visceral injury

The following is the Standard Operating Procedure:

- Pelvic binder can be applied even if lateral compression injury is suspected.
- The binder should be placed **around the trochanters, not the iliac crests**. The aim is to close the pelvis not compress it.
- If binder applied pre-hospital leave it in-situ, check it is positioned correctly and x-ray.
- sBP < 90mmHg: Activate massive transfusion protocol.
- Obtain an **early** pelvic x-ray to clear the pelvis.

**Do NOT examine the pelvis for mechanical stability**
**Do NOT logroll the patient until the pelvis is cleared**
**Do NOT catheterise a male patient without senior orthopaedic involvement**
and referral to relevant trauma guideline

A single, good quality AP Pelvic x-ray has a high sensitivity and should demonstrate 97% of significant fractures.

If this x-ray is normal, the pelvis is cleared: remove binder and then **repeat x-ray** (an AP compression – open book – injury can be perfectly reduced by the binder so that the plain x-ray and CT scan is completely normal. A check x-ray after removal of the binder will identify this problem). If there is haemodynamic instability, replace the binder.

See Major Trauma Clinical Guidelines for further management of pelvic injury and subsequent catheterisation / imaging of urinary tract.

Haemorrhage attributed to pelvic fracture may need **interventional radiology** – **plan ahead** and consider early – specialists may need to be called in with inherent delay.

In very small children an improvised pelvic binder may be needed, consider a sheet / gown or large BP cuff with Velcro fasteners.
**SPINAL IMMOBILISATION**

The scoop stretcher supports the spine whilst optimising examination of the patient when pelvic injury is a risk and log rolling is to be avoided. Ideally the patient will arrive on a scoop stretcher instead of a spinal board.

The patient should be transferred from the spinal board to the scoop as soon as it is safe and possible. All members of the trauma team must be familiar with how the scoop works. The neck, spine and pelvis should be protected throughout but it is not necessary to perform a full log-roll of the patient to put the scoop beneath them. The scoop facilitates patient transfers; it is compatible with CT and does not need to be removed during the CT scan.

Once the pelvis is cleared and log rolling permissible a full exam of the back must be done. Clear documentation and handover is needed if this is not completed in ED.

There is no equivalent for very small children who may not be supported by the scoop stretcher and need alternate spinal support during transfers.

**AIRWAY AND BREATHING**

The anaesthetist will be in charge of the airway but the team leader must liaise closely to optimise need for, and timing of, intubation. Anaesthetic assessment and treatment of airway and ventilation problems will follow the NUH Major Trauma Guidelines for Anaesthetists and all team leaders should be familiar with these (see major trauma intranet site). Involve the PICU consultant or paediatric anaesthetist for paediatric trauma needing intubation in ED.

Allocate Doctor 1 to perform the primary survey which will initially include airway and breathing assessment. Findings of airway and chest injury must be clearly relayed to the team leader and include potential risk factors such as facial fractures, chest bruising and clinical evidence of rib fractures. This will guide the level of suspicion for potential injury and the need for further investigation.

Intubation and ventilation may be essential for the safe assessment of a very agitated patient (remember hypoxia and hypovolaemia are prime causes of agitation), or may be humanitarian in the presence of multiple painful injuries and the inevitability of theatre and / or AICU destination.
• CXR should be performed at the earliest opportunity, but both rib fracture and pneumothorax (particularly anterior) may be missed on the X ray and only detected clinically or on CT scan. CT may occur early enough to totally remove the need for CXR in some cases.

• The Trauma Team should appreciate the diagnostic importance of an early chest x-ray and must facilitate the radiographer so that a CXR is obtained as a priority.

• The trauma team should continue to assess / treat the patient during x-rays whenever possible – the wearing of lead will enable this. It is not acceptable for the entire team to leave a major trauma patient during x-rays, this breaks any momentum of care and delays time to definitive treatment.

• The T&O or general surgery SpR may be asked to insert chest drains and should be familiar with this procedure.

• Trochars must not be used for insertion of chest drains. Follow ATLS and British Thoracic Society guidelines.

• At no time should chest drains be clamped.

• If there is deterioration in clinical status, assume and check for drain malfunction, reposition or place additional drains.

• DOCUMENT chest drain insertion including degree of consent obtained, sedation / analgesia used, patient position, site and size of drain, imaging pre and post insertion and patients clinical condition pre and post insertion. Document drain condition post insertion ie whether it is draining / swinging / bubbling.

• Beware anterior pneumothorax! It can be difficult to detect and may not be drained by a chest drain placed in a normal position (posterior in the pleural cavity). An anterior pneumothorax can tension in this situation. If a patient continues to deteriorate after placing a chest drain, anterior tension pneumothorax should be considered as part of the differential diagnosis.

CIRCULATION

For the early part of resuscitation in the hypotensive trauma patient use permissive hypotensive resuscitation maintaining SBP around 80mmHg titrated to a radial pulse. In the presence of head injury this should be higher (>90mmHg). Beyond the first hour post injury, normotensive resuscitation is usually optimal.

Haemorrhagic shock should be resuscitated with blood products, a massive transfusion policy is in place. Until blood products are available use 250ml boluses of warmed normal saline (ranger warmers pictured left, or Level One transfusers are available). Do not use more than 2 litres of crystalloid. Ongoing bleeding needs to have the underlying cause treated –
ensure surgeons are actively involved; we should aim to get the patient with severe, ongoing haemorrhage (the non-responder) to the operating theatre within 20 minutes of arrival in ED. If the SBP<90 ask the surgical registrar to involve their consultant.

All trauma patients should have two large peripheral lines but in cases of haemorrhagic shock consider large subclavian or neck central lines – swann ganz sheaths allow for very rapid transfusion and your anaesthetic colleagues will usually be able to help with placement. Beware risk of iatrogenic pneumothorax so image after line placement.

Patients who require this degree of resuscitation usually need immediate surgical control of haemorrhage. In this situation ask yourself, “Where is the bleeding. Who can stop it? Should this patient go to theatre now?”

Use intraosseous infusions for fluids and medications including RSI when iv access is at all delayed. Blood products and fluid can be infused under pressure at a decent rate although may be uncomfortable for the patient – consider intubation if the priority is to resuscitate and analgesia is an issue.

Obtaining intravenous access in children only differs in scale not necessity – withholding needles for pastoral reasons is of no benefit in significant trauma and will prove detrimental in some cases. Children compensate extremely well despite very severe injuries but decompensate very fast. Obtain iv access early and secure all lines. Intra-osseous access is an option and should be considered earlier than in adults. IO is used in preference to a central line unless expert anaesthetic / critical care colleagues available.

Tranexamic acid should be given to all trauma patients suspected to have ongoing bleeding and with a SBP<110 or HR>110. Dose 1g iv over 10 mins followed by infusion 1g over 8 hrs. Paediatric dose is 20mg/kg over 10 min then 10 mg/kg/hr over 8 hrs infused.

For penetrating chest trauma where cardiac injury is suspected call the Consultant Cardiac Surgeon on-call (not the SpR). They should be contacted via City Hospital bleep desk (ext 56155). The NUH guidelines are that the patient should be transferred to QMC Emergency Theatre anaesthetic room for continued resuscitation when emergency thoracotomy is an option.
The cardiac surgeon should go directly there to assess the patient. Consideration of transfer to NCH needs consultant involvement.

**MASSIVE TRANSFUSION PROTOCOL**

Criteria for activation:

- Adult patient (or child over 50kg) with profound haemorrhagic shock due to trauma
- SBP less than 70mmHg on admission or less than 90mmHg after initial fluid challenge, with suspected haemorrhagic cause

- beware of other potential causes of shock in trauma such as tension pneumothorax, cardiac tamponade, cardiogenic shock, neurogenic/spinal shock and isolated severe head injury.

Patients needing a massive transfusion for traumatic injury are also likely to be coagulopathic on presentation.

Be aware – the treatment of haemorrhage is to stop the bleeding – ensure senior surgeons are actively involved in management plans. If the surgical registrar is unable to attend the trauma ask the SHO to call the consultant.

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**PACKS**

Pack 1
- 4 units of O-negative packed red cells (PRC)

Pack 2
- 6 units of cross-matched PRC
- 6 units of FFP
- 1 bag of platelets
- 1 adult dose cryoprecipitate
- rFactor VIIa (adult dose)

Pack 3
- 6 units of cross-matched PRC
- 6 units of FFP
- 1 bag of platelets
- 1 adult dose cryoprecipitate
- rFactor VIIa (adult dose)

**MASSIVE TRANSFUSION PACKS**

- After pack 1 consider giving FFP of pack 2 first to keep ratio nearest to 1:1 PRC:FFP

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rFactor VIIa may be considered in patients who do not respond and remain severely hypotensive (sBP < 80mmHg). However, rFactor VIIa is only shown to be of benefit if used in conjunction with normothermia, normal pH and near normal platelet count. There is no strong evidence for its use in trauma. It is associated with a significantly increased risk of arterial thrombosis and should...
only be used with caution. This is an ‘off-label’ prescription and it must be authorised by a consultant. It is likely to not be routinely included in the trauma packs in the future and needs to be actively requested from Haematology.

If the patient is significantly delayed in arriving at QMC post injury or spends a prolonged period in the department consider ROTEM thromboelastography (available in theatres and AICU) to assess and guide treatment of any coagulopathy and guide blood products to be administered. A major trauma patient should in theory not spend sufficient time in ED for this to be routinely necessary.

Patients receiving a massive blood transfusion may become hypocalcaemic. Ionised calcium levels should be checked and corrected if necessary using 5-10mls 10% calcium gluconate. Consider after 3:3 PRC:FFP and after every subsequent 3-4 paired units of PRC:FFP. Monitor levels with blood gas analysis.

Potassium will increase in a massive transfusion. Check a blood gas to monitor levels and consider giving insulin / dextrose based on gases but likely after 10:10 paired PRC:FFP.

If the Massive Transfusion Protocol is instigated but then not required (e.g. unexpected rapid response or patient death) please let the haematology technician know so that blood (+ products) are not wasted.

NB Blood can be transfused without the need for the massive transfusion protocol to be activated – if you plan that only a relatively small transfusion is needed request O Neg / type specific / fully cross matched blood as relevant. If you communicate with the lab (784-1342) group specific blood can be available within 10 mins of the lab having a blood sample.
## TRAUMA CT SCAN

Decision-making regarding ‘stability’ for transfer from ED to other clinical areas eg CT, can be difficult; seek senior advice. Consider what is needed, priorities for transfer and risks versus benefits.

CT scanning has become the gold standard for the secondary survey in adults but does not replace a thorough clinical examination followed up by detailed tertiary survey within 24 hours of admission.

<table>
<thead>
<tr>
<th>It should be obtained as early as possible. In centres of excellence the scan plus a report of immediately life-threatening injuries is obtained within 30 minutes of arrival. This should be our aim.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT4 is the scanner of choice as it is next to the resuscitation room. It is the quickest and best quality scanner. CT3 is an alternative.</td>
</tr>
<tr>
<td>The scoop can facilitate easy transfer of the patient and can be used in the CT scanner. Consider transfer from the spinal board to the scoop very early in the patient management.</td>
</tr>
<tr>
<td>The scribe should move to CT with the team and observations continued on the trauma sheet with timings of key events documented</td>
</tr>
<tr>
<td>Trauma CT should be from vertex to symphysis pubis. Move the arms to give optimal images whenever an option between the head and body scans.</td>
</tr>
<tr>
<td>The ultimate decision on scanning is with the Trauma Team Leader, in consultation with anaesthetist and specialty consultants</td>
</tr>
<tr>
<td>If a patient with a sBP&lt;90 mmHg is to go to CT, the anaesthetic guideline is for the on-call Consultant Anaesthetist to be involved / informed</td>
</tr>
<tr>
<td>Patients with sBP 70-90 mmHg may benefit greatly from the diagnostic accuracy of a scan but the decision is difficult:</td>
</tr>
<tr>
<td>a. If high volumes of IV fluid are required to maintain this level of BP, a CT scan may not be safe</td>
</tr>
<tr>
<td>b. Consultant level decision making should be involved</td>
</tr>
<tr>
<td>c. If intra-abdominal bleeding suspected, Consultant General surgeon must be aware</td>
</tr>
<tr>
<td>d. Trauma team must accompany patient to CT</td>
</tr>
<tr>
<td>Patient with sBP &lt; 70 mmHg should probably go to theatre not CT</td>
</tr>
<tr>
<td>IV contrast to be used unless contraindication eg allergy</td>
</tr>
<tr>
<td>Peripheral injuries eg pilon or plateau fractures may be scanned at the same time provided the patient is fit enough. The rapid sequence scanner in CT4 will facilitate this</td>
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</tbody>
</table>
The following is adapted from the document: Guidance on the role of the General Surgeon in major trauma, NUH 2011:\textsuperscript{1}

**Blunt Torso Trauma**

**Abdomen**

FAST and CT are the main adjuncts for the evaluation of blunt torso trauma in adults. Formal ultrasound is usually first line investigation in children – discuss with the surgeon and the trauma team radiologist should be able to facilitate.

1. **Clinical abdominal assessment is difficult.**
   a. Peritonitis requires a laparotomy.
   b. Equivocal or negative findings with other injuries or confounding factors requires further investigations.
   c. Patients with head/chest injuries and lower limb/pelvis injuries require formal exclusion of abdominal injury regardless of absent physical signs as the risk of abdominal injury is significant.

2. **FAST**
   a. Focussed assessment with sonography for trauma is a rule in investigation only and cannot be used to rule out an injury.
   b. A negative FAST means nothing.
   c. FAST only looks for fluid in the perihepatic, perisplenic, pericardiac and pelvic region.
   d. An unstable patient with fluid on FAST should have a laparotomy.
   e. A stable patient with a positive FAST should have a CT to determine the source of bleeding.
   f. Repeat the FAST as the situation evolves.

3. **CT**
   a. Free fluid (blood) in the abdomen on a trauma CT without solid organ injury requires a laparotomy
   b. Solid organ injury on CT in a stable patient may be managed conservatively in a critical care area with frequent (2-3 hourly) reassessment by the General Surgical Registrar
   c. Development of peritonitis or cardiovascular instability requires a laparotomy
   d. There is a 2-15% incidence of missed hollow viscus injury in patients with solid organ injury – **BEWARE**
   e. The lack of free air on an abdominal CT does **NOT** rule out hollow viscus injury
The General Surgical Consultant should be present for all trauma laparotomies. NB see above for consideration of Trauma CT to be considered prior to laparotomy.

**Indications for emergency laparotomy** (this list is not exhaustive)

<table>
<thead>
<tr>
<th><strong>All unstable patients or patients with peritonitis and evidence of abdominal injury require an immediate laparotomy (CEPOD 1)</strong></th>
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</table>

**INDICATIONS FOR EMERGENCY LAPAROTOMY (WITH OR WITHOUT CT):**
1. Unstable patient with abdominal trauma
2. Clinical peritonitis
3. Unstable patient with positive FAST
4. Unstable patient with free fluid on CT
5. Evidence of hollow viscus injury on imaging
6. Retained weapon
7. Gunshot wound abdomen
8. Evisceration
9. Free fluid (Blood) in the abdomen on a trauma CT without solid organ injury

**Chest**

**Thoracotomy in blunt thoracic trauma**

1. The basic tenant is that there is no role for emergency thoracotomy in ED for blunt thoracic trauma

2. The final decision will always rest with the ED Consultant and General Surgical / Thoracic / Cardiac Consultant if present

3. Unstable patients with blunt chest trauma but with vital signs can be considered for thoracotomy but this should aim to be done in theatres

4. **You must discuss with your Consultant** - be prepared to move the patient rapidly
Penetrating Torso Trauma

These cases should all be ‘Trauma calls’. Please request a call if this has not already happened.

Abdomen

1. **Gunshot wounds** (GSW) to the abdomen require an immediate laparotomy although occasionally they can be tangential passing through soft tissue only; this is rare in the UK and a laparotomy is the most appropriate investigation. CT and occasionally plain x-rays have a role in stable patients to assess for associated fractures, foreign body retention and track of the round. Always check THOROUGHLY for an exit wound.

2. ‘Stable’ patients with **stab wounds** to the torso may undergo CT

   - CT is a good investigation for stab wounds to the back
   - With a **completely normal** CT the patient can be observed with regular clinical evaluation (2-3 hourly)
   - Development of peritonitis requires a laparotomy
   - Abnormal CT (free air, fluid etc) requires a laparotomy
   - CT is poor in patients with thoraco-abdominal wounds – these patients should undergo laparoscopy to exclude diaphragmatic injury
   - Evisceration or omental herniation requires a laparotomy

Do **NOT** remove retained weapons from the torso (or neck) in ED. Do not forget pregnancy tests in a wide ranges of ages

Chest – cardiac origin

If cardiac injury is suspected call the **Consultant** Cardiac Surgeon on-call (not the SpR), and **Consultant** General Surgeon.

1. If the patient **arrests in ED, is peri-arrest, or has arrested within 5 minutes of hospital arrival and there is penetrating chest injury** then a thoracotomy performed in ED may be indicated

   - The general surgical SpR (if they have been trained in this procedure) or Consultant should undertake this procedure. Occasionally the ED Consultant may have started the thoracotomy before you arrive – assist them and take the lead as required

   - The Consultant Surgeon must be called

   - Ensure that you are trained to perform a thoracotomy and know what to do if you find injury
There is appropriate equipment in ED - make sure you know where it is. It is your responsibility to familiarise yourself with the kit.

The cardiac surgeon should be contacted via City Hospital bleep (ext 56155).

Many of the T&O SpR’s will have some experience in thoracotomy which is performed on a regular basis in spinal surgery. They may be able to help.

2. In patients who have not arrested but in whom there is suspicion of a cardiac injury:

° NUH guidelines state the patient should be transferred to the QMC Emergency Theatre anaesthetic room for thoracotomy and continued resuscitation.

° The cardiac surgeon will go directly to theatre to assess the patient.

° Ideally, the patient should not be anaesthetised, intubated and ventilated until the cardiac / operating surgeon is present, as this is often the point at which cardiovascular decompensation occurs.

3. If you are going to theatre immediately, warn them! Please do not transfer a patient to theatre without involving the anaesthetic team.

Theatre Coordinator: Ext 64668 or bleep 7843201
Theatre 1 (General Surgery): Ext 64253
Theatre 7 (Trauma): Ext 64235

Chest—non cardiac origin

° The general surgical or orthopaedic SpR will be expected to perform thoracostomies / place chest drains in patients with diagnosed or suspected haemothorax in the trauma resuscitation

° Unstable patients with significant haemothorax (>1500ml stat) will require a thoracotomy

° Call the General Surgical Consultant and Thoracic Surgical Consultant and transfer the patient to QMC theatres. There is no role for the transfer of unstable patients to City Campus.

° There is not yet an equivalent thoracic trauma protocol to the cardiac protocol, however in the peri-arrest / arrested patient then a
thoracotomy will be required. Whenever possible thoracotomy should be performed in theatres so if predicted move early.

- **Definitive Surgery in Trauma Skills course recommends a left antero lateral thoracotomy converted into a clamshell**

- Ideally a decision on surgery can be undertaken between the general surgical and thoracic surgical consultants

- In the more stable patient on going blood loss (200-300ml/ hour) should be discussed with the thoracic surgery consultant with view to surgery
**Secondary Survey**

The secondary survey should include the top to toe examination of the patient listing all injuries found and diagnoses confirmed by investigations to date.

Ensure all neurology is listed – ideally before intubation and paralysing drugs administered.

Examine fundi, pupils and tympanic membranes. Document a temperature – both core and peripheral in serious burns cases.

Ensure the back is examined with log roll and PR whenever possible.

Clearly document if anything is unable to be done eg spinal clearance / logroll so this can be included in subsequent management plans when the clinical condition allows.

Consider urinary catheter, arterial lines (and timing of), tetanus, antibiotics.

The following is adapted from the document: *Guidance on the role of the Trauma and Orthopaedic Surgeon in major trauma, NUH 2011*:

The T&O SpR is responsible for the secondary survey of the limbs:

1. Document all wounds, grazes and degloving.
2. Evaluate each joint and long-bone for dislocation / stability / fracture.
3. Neurovascular examination of all limbs.
4. Record presence or absence of key peripheral pulses & neurological findings.
5. Splint fractures.
6. Repeat neurovascular examination after splinting.
7. Arrange appropriate x-rays.
8. Peripheral x-rays must not delay Trauma CT Scan.
9. In some cases it may be best to delay x-rays until the patient is in theatre and good quality traction x-rays can be obtained.

If emergency fracture fixation or wound management is likely, warn the theatre coordinator as early as possible so that the theatre staff can start preparations.

Contact Theatre coordinator on Ext 64668 or bleep 784 3201 or Theatre 7 (Trauma) on Ext 64235

**Open fractures**

1. Check tetanus status
2. Give IV antibiotics:
   - Grade I or II: Augmentin
   - Grade III: Augmentin + Gentamicin
   - Farm / aquatic (e.g. river Trent): add Metronidazole.
Definitive management
1. Discuss with consultant
2. Timing depends on other injuries, available theatres, surgeons, plastic surgery
3. Debridement, wound closure and definitive fracture fixation should be within 24h
4. Severely contaminated, farm and aquatic injuries remain a surgical emergency and must be debrided as quickly as possible.

Laboratory Tests and investigations
All major trauma patients should have baseline blood tests and group and save or cross match as appropriate. Do not forget pregnancy tests in a wide range of ages. Investigations are ordered electronically through Notis and a major trauma order set facilitates this group order in association with radiology requests.

This Notis request has been set up to enable nursing staff to order blood tests and x-rays / CT scans under the order set “ED Major Trauma Nurse orders”.

Xray request should be electronically processed prior to xrays being done. Nurse ordering should facilitate this together with an EDA on the trauma team who can rapidly book in trauma patients to produce the K number required.

Blood gases (including lactate) are available in resus and should be done on all Major Trauma patients

Thromboelastography (ROTEM) is available in AICU and theatres with images networked to monitors in resus and on Notis (due 2011/12).

<table>
<thead>
<tr>
<th>Beware the terrible triad – Hypothermia, Coagulopathy and Acidosis.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypothermia:</strong></td>
</tr>
<tr>
<td>· Patients must be actively kept warm during resuscitation – warming blankets available and transferable to CT.</td>
</tr>
<tr>
<td>· If the core temperature is &lt; 35°C do not perform ETC</td>
</tr>
<tr>
<td><strong>Coagulopathy:</strong></td>
</tr>
<tr>
<td>· Platelets &lt; 120 or INR &gt; 1.5 do not perform ETC</td>
</tr>
<tr>
<td><strong>Acidosis:</strong></td>
</tr>
<tr>
<td>· pH &lt; 7.25 or Base excess &lt; -5.0 do not perform ETC</td>
</tr>
</tbody>
</table>

ETC: Early Total Care
Lactate Controlled Early Total Care in orthopaedics

Venous or arterial lactate is a very useful guide and should be measured serially. It seems to reflect the adequacy of resuscitation as it is one of the last indices to return to normal. The levels will guide decision making between Early Total care (ETC) and damage control orthopaedics (DCO) for fracture care in the first 12-24 hours.

We use the guidelines from Shock Trauma, Baltimore:

- Lactate < 2.0 → ETC possible
- Lactate > 2.5 → continued resuscitation
- Lactate 2.0 – 2.5, trend up → continued resuscitation
- Lactate 2.0 – 2.5, trend down → ETC possible

TRANSFERS

Trauma is a team game and decisions on timing and order of surgery need to be made in consultation with other members of the trauma team, particularly the anaesthetist and critical care.

Transfer to, and resuscitation in, CT or later on ITU should be performed as a team with active input from the surgeons, anaesthetists and intensivists, all of whom have complementary skills in the early resuscitation of the multiply-injured patient.

Formal handover between team members following the SBAR format should be done at each opportunity – do not assume other team member’s knowledge of events. Ensure this is done when leaving each clinical area eg on leaving ED, in the operating theatre, and onto ITU or the ward etc.

On occasions, critical care will have insufficient staff or beds to allow continued resuscitation on ITU. In this situation, the senior clinicians will need to decide the safest environment to continue resuscitation: this may be in the Emergency Department, theatre or the theatre recovery area. The patient must not be abandoned in any of these areas.

Ensure transfer is safe with all equipment and drugs needed. Lines and drains must be secured and all documentation complete. Handover to a lead specialist for ongoing care, usually ITU or anaesthetics, is vitally important.

Documentation to move with the patient from ED includes a copy of the Resuscitation Chart, Blood transfusion record if relevant, a copy of electronic EDIS notes (ED record), the Major Trauma Admission document (completed by the admitting team) and provisional radiology reports.
Additional documents to refer to include

1. Early Management of major trauma: the role of the general surgical team. East Midlands Regional major Trauma Network. 2011 Guidelines for Nottingham University Hospital NHS Trust

2. Early Management of Polytrauma and severe musculoskeletal trauma, role of the orthopaedic team, 2010

3. Early management of polytrauma and severe musculoskeletal trauma: the role of the anaesthetic team. 2011 Guidelines for NUH NHS Trust

3. Roles and Responsibilities of the Trauma Team, 2011

4. Major Trauma Clinical Guidelines, March 2011

All available through the NUH Queens Medical Centre major trauma website: http://www.nuh.nhs.uk/ed/majortrauma.aspx.

5. NUH NHS Trust Transfusion Policy: transfusion management of massive haemorrhage. Revised version due 2011 and available on Trust Intranet

Acknowledgements

This document was written by Jo Ollerton, Consultant Emergency Medicine at Nottingham University Hospital (NUH): joanne.ollerton@nuh.nhs.uk. It is written in close collaboration with speciality specific guidelines and thanks to Jo Haycock and Adam Brooks for this. All are based upon the T&O document originally developed by Chris Moran, Professor of Orthopaedic Trauma Surgery at NUH.

Professor Moran, Dr J Haycock, Mr J Coleman, Dr C Dieppe and A Bristow all contributed to the development of these guidelines.
Appendix A
Injury Severity Score & Abbreviated Injury Scale

Major Trauma is defined as injuries producing an Injury Severity Score (ISS) \( \geq 16 \)

The ISS is based on the Abbreviated Injury Scale (AIS).

Abbreviated Injury Scale (AIS)

The AIS is taken from a catalogue listing types of injury and describes the severity of injury to one defined body region:

1. Minor
2. Moderate
3. Serious
4. Severe
5. Critical
6. Maximal (lethal injury)

Injury Severity Score (ISS)

To calculate an ISS for an injured person, the body is divided into six regions. These body regions are:

1. Head and neck including cervical spine
2. Face, including facial skeleton
3. Thorax, thoracic spine and diaphragm
4. Abdomen, viscera and lumbar spine
5. Extremities including pelvic skeleton
6. External soft tissue

An ISS is then calculated according to \( \text{ISS} = A^2 + B^2 + C^2 \) where \( A, B, C \) are the AIS scores of the three most injured body regions.

The ISS takes scores from 0 to 75 (ie AIS scores of 5 for each category).

If any of the three scores is a 6, the score is automatically set at 75. Since a score of 6 ("unsurvivable") indicates the futility of further medical care in preserving life.

Example:

<table>
<thead>
<tr>
<th>Region</th>
<th>Injury</th>
<th>AIS</th>
<th>AIS^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head/Neck</td>
<td>Single cerebral contusion</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Face</td>
<td>No injury</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td>Flail chest</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1. Liver laceration</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>2. Completely shattered spleen</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Extremity</td>
<td>Fractured femur</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>External</td>
<td>No injury</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Injury Severity Score (ISS) = 50
Appendix B

NUH TRAUMA TEAM ACTIVATION CRITERIA

On assessment in ED

A – If Middle Grade ED doctor deems it necessary/nurse in charge of department

B – Physiological Triggers for adults and children after trauma
   Airway compromise
   Clinical evidence of hypovolaemia
   GCS < 13

   Physiological triggers for adults only
   Systolic BP < 90mm Hg
   RR < 10/min or > 29/min

C - Anatomical Triggers
   Flail Chest
   Two or more long bone fractures (humerus, femur, tibia)
   Amputations proximal to wrist or ankle
   Penetrating trauma to head, neck, chest, abdomen and groin
   Limb paralysis/Spinal cord injury
   Suspected significant pelvic fracture
   Significant burn with history of additional trauma or enclosure

D - Mechanism of Injury Triggers
   Significant Intrusion
   Fall > 10 feet or fall more than twice the estimated height of the child
   Death of another occupant of vehicle
   Ejection
   Other significant Mechanism of Injury

E - Multiple Trauma Victims
   Have a lower threshold to activate when considering the elderly
   with relatively minor mechanism and those with multiple co-
   morbidities

Pre hospital activation

By Physician attended Call Out Team or by ED staff on reception of reliable information from ambulance service as per above protocol.
Appendix C

NUH - USEFUL CONTACT NUMBERS

Anaesthetic Registrar, 3rd on 784-3051
Anaesthetic Registrar, 2nd on 784-1051
Anaesthetic Registrar, 1st on 784-1050

Radiology (Head)  784-7975
Radiology (Body)  784-7974 (and out of hours)

XRay  63101
CT 3  66750
CT 4  70446

MASSIVE TRANSFUSION  784-1342
(remember to stand down after event)

Blood Bank  63660

THEATRE COORDINATOR  64668 or bleep 784 3201
Theatre 1 (General Surgery):  64253
Theatre 7 (Trauma):  64235

AICU  62758 or 62762
PICU  63288

CITY SWITCH  57199 or bleeps on 56155 or 53053
QMC SWITCH  0 or bleep desk 63063

NIC Area 1  70404

Organ Donor Coordinator pager 07659-137821