NOTE: These guidelines are regularly updated. Check the intranet for the latest version. 
DO NOT PRINT HARD COPIES

Please note these Major Trauma Guidelines are for UHS Adult Major Trauma Patients.

The Wessex Children’s Major Trauma Guidelines may be found at
http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/ChildrenMajorTraumaGuideline/Wessexchildrensmajortraumaguideline.doc

NOTE:
If you are concerned about a patient under the age of 16 please contact SORT (02380 775502) who will give valuable clinical advice and assistance by phone to the Trauma Unit and coordinate any transfer required.

http://www.sort.nhs.uk/home.aspx

Please note current versions of individual University Hospital Southampton Major Trauma guidelines can be found by following the link below.

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Introduction

‘These guidelines are the current policies and practice for the management of adult major trauma patients at University Hospital Southampton. They have been designed to provide a day to day framework for the management of patients; including the roles and responsibilities of clinical teams and their members. The guidelines were produced to try and ensure timely, consistent, high-quality care for all patients whatever day or time of day they present, recognising that these are challenging and often stressful cases.

There will be situations when it is appropriate to deviate from the guidelines or where the guidelines do not cover the specific circumstances. In these cases it is essential that care of the patient is the foremost consideration, that senior staff are directly involved and that documentation is clear. If in doubt, seek senior advice and document their involvement.

These guidelines have evolved from department and hospital guidelines from across the country. Particular thanks must go to Drs. Cordingly and Hell for the NeuroICU guidelines and Dr. Hyde for the Paediatric trauma guidelines which provided inspiration. Also to guidelines from colleagues in Cambridge, Nottingham and London for allowing their work to be integrated into ours. My personal thanks to all members of the anaesthetic trauma group who have worked on bringing these guidelines to life. These are the first version and I accept full responsibility for any inaccuracies and omissions.’
1.1 Pre-hospital triage alert

The pre-hospital triage tool was developed by the Wessex Trauma Network (WTN) to identify patients who have or are at high risk of having sustained major trauma. Patients who are within a 45 minute travel time of UHS may be transferred direct to UHS as the Major Trauma Centre (MTC), bypassing hospitals closer to the scene of the accident. The rationale for this is that it is time to definitive treatment rather than time to arrival in hospital that makes the biggest difference in outcomes. UHS was chosen as the MTC as it has all major trauma services on site.

The pre-hospital team (ambulance service, BASICS, HIOWAA) will alert the ED that a patient with major trauma is en-route. It is expected that a basic ATMIST (see p10) handover will be received with details of the mode and likely time of arrival of the patient.

Patients who are outside a 45 minute travel time or who are deemed to be at risk of imminent airway compromise or have catastrophic haemorrhage will go initially to their nearest trauma unit (TU) for resuscitation. Once resuscitated, if the TU feel that the patient’s injuries are beyond their local facilities, the patient will be transferred on to either the MTC or another TU with specialist facilities (see Secondary transfer protocol).

Certain hospitals have been designated as local receiving hospitals (LRH) by the Wessex Trauma Network. Trauma patients will only go to these hospitals if there is an imminent cardiac arrest or immediate airway problem. Patients will be expected to have only these immediate life-threatening conditions controlled before onward transfer to a TU or MTC.
Figure 1.1: Wessex Trauma Network Trauma Unit Bypass Tool
1.2 ATMIST

Ambulance services, including the air ambulance service, are using the ATMIST handover tool. This gives basic information to enable preparations to be made to receive the patients. The sticker below is completed by the team leader and then it is stuck into the trauma booklet on arrival in ED resus.

**Figure 1.2: South Central Ambulance Service ATMIST sheet**
1.3 Adult Major Trauma team activation

Introduction
A two-tier response to trauma calls has been developed at UHS. A full trauma team response (Trauma 1 call) should be generated by the ED consultant when a patient activates a pre-hospital major trauma call and there is concern by the ED team that a full trauma team response is required. For less severe trauma it may be appropriate to call the ED trauma team alone (Trauma 2 call) that can be escalated if more significant injury is found.

Trauma 1 call (call 2222 and ask for adult trauma team)
Criteria for a trauma 1 call include (but are not limited to):

- **Pre-hospital major trauma alert**
  - **Physiological, anatomical or mechanism**

<table>
<thead>
<tr>
<th>Physiology</th>
<th>Anatomical</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate &lt;10 or &gt; 29</td>
<td>Penetrating injury to chest, abdomen, head, neck or groin</td>
<td>Gunshot wounds, stabbing or impaling</td>
</tr>
<tr>
<td>Systolic Blood Pressure &lt; 100 mm Hg</td>
<td>Burns with Trauma</td>
<td>Falls &gt; 6 metres</td>
</tr>
<tr>
<td>Glasgow Coma Score – Motor Score of 4 or less</td>
<td>Flail chest, tension pneumothorax or haemothorax</td>
<td>High impact RTC (Ejection, pedestrian struck by vehicle&gt;30mph)</td>
</tr>
<tr>
<td></td>
<td>Amputated limb(s)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 1 fractured long bone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suspected major pelvic injury</td>
<td></td>
</tr>
</tbody>
</table>
1.4 Adult Major Trauma Level 1 team membership

ED Consultant
Trauma orthopaedic Consultant bleep 1780 (daytime)
Senior anaesthetist bleep 1783
Named Anaesthetist (day) bleep 1646
GICU SpR bleep 2110
ODP / tech bleep 1784
General Surgery SpR / Cons bleep 9990
Orthopaedic Surgery SpR bleep 2702
Porter
Site manager (if helipad arrival) bleep 2238
Radiographer bleep 1781
Major Trauma Clinical Coordinator (currently day only) bleep 1963

Neurosurgery:

- There is agreement that the Neurosurgical registrar (voice bleep 2877 or mobile 07554223539) will not be part of unselected level 1 calls.

**NOTE:** The Neurosurgeon should be alerted *when it is identified the patient might have either a significant head or spine injury and they are going to CT.*

- Ask switchboard to call the registrar with the message ‘Major trauma in resus; going to CT in X minutes’.
- In the absence of timely response from the Neurosurgical Registrar then the consultant should be called.
- There may be rare cases in which neurosurgical input may be directly requested prior to imaging and this can be determined on an individual case basis by the trauma team leader.
- If other clinical staff are required (e.g. cardiothoracic registrar bleep 9211) the team leader should explicitly request switchboard to inform them.
In addition to the above team members the complete Level 2 Trauma Call Team (below) also attend Level 1 trauma calls;

**Adult Trauma Level 2 team membership**

- ED Consultant or ED ST4+
- ED SHO
- ED Nurse in charge
- ED Nurse x 2
- HCA (Scribe)
- Radiographer

### 1.5 Responsibility of major trauma team members

**On receiving alert**

- On receiving a major trauma alert, all members of the major trauma team should assemble in the ED resus area to be briefed on the nature of the patient expected. This information should be written on a board or flipchart for the team to view throughout the trauma call.
- If a member of the team cannot attend within the given timeframe they should notify the ED immediately (x4979).
- If a specialty surgical registrar cannot attend, the duty specialty consultant must be informed and attend.

**CT**

- CT should be informed that a potential major trauma patient will be arriving and will be on stand-by for performance of a trauma CT series.
- The default emergency CT is the C level scanner adjacent to the ED (x8002).
- Transfer equipment should be made ready in the expectation that the patient will be moving from resus to CT.
- To request a multi-trauma CT the Radiology department have agreed that only the one telephone call to the scan room is required. The radiographer will alert the duty registrar.
Code Red (Major Haemorrhage)

- If the pre-hospital information suggests that the patient has severe, life-threatening haemorrhage a ‘CODE RED’ should be called.

- See Section 2.1 for UHS Major Haemorrhage Protocol.

- Consider allocation of ‘T’ (Transfusion) number for patients who have Code Red declared prehospital. A number of patient note folders and ‘T’ numbers have been pre-assigned. Blood bank can issue FFP using a ‘T’ number. See section 2.1.

- Inform Blood Bank if a ‘T’ number is issued.

- Three of the Air Ambulances carry blood for prehospital use (KSS, Thames Valley, Hampshire & IOW). If Hampshire Air Ambulance has given blood prehospital please inform blood bank before their arrival as the air ambulance will need restocking.

Helicopter transfers

- If the patient is being transferred by helicopter, switchboard will be informed and asked to alert the helipad team (site manager, portering staff).

- The Trauma Team is far more effective looking after major trauma patients in ED Resus.

**NOTE:** Aside from the helipad team, no members of UHS staff are to attend the helipad even if the patient is critical
Trauma Team Roles

**A. Trauma team leader (ED consultant)**

**Role**

- Coordinates the initial resuscitation
- Prioritises investigations and treatments (consider foregoing plain film X rays if patient will have multitrauma CT)
- Responsible for clinical decisions in conjunction with trauma consultant and anaesthetist
- Ensures that all team members wear protective equipment including aprons and identification
- Allocates roles and ensures that personal introductions are made
- Ensures that patient gets to CT safely and swiftly without unnecessary procedures / investigations
- Ensure observers are kept to a minimum number and only physically involve themselves when requested by the team leader.

- **Trauma calls can easily become chaotic and disordered.**

**NOTE:** It is imperative that the Trauma Team Leader maintains control and insists on **MINIMUM noise** from the Trauma Team members

**Checklist**

- Pre-alert to CT, interventional radiology, specialist consultants (including Cardiothoracics if required)
- Activate ‘Code Red’ if patient has criteria for major haemorrhage protocol. Order Pack 1 and 2.
- Consider issuing ‘T’ number (see above)
- Ensure Blood product transfusion approaches ratio of 1:1:1 (PRBC: FFP: platelets) in cases where >4 Units PRBC need administering. FFP is now kept pre-defrosted within blood transfusion.
- Tranexamic acid 1g over 10 minutes if blood products given.
Warm fluid run through and Belmont primed if necessary
Paediatric calculations completed
Consider
  a. Logrolling if a penetrating injury is suspected
  b. Antibiotics (see Antibiotic Protocol for Major Trauma – section 2.6
  c. Urinary catheter
  d. Arterial line (there are only a very few indications for inserting invasive lines prior to CT, even in cardiovascularly unstable patients)
  e. Tetanus toxoid

NOTE: All the above procedures can be delayed if emergency intervention required. The aim is to transfer the patient to CT within 30 minutes of arrival in ED)

NOTE: The Team Leader will read aloud the Checklist for actions prior to leaving ED – the main indication for this is transfer to the CT Scanner.

Handover

Ensure full handover to consultant(s) responsible for ongoing care and attending anaesthetist
  a. Full description of injuries and CT findings
  b. PMH
  c. Allergies
  d. Diagnoses
  e. Drugs given
  f. Whether secondary survey has been performed
  g. Blood products / fluids given

Following transfer of patient from department

Inform blood bank of either a) patient’s location and new clinical lead for massive transfusion or b) stand-down as appropriate
Speak to relatives updating them and informing them of patient’s location
Debrief trauma team and ensure documentation complete (Trauma Booklet)
B. Anaesthetist and ODP

Prior to patient arriving:

- Check all equipment including suction, airway equipment and rescue devices.
- Ensure dedicated anaesthetic drug packs 1 & 2 have been retrieved from the ED Resus CD cupboard and fridge.
- Decide drug choice, consider doses and who will give them (see Trauma RSI Protocol – section 2.2).
- Consider appropriate ongoing sedation/ muscle relaxant.
- Allocate role of cricoid pressure to ODP.
- Discuss who will provide MILS (Manual in-line stabilisation of neck) if intubation is required.
- Consider availability of second anaesthetist (bleep 1646 daytime. Bleep 2265 out of hours) or airway competent ICU registrar (bleep 2110) if required.
- Discuss failed intubation procedure.

Roles

- Start the wall digital clock when patient arrives (ODP).
- Assess and manage airway as appropriate.
- Intubate when appropriate in discussion with Trauma team leader.

NOTE: Prior to intubation where possible it is extremely useful to perform examination of the pupils (size/light response) and whether all four limbs are moving.

- Ensure cervical spine immobilised for blunt trauma.
- ‘Breathing’ assessment is either done by the Anaesthetist or ED Doctor 1. In either case the Anaesthetist must satisfy themselves that this has been correctly performed.
- Each trauma patient should have large bore IV access (at least 2 cannulae to enable contrast to be given in the CT scanner).
- Ensure each of above is communicated to the team leader and scribe.
If patient is alert, take AMPLE history
   A  Allergies
   M  Medications
   P  Past medical history
   L  Last meal
   E  Everything else relevant

- Control the log roll (often now not performed prior to CT)
- Coordinate transfer to CT / theatre / ICU as appropriate in discussion with the Team leader / Trauma consultant
- Sign for used controlled drugs as well as completing a record of your interventions and assessment in the Trauma Booklet.

**Consider**

- Arterial line
  - Although insertion may be rapid, assembly of the transducer set is often time consuming in ED. If NIBP is working this is almost always sufficient until after CT.

**NOTE:** Insertion of invasive lines should not delay transfer to CT or theatre

- Oro/naso-gastric tube
- Although additional access (e.g. CVP line) may be desirable it should not delay transfer to CT / theatre (as per arterial line)
- Temperature probe

**C. ODP**

- **Start the wall digital clock.** It is easy to forget!
- Together with the anaesthetist run through the RSI checklist to ensure all equipment is present.
- Assistance to anaesthetist.
- Prepare airway equipment including rescue equipment/ Difficult Airway Trolley
• Check under trolley O\textsubscript{2} cylinder is full
• Check suction
• Check ventilator and appropriate circuits are present
• Prepare anaesthetic drugs
• Perform cricoid pressure and help with intubation
• Ensure airway is secured appropriately
• Responsible for taking emergency airway equipment / drugs on transfer from ED
• Restock red/blue and yellow drug pouches after patient leaves ED.

D. Doctors 1 and 2

Doctor 1 roles:
• Primary survey: C-ABCD
• The first C is for ‘Control of Catastrophic haemorrhage’ and takes priority over everything else
• A - includes ensuring correct application of C spine precautions where indicated
• B- Assessment of B may be performed by the anaesthetist with prior discussion, if not this part of the role of Doctor 1.
• C- Assessment of Circulation
• D – Disability includes
  a. GCS
  b. Pupillary size and reaction
  c. Ensure movement of all limbs is recorded before use of anaesthetic/paralysing agents
    These may be performed by the anaesthetist in conjunction with Dr 1
• Ensure information conveyed to team leader and scribe
• Take AMPLE history if anaesthetist is busy
• Secondary survey
  a. Only when primary survey complete and necessary interventions performed
b. General surgeon should assess abdomen

c. Orthopaedic surgeon should assess limbs and soft tissue injuries.

d. Information from secondary survey may help to guide need for additional CT after standard multi-trauma CT (e.g. tibial plateau fracture may require angiography).

e. Ensure documentation within trauma booklet whether secondary survey performed.

NOTE: **CT angiograms are not to be performed in the acute stage.**

f. Administer drugs (Non-anaesthetic). Confirm Antibiotics/Tranexamic Acid/Tetanus administration where indicated

g. Ensure patient kept warm (Bair Hugger, fluid warmer, limitation of exposure, overhead heaters).

**Doctor 2 roles:**

- Two wide-bore IV access. Consider EZ-IO (intraosseous). If difficult iv access consider asking another team member e.g. an anaesthetist for assistance with either peripheral or large bore central access.

- Take blood
  - a. FBC & Clotting
  - b. Group and save / crossmatch
  - c. Pregnancy test for all female patients of reproductive age
  - d. BM
  - e. Glucose, LFT’s, U&E should be sent but are unlikely to affect management at least initially)
  - f. Venous blood gas (will give Hb, glucose, lactate, Base Excess)

- Ensure bloods sent as EMERGENCY samples

- Administer drugs

- Ensure patient kept warm

**FAST scan**

May be done by either doctor 1 or 2 if accredited but should not delay responsibilities above or time to CT.
E. Nurse 1 and 2

Nurse 1 roles

- Overall responsibility for patients in the Resuscitation Room and supervision of other nursing staff in that area. Completed and signed off competency document for managing major trauma.

Prior to arrival:

a. Allocation of nursing roles for expected patient—inform nurse in charge of ED if additional nursing support required.

b. Oversee preparation of equipment (consider need for yellow scoop if patient is being brought in by South West Ambulance Service & splinting equipment) and drugs, fluids, antibiotics, tetanus toxoid, Tranexamic Acid.

c. Retrieve both Anaesthetic drug packs 1 & 2 from CD cupboard and fridge and give to ODP

d. Inform laboratories/x-ray if required (in liaison with trauma team leader)

e. Consider if need for ‘Code Red’ in discussion with trauma team leader—follow ‘Code Red’ protocol if required.

f. Ensure all the team are assembled and assist with team brief

g. Brief receptionist with patient ETA

On patient arrival

Triage patient

a. Start clock if not done by ODP

b. Assist with removal of clothes

c. Attach monitoring (Sp02, BP, ECG monitoring, end tidal CO2 if appropriate). Ensure BP on 5 minute cycle

d. Check temperature

e. Ensure scribe records observations. If scribe role performed by HCA they may require assistance with e.g. drug names, doses etc

f. Ensure that junior doctor obtains access and bloods (remember VBG) and that they are sent to the labs
g. Supervise the use of non-anaesthetic drugs, infusion and bloods.

h. Liaise with definitive care areas/teams (CT/ITU/Theatre) prior to transfer

i. Ascertain where possible next of kin or ensure efforts are in place to locate next of kin

j. Oversee listing and labelling of property

k. Liaise with relatives/police

Nurse 2 roles

Prior to arrival

a. Ensures necessary equipment prepared including transfer monitor and pumps. Ensure trolley has full transfer oxygen cylinder available.

b. Pre-label sample packs if possible

On patient arrival

a. Assist with removal of clothes

b. State first set of observations

c. Assist with procedures

d. Prepare for transfer (documentation, monitoring etc)

e. Accompany patient to CT / theatre / ICU / ward

f. Ensure documentation goes with patient and equipment returns to ED
F. HCA

Prior to arrival

- Assists Nurse One/Two as required and directed
- Assist in helping to prepare necessary equipment.
- Ensure necessary documentation packs are available – begin documentation on Trauma chart
- Document team names and roles allocated (MTCC when available)
- Ensure clock is zeroed prior to patient arrival and an individual allocated to start clock on arrival
- Ensure that facilities are available for relatives (i.e. allocation of relative room)

On patient arrival

- Document vital signs, drugs and fluids given (every 5 minutes)
- Approach visiting clinical staff and record name and designation (consultant, registrar etc) on Trauma Booklet
- Assist with obtaining equipment as directed by Nurse One
- Assist with preparation for transfer
- Accompany patient to CT/Theatre/ITU/Ward as instructed and ensure continued documentation of vital signs, investigations and procedures

G. Receptionist

Prior to arrival

- Report to team leader
- Report to nurse in charge/ MTCC

On patient arrival

- Get handover from paramedics
- Book patient in
- Print labels
- Inform nurse in charge/ MTCC that patient is ready for triage
- Direct any relatives to relatives room
H. General surgeons

Prior to patient arrival

- Identify yourself to team leader and to scribe
- Identify role expected
- If you are not required as doctor 1 or 2 position yourself outside the immediate vicinity of the patient.

On patient arrival

- Inform consultant Surgeon on call immediately if patient has SBP <90mmHg, has complex multi-system injury or needs early surgery
- Perform abdominal examination and PR when requested by Trauma team leader
- Discuss timing of logroll

**NOTE:** Logroll is usually left until after CT – however with suspected spinal injury if there is time before the patient is intubated it is useful to perform PR examination and assess anal tone prior to anaesthetic drugs/ neuromuscular blockers). Anal tone is NOT abolished by either anaesthetic drugs or neuromuscular blockade.

- Ensure findings known to Trauma team leader and scribe
- Discuss surgical plan with Trauma team leader
- Assist coordination of theatres
- Document surgical plan clearly in trauma booklet.
- Stay with the patient until stood down by trauma team leader (this may be after hot debrief)
I. Orthopaedic surgeons

Prior to patient arrival

- Identify yourself to team leader and to scribe
- Identify role expected – if you are Doctor 1 or 2,
- If you are not required as doctor 1 or 2 position yourself outside the immediate vicinity of the patient.

On patient arrival

- Inform trauma orthopaedic consultant immediately if the patient has orthopaedic injuries or needs early surgery
- Perform secondary survey of limbs when requested by Trauma team leader.

NOTE: It is the responsibility of the orthopaedic doctor to ensure the secondary survey is performed and the results are documented.

Secondary survey includes assessment of:

- Wounds, grazes, degloving
- Each bone / joint for stability / fracture / dislocation
- Neurovascular status of each limb
- Risk of compartment syndrome
- Identify injuries that require inclusion in CT scan (e.g. tibial plateau fracture)
- Splint fractures and re-examine neurovascular status
- Note requirement for x-rays (these must not delay CT scan).
- Ensure findings known to Trauma team leader and scribe
- Discuss surgical plan with Trauma team leader
- Assist coordination of theatres
- Document surgical plan clearly in trauma booklet
- Stay with the patient until stood down by trauma team leader (this may be after hot debrief)
J. Neurosurgeons

Prior to patient arrival (if requested by team leader)
- Identify yourself to team leader and to scribe

On patient arrival (if requested)
- Inform neurosurgical consultant immediately if the patient has need for early surgery
- Identify need for imaging (multitrauma CT will include brain, cervical spine, thorax, abdomen and pelvis)
- Ensure doctor 1 has completed necessary neurological examination and results known to Team leader and scribe.
- Discuss surgical plan with Trauma team leader e.g. need for ICP monitor, priority of head injury management over other surgical considerations
- Assist coordination of theatres
- Document surgical plan clearly in trauma booklet.
- Stay with the patient until stood down by trauma team leader (this may be after hot debrief)

On request to attend CT
- Attend C level CT promptly
- Identify yourself to team leader / MTC consultant if present
- Inform neurosurgical consultant if patient has need for early surgery
- Discuss surgical plan with Trauma team leader e.g. need for ICP monitor, priority of head injury management over other surgical considerations
- Assist coordination of theatres
- Document surgical plan clearly in notes
- Stay with the patient until stood down by trauma team leader (this may be after hot debrief)
K. Radiographer / radiologist

Prior to patient arrival

- If CXR/PXR are anticipated place cassettes under the trolley.

NOTE: Plain films are rarely performed in Major Trauma patients as CT is the preferred imaging modality. However very unstable patients or those with significant chest injuries including penetrating injuries may have plain XR on patient arrival.

- Liaise with Trauma team leader as to likely need for CT and time expected before arrival in CT
- Liaise with CT scan room to ensure CT room free. If delayed, ensure Trauma team leader is aware

On patient arrival

- Liaise with Trauma team leader as to whether plain x-rays necessary
- If x-rays needed, countdown ‘X-rays in 3-2-1 X-ray’
- Ensure Trauma team leader aware if procedures / team members are delaying x-rays
- Facilitate rapid transfer of patient to CT

1.6 Hands off Handover

Generally unless CPR is in progress an ATMIST handover will be given by the ambulance staff whilst UHS staff stand-off the patient. The trauma team leader will first ask where the pre-hospital team are happy to give a ‘hands off handover’. Ambulance staff assisted by UHS staff will transfer the patient from the stretcher to the trolley in resus. Patients should remain on the scoop-stretcher.

The ATMIST handover should be completed within 30 seconds and is designed to give ALL members of the trauma team the information necessary to proceed with the immediate care of the patient. Further information regarding the patient can be relayed to the Trauma team leader following the ATMIST handover.
1.7 Executive Roles for the Trauma Team Leader (TTL) - ED Consultant

Introduction

- The ED consultant has authority from the Chief Executive and Medical Director to request any specialty consultant to attend.
- If a patient has clearly a single specialty injury, the duty consultant for that specialty should be contacted and will be the trauma consultant for that patient (i.e. penetrating chest trauma to cardiothoracics, severe isolated head injury to neurosurgery).

**NOTE:** The Trauma & Orthopaedics Consultant is responsible for polytrauma patients where there is no clear single specialty.

- All UHS consultants have a statutory duty to be able to respond in an emergency within **30 minutes** of request.

The Trauma Team Leader has overall responsibility for:

- Determining and arranging the appropriate destination for the patient i.e. theatre, ICU, ward
- Ensuring that medical staff of the appropriate seniority are involved in the care of the patient
- Ensuring that only essential imaging is performed
- Ensuring that necessary documentation has been completed
  a. Major trauma activation
  b. Trauma team attendance (including time of arrival and grade of doctor)
  c. The extent of examination performed in the ED and whether a further secondary examination is required
  d. The secondary survey must be signed off as complete at the earliest opportunity (the team leader is responsible for ensuring the sur-
vey is performed and documented. The default specialty to complete the secondary survey is the T&O Doctor.

e. Ensuring spinal precautions are applied throughout where indicated.

f. Ensuring that handover of a multi-trauma patient to a specialty service is formally documented. Until this has occurred, the patient will remain under the care of the Trauma Team Leader.

g. Handover between the Trauma Team Leader and the receiving team Doctor should always be done in person with a written handover of all admissions and any necessary actions.

NOTE: The MTC consultant or Trauma Team Leader must always attend the CT scanner and liaise with the Anaesthetist as to the patient’s injuries and planned destination after CT.

- In exceptional circumstances the TTL can delegate escorting the patient to CT to an appropriately senior Doctor from outside ED – e.g. the T&O Consultant. Their principal role is not to guide resuscitation (typically this will be performed by the anaesthetist) but to ensure prompt liaison with other teams (e.g. Neurosurgery) as required.
4.6 Responsibilities of the Site manager

- It is essential that patients can move as swiftly as possible from the ED to their place of definitive care.
- Patients may require immediate theatre / ICU bed / ward bed
- Patients requiring immediate theatre
  a. Coordination of theatre will be done by the TTL with the Named Anaesthetic Consultant
  b. Patients with isolated head / spinal cord injury requiring immediate theatre should be managed in the appropriate specialist theatre
  c. The duty anaesthetic consultant will be responsible for coordinating the ongoing resuscitation

**NOTE:** F Level Theatres recovery can be used for patients requiring ongoing resuscitation after CT whilst theatre is being prepared.

- Patients requiring an ICU bed
  a. In principle, patients with a primary neurological diagnosis (head or spinal cord injury) should be managed on NeuroICU with the proviso that there are very limited resuscitation facilities available in the Wessex Neurological Centre. As such, patients with ongoing resuscitation needs or with significant cardiovascular injury are best managed initially on General ICU.

- Patients requiring ward beds
  - Patients with single system injury are best managed on wards with experience of managing that injury
  - Patients with multi-system injury requiring a ward bed should by default go to the T&O ward on F level (often F4)
  - Patients with isolated thoracic injuries will be admitted to the thoracic ward under the care of Thoracic surgery.
4.7 Major Trauma Clinical Coordinator (MTCC) role

Before patient arrives
- Record all those who have attended the trauma call plus times
- Organise the collection of any other additional equipments needed

Patient handover
- Record and document the hand over from the ambulance crew
- Marry up the ambulance staff and receptionist to ensure the booking in of patients
- Triage the patient and collect documentation

During resuscitation
- Record observations
- Record timings of time of handover in ED, Chest drain, Intubation, time in CT, time of blood products given.
- Time keeper to the consultants giving time report at 10, 15 and 20 minutes until we leave for CT scanner
- Record nursing documentation as appropriate such as relatives, property and police contact details.
- Ensure all paperwork is kept together including CT request, check list, blood gas and all are filled out
- Assist with the Belmont and checking out blood where appropriate

CT
- Accompany the patient to CT recording the time in the scanner.
- Continue recording patient observations

Theatre
- Accompany the patient to theatre recording the time of arrival
- Continue recording observations until able to step away

Return to ED
- Handover to ED staff
- Follow up on any outstanding tasks
- Ensure notes are completed and scanned and taken to the ward

Family
- Establish family and give contact details of MTCC
- Deliver or assist in breaking bad news, where and when appropriate

Police
- Collect police password if appropriate
- Ensure police details are written down, Name, ID no and contact number
2.0 Secondary transfer tool

Introduction

- The secondary transfer tool has been developed by the Wessex Trauma Network to ensure that patients with certain categories of major injury, who are managed initially in a trauma unit or local receiving hospital, are rapidly transferred to the Major Trauma Centre without delay.

The categories of patient to which this applies are:

a. Pre intubation GCS Motor Score 4 or Less AND evidence from CT of intracranial bleeding (any variant)

b. Life threatening haemorrhage not amenable to control at Trauma Unit

c. Successful resuscitative thoracotomy at Trauma Unit

- These patients fulfill automatic acceptance criteria for transfer to the MTC. At the Trauma Unit the senior doctor will call the Ambulance Service and state that they have a “Time Critical Trauma Transfer”

- The trauma unit team leader will then inform the Major Trauma Centre via the red phone in the Emergency Department and state that there is a “Secondary Trauma Transfer” When prompted the trauma team leader will give an extended ATMIST summary of patient.

**NOTE:** Do not negotiate terms of admission to UHS with the Trauma Unit. The transfer tool has been specifically written to ensure *automatic acceptance* by the MTC. The phone call from the Trauma Unit is purely to alert the MTC rather than to seek permission for the transfer.
The patient will be transferred to the Emergency Department at University Hospital Southampton. The transferring team will be met and accompanied to final destination where clinical handover will occur. Only if the patient has been unstable en-route should the patient be directed into the resuscitation bay.

**NOTE:** Any paediatric secondary transfer referrals must go via SORT (02380 775502) who will not only coordinate the transfer but also give valuable clinical advice and assistance by phone to the Trauma Unit.

http://www.sort.nhs.uk/home.aspx
Figure 1.3: Wessex Trauma Automatic Acceptance Tool

1. Pre intake CCS Motor Score 4 or Loss AND evidence from CT of Intracranial bleeding (any variant)?
2. Life threatening haemorrhage not amenable to control at Trauma Unit?
3. Successful resuscitative thoracotomy at Trauma Unit?

Patient fails automatic acceptance criteria for transfer to MTC.
- Call Ambulance Service on 000
- State "Time Critical Trauma Transfer"
- Inform Major Trauma Centre via 02380 796666
- State "Secondary Trauma Transfer"
- When prompted give ATMS7 summary of patient

Transfer patient to University Hospital Southampton. Go to Emergency Department where you will be met and accompanied to final destination where clinical handover will occur.

Where injuries exceed local capabilities, but do not trigger ‘Automatic Acceptance’ the Secondary Transfer Team (overleaf) should be used to identify appropriate specialty below. ‘Time Critical’ ambulance transfer might still be appropriate.
- Death Injury Neurosurgical SpR: 02300 777222 Bleep 2577
- Spinal Cord Injury Spinal Surgical SpR: 02300 777222 Bleep 2577
- Pelvic Injury Orthopaedic SpR: 02300 777222 Bleep 2762
- Limb Injury Refer to Orthopaedic secondary transfer protocol
- Burns Refer to Burns Protocol
- Thoracic Injury Cardiac Anaesthetist SpR: 02300 777222 Bleep 9211
- Liver Injury General Surgical SpR: 02300 777222 Bleep 9990

Where referring clinician is unable to obtain a response from the registrar, the relevant on call consultant should be contacted via the receiving hospital switchboard.

Age
- Time (Time of Incident)
- Mechanism
- Injuries Found (Head to toe)
- Sgrs (HR BP SpO2 GCS Pupils Temp)
- Treatment Given (including expected to arrive at door of MTC e.g. 12345)

Notes:
- All transfer decisions should be made at consultant level in the Trauma Unit.
- All cases where a consultant in the Trauma Unit believes the injuries are not survivable, or the patient would not be a candidate for multi organ support on grounds of co-morbidity, should be discussed with the relevant specialist team prior to transfer.
- In the Trauma Victim, haemodynamic stability may never be achieved until definitive management. Consider transfer despite instability if the source of instability cannot be managed locally.
- Call in MTC to be made by a senior clinician (ideally the team leader).
- If patient becomes unstable on route inform MTC (02380 796666). Request full Trauma Team activation and divert into resus room on arrival.
- Consider helicopter transfer in time critical transfer if helicopter appropriately trained accompanying personnel available.
- Ensure all imaging done at Trauma Unit is loaded onto EXOPACS including sagittal and coronal reformating of spinal CT imaging where applicable.
- Patients transferred due to brain injury should have full spinal immobilisation maintained in all cases.
South Central
Trauma centre location

Figure 1.4: UHS location in South Central

Figure 1.5: MTC links with South England

Emergency departments are not shown on the map, however they do form an integral part of the NHS South of England major trauma networks.
1.8 ATMIST Handover for secondary transfers

- More information is likely to be available for patients undergoing a secondary transfer from another trauma unit. As such there is a modified ATMIST handover sheet that should be used whenever there is a secondary transfer.

ATMIST Handover - TRAUMA SECONDARY TRANSFER ONLY

Calls should be received by an ED consultant if on duty. (A 60 second delay is acceptable to achieve this)

Date _____/_____/201____
Time ___:____ (24 Hour Clock)
Caller Name ______________________________   Consultant ☐ SAS/ST4+☐
Other Dr ☐ Nurse☐
Caller Contact Number (Mobile)
______________________________

Hospital __________________________________________________________________

Q: “Which of the 3 Automatic Acceptance Criteria Applies?”

1. Pre intubation GCS Motor Score of 4 or less and CT evidence of intracranial blood☐
2. Life Threatening Haemorrhage not amenable to control at Trauma Unit ☐
3. Successful Resuscititative Thoracotomy in Trauma Unit ☐

If ANY of the above applies then UHS will accept the patient (Regardless of bed states or other commitments). The following is then a handover only. Ask for all the information in the order below.

Patient Full Name:_________________________________________________________
Male ☐ Female☐   Hosp # (@above unit) ________________   DOB
_____/_____/19 ___
Age _________  If 15 or less ask caller to Redial PICU on 02380 775502
Time (Estimated to arrive at UHS ED) _____:_____ by Road □  Helicopter□
Mechanism: __________________________________________________________
Injuries: ____________________________________________________________

Signs:          HR _____       BP ___/___    SpO₂ ___%
                GCS (@ Scene of incident) E___V____M____
                GCS (Pre Intubation) E___V____M____
                Pupils R____ L_______  Temperature ______°C

Treatment @Trauma Unit:______________________________________________
____________________________________________________________________
____________________________________________________________________

Is the patient on Anticoagulants Y/N : If Yes have these been reversed? Y/N
Any other relevant information (e.g. Pre morbid state and Function, Significant
Past Medical History)
____________________________________________________________________

–
If transfer is for head injury (Criteria 1) Read the following: “When the patient
leaves your department, please call the neurosurgical registrar at UHS on
02380777222 bleep 2877 to give an updated ETA and to give any other back-
ground information which you have obtained”

Figure 1.6 ATMIST for Secondary Transfer
Actions after secondary transfer call

- Following a secondary transfer call the optimum response is to call a full Level 1 trauma call when the patient arrives. It is expected that these patients will have a management plan in place before arrival at UHS and should move swiftly from ED to their destination. In order to achieve this the following should occur:

- Actions after Secondary Transfer Call by ED Consultant; (ST4+ 0000-0800, Ed consultant on-call with 30 minutes response time)
  a. In all cases, put out tannoy call for ED Receptionist to come to your location. The receptionist will pre-register the patient and provide ED and UHS Medical Notes / ID Band prior to arrival

I. If Reason for Transfer is a pre-intubation GCS motor score of 4 or less and CT evidence of intracranial blood:

  a. 2222 call Neurosurgical registrar and Site manager to be Fast bleeped with message “Trauma Secondary Transfer, Contact Emergency Department”
  b. Neurosurgical registrar will call back on the Red Phone; Ask them to review images and confirm if they would like the patient taken to theatre or critical care bed in first instance. They must inform you of where the patient should go.
  c. It is the responsibility of the Neurosurgical SpR to activate the theatre team / Anaesthetist and to meet the patient upon arrival at final destination point.
  d. Brief site manager on arrival in ED. Site manager to arrange Level 3 Bed - Preference NICU > GICU > CICU. Site Manager to discuss with NICU Consultant regarding patient moves if NICU is full.
  e. Site Manager to ensure relevant ICU resident medical team and Neurosurgical registrar aware of location of bed if going direct to ICU.
f. ED Consultant and Site manager to “Receive patient”. Site manager responsible for ensuring transferring teams know where to go.

g. Involve relevant subspecialties (e.g. neurosurgery, cardiothoracics) if there are relevant injuries – ED consultant Responsibility

h. All patients should have UHS ID band attached and Hospital notes issued as they pass through the department as well as emergency bloods sent (FBC, Cross-match, U&E’s, Clotting, blood gas – arterial or venous)

II. If Reason for Transfer is Life threatening haemorrhage not amenable to control at Trauma Unit:

a. 2222 “Full Trauma Team Activation”

b. When Team arrive, brief that this is a secondary transfer, review imaging with relevant teams and plan for patient’s arrival. This may include activating Theatre or Interventional Radiology teams.

c. This patient will go to ED RESUS (with waiting trauma team) on arrival unless exact cause of haemorrhage known and time to prepare theatre/Interventional Radiology prior to arrival.

d. Any decision to Bypass ED RESUS is only to be made by a consultant team leader.

III. If Reason for Transfer is Successful resuscitative thoracotomy in Trauma Unit

a. 2222 Site Manager and Cardiothoracic (CTX) registrar (9211) to be Fast bleeped with “Trauma Secondary Transfer, Contact Emergency Department”
b. Instruct cardiothoracics to prepare to receive patient in relevant theatre (CTX registrar should inform consultant; activate theatres and anaesthetist/ perfusionist)

c. Brief site manager on arrival in ED. Site manager to arrange Level 3 Bed, Preference (Cardiac > General > Neuro)

d. ED Consultant and Site manager to “Receive patient”. Site manager responsible for ensuring transferring teams know where to go.

e. The initial destination in UHS (ED Resus versus cardiac/thoracic theatres may need to be decided on a case by case basis) by the TTL.

f. Other specialities to be involved if there are other significant injuries – ED consultant Responsibility

g. All patients should have ID band attached and Hospital notes issued as they pass through the department. Take emergency bloods as above)

Figure 1.7 UHS Secondary Transfer Acceptance form

Name of ED Consultant / Registrar completing the above
____________________________________

Name of Duty Site manager involved:
____________________________________

Initial Destination Point Agreed:
Neuro Theatre ☐ Direct to ICU ☐ Theatre ____________ Cardiac Theatre ☐

Time above Completed: ____:____ Arrival time of Patient: ____:____
Divert to Resus on Arrival as patient too unstable to go direct to Destination point ☐
Divert to Resus as no Final Destination arranged / Available yet ☐
(RISK EVENT; PLEASE COMPLETE RISK FORM)
Time Left ED ____:____
This form should be filed in the patients ED Notes.
## 1.9 Trauma team hot debrief

It is helpful for the trauma team leaders (ED consultant and MTC consultant) to debrief members of the trauma team as soon as is realistically possible. Any adverse clinical issues should be noted for raising at the M&M meeting and if necessary forwarded to the MTC Clinical Governance group. Equally, good practice should be highlighted.

<table>
<thead>
<tr>
<th>Area</th>
<th>Learning Points &amp; Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation prior to patient arrival</td>
<td></td>
</tr>
<tr>
<td>Team organisation</td>
<td></td>
</tr>
<tr>
<td>Clinical Plan</td>
<td></td>
</tr>
<tr>
<td>Investigations</td>
<td></td>
</tr>
<tr>
<td>Interventions</td>
<td></td>
</tr>
<tr>
<td>Patient Safety</td>
<td></td>
</tr>
<tr>
<td>Conflict Resolution</td>
<td></td>
</tr>
<tr>
<td>Documentation</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>Trauma Team Response – was the appropriate</td>
<td></td>
</tr>
</tbody>
</table>
### Figure 1.8 UHS Trauma team debrief form

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Attendees**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date &amp; Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 2  Trauma resuscitation: C-ABCDE

2.1 C: Immediate management of Catastrophic Haemorrhage

Introduction to Catastrophic Haemorrhage
In the event of catastrophic bleeding, control of haemorrhage takes precedence over other treatments as per CABC guidelines.

I. This is to be used in management of injuries that result in severe, life-threatening external haemorrhage, particularly from limbs or junctional areas of the body (i.e. axillae and groin). It is not designed for the use in situations where blood loss is limited and not life threatening, or easily controlled.

II. The pressure that has to be applied over a wound is significant and is best applied by pushing through the palm of the hand locking your elbows as you would for performing chest compressions in CPR. If pressure is insufficient kneeling on the wound using your body weight is an option.

III. In junctional areas applying traction to the limb might aid the application of pressure and haemorrhage control. Pressure should be applied ideally for 5 minutes to see if it takes effect.

IV. Consider logrolling if there is a penetrating injury

Direct digital pressure to the appropriate artery supplying a bleeding limb (axillary, femoral, brachial and political) may also be indicated in uncontrolled haemorrhage.

SOP Management of Catastrophic Haemorrhage

SOP for the Management of Catastrophic Haemorrhage

<table>
<thead>
<tr>
<th>Date</th>
<th>January 2011</th>
</tr>
</thead>
</table>
| Author     | Dr Nick Maskery  
Consultant in Emergency Medicine |
| Review Date| April 2012   |
| Distribution List | ED Doctors, ED Nurses |
| Related Documents | SUHT Trust Guideline Massive Transfusion Policy |

1. This SOP is to be used in management of injuries that result in severe, life-threatening external haemorrhage, particularly from limbs or junctional areas of the body (i.e. axillae and groin). It is not designed for the use in situations where blood loss is limited and not life threatening, or easily controlled.

2. In the event of catastrophic bleeding, control of haemorrhage takes precedence over other treatments as per ABC guidelines.

3. The following algorithm should be followed:

```
<table>
<thead>
<tr>
<th>Head/neck/junctional area</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Emergency Dressing&quot; and apply pressure</td>
</tr>
<tr>
<td>Haemorrhage not controlled</td>
</tr>
<tr>
<td>Celox gauze and redress. Apply pressure</td>
</tr>
<tr>
<td>Haemorrhage not controlled</td>
</tr>
<tr>
<td>Apply further dressings/pressure and seek help</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Emergency Dressing&quot; and apply pressure</td>
</tr>
<tr>
<td>Haemorrhage not controlled</td>
</tr>
<tr>
<td>Celox gauze and redress. Apply pressure</td>
</tr>
<tr>
<td>Haemorrhage not controlled</td>
</tr>
<tr>
<td>Stabilise dressing / tourniquet</td>
</tr>
<tr>
<td>Haemorrhage not controlled</td>
</tr>
<tr>
<td>Immediately life threatening or pupil pin area</td>
</tr>
</tbody>
</table>

Haemorrhage Controlled
```

Figure 2.1 Management of Catastrophic Haemorrhage
Haemostatic dressings: Celox gauze

- Celox™ is made with chitosan, a natural polysaccharide. It stops bleeding by binding with red blood cells. It does not set off the normal clotting cascade but rather just clots the blood that it comes into contact with. It works even in the presence of heparin or warfarin.
- Celox™ may have been applied pre-hospitaly.

**NOTE:** Do not remove the Celox™ unless you have the ability to control the bleeding.

**Application of Celox™**

Figure 2.2 Application of Celox Gauze and Figure 2.3 Celox Gauze
CAT Tourniquet

Figure 2.4: Examples of Tourniquets

Combat Application Tourniquet (CAT) tourniquet should be applied as low (distally) down the limb as possible. Time of application should be recorded in the notes, and ideally the patient should be marked with a “T” on the forehead, and the tourniquet time marked on the limb with permanent marker. The limb should not be covered (with blankets for example) to ensure that the tourniquet is obvious to any receiving teams. Usually the application of the tourniquet is a painful procedure, and analgesia should be given at the earliest opportunity, though this should **NOT** delay control of haemorrhage.

If bleeding is not controlled with the CAT a second CAT may be applied proximal to the first one.

Patients arriving with CAT’s already in situ by the ambulance staff and having ongoing distal bleeding should have the CAT adjusted as appropriate.

**NOTE:** Tourniquets applied with insufficient pressure can exacerbate the bleeding by restricting venous drainage but still allowing arterial inflow.

Further resuscitation should be given as required, referring to massive transfusion guidelines if required.
Tourniquets are an emergency treatment for catastrophic haemorrhage. There is still an overriding need to limit their time of application to as little as possible to reduce nerve, muscle and other soft tissue ischaemia. If ongoing use of tourniquet is definitively needed then consider changing to a formal pneumatic tourniquet (available from orthopaedic theatres).

**Code Red**

**Massive transfusion policy**

The Major Haemorrhage Protocol is intended to assist and guide all staff members involved at any stage of the transfusion process with patients that have major haemorrhage. **Code red** is the term used for the activation of the major haemorrhage protocol. This includes the use of a simple flowchart to guide the clinician to replace blood components and products to minimise bleeding. On page 49 is the UHS Adult Major Haemorrhage Protocol.

The latest version of the UHS massive transfusion policy can be found on the staffnet;  
http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/MajorHaemorrhageProtocol/MajorHaemorrhageProtocol.doc
ADULT MAJOR HAEMORRHAGE PROTOCOL: CODE RED

Suspected Major Haemorrhage

**Action**

- Commence resuscitation (warm fluids if possible) until blood available
- Send G+S to transfusion lab and **activate CODE RED** (ext 4620 or red phone)
  - Request Pack 1
- Allocate staff member/ **Code Red** practitioner to coordinate transfusion activity
- **Make plan to stop bleeding:**
  - on-call Surgeon (bleep 9990)
  - Endoscopist or Interventional Radiologist via switchboard
- Give Tranexamic acid 1g IV
- Ensure reversal of anti-coagulants:
  - Warfarin: Octaplex 30iu/kg + give Vit K 10mg IV
  - Heparin: Protamine
  - Clexane / Anti-platelet agents/ new oral anti-coagulants: discuss with Haematology

**Major Haemorrhage Pack 1**

- 6U Blood: O –ve from nearest fridge or type specific/cross matched blood from lab (dictated by urgency)
- 4U FFP: 40 mins thawing time (type AB until group specific available) or pre-thawed if available
- Inform blood bank of used stock to replace immediately

**Aims of Transfusion**

- Haemodynamic Stabilisation
- Hb > 80g/l
- Platelet count > 75x10^9/l
- (>150x10^9/l in CNS trauma)
- INR and APTT ratio <1.5
- Fibrinogen > 1.5
- iCa^2+ > 1.1 mmol/l
- Temp > 36°C
- pH > 7.2
- Lactate < 4 mmol/l

** Continued Haemorrhage **

Request Major Haemorrhage Pack 2

- 6U blood (O –ve until group/ type specific/cross matched blood available)
- 4U FFP
- 1U platelets
- 2U of cryoprecipitate
- Keep iCa^2+ above 1.1mmol/l with calcium chloride (starting adult dose 10ml of 10%)

** Alternate pack 1 & pack 2 until bleeding controlled**

- Discuss clinical situation with on-call Haematologist
- Consider use of Novoseven (rFVIIa) if no reversible surgical cause and the ‘aims of transfusion’ are achieved
- Consider 2nd dose of tranexamic acid

**Figure 2.5 UHS Major Haemorrhage Protocol**

For patients registered as ‘Unknown Unknown’: DO NOT update clinical details until bleeding risk stopped, the patient will need an urgent rpt G+S sent with updated details.
OCTAPLAS and FFP

Patients born after the 1st of January 1996

**NOTE:** Fresh frozen plasma (FFP) must not be transfused to patients born after 1 January 1996.

- Octaplas (virally inactivated FFP) must be administered instead. Contact the transfusion laboratory to order, or for advice, on ext 4620.

- If a patient born after 1 January 1996 requires cryoprecipitate Methylene Blue (MB), treated cryoprecipitate must be ordered.

- If your patient is an ‘unknown unknown’ (see section below) but you believe their birthday to be after this date then the lab needs to be informed when instigating a CODE RED.

- The rationale for this cut off date is that children born since 1996 are considered to have received minimal exposure to the BSE agent because of the effectiveness of the animal feed ban which was fully implemented from 1996 and the exclusion of animals above 30 months entering the food chain.

Pre-defrosted FFP

- As part of the UHS ‘Code Red’ or Massive Transfusion Protocol the use of pre-defrosted FFP has been initiated.

- FFP takes a minimum of 20 minutes to defrost and often longer, leading to significant delays in replacement of clotting factors. Pre-defrosted FFP allows us to give packed cells and FFP concurrently aiming to maintain coagulation homeostasis.
The lab defrosts 2 units FFP every 24 hours. For the first 12 hours this FFP is solely for the use of those where a CODE RED has been instigated. After that it will be issued on a rolling base whilst aiming to maintain 2 units defrosted. Pre-defrosted FFP is kept for 24 hours only as the clotting factor ability is diminished after this time.

UNKNOWN UNKNOWN PATIENTS
Procedure for ‘Unknown unknown’ patients and the registration of emergency patients requiring blood transfusion.

- A small number of the patients admitted as an emergency to UHSFT will be admitted in circumstances when their identity is not known or cannot be confirmed.

- Some of these patients inevitably require an immediate blood transfusion. A procedure already exists to register a patient on the Trust e-Camis Patient Administration System (PAS) with an ‘unknown’ identity by entering agreed parameters for demographic registration fields.

- However, when a patient registered in this way has begun or is likely to need a blood transfusion, any changes made to these registration details can introduce a delay in administering that transfusion.

- In order to avoid any potential delays in transfusion the alternative process involves the allocation to the patient of a temporary PAS registration (T number).

**NOTE:** This T number should be left in place and not merged until they have no risk of requiring immediate transfusion (typically 48 hours). This is to avoid a situation where there is a mismatch between the patient number and that of their initial Crossmatch sample.
A patient with incorrect details should also not have their details changed until they also have no risk of requiring transfusion. Before their details are changed, this must be discussed with a senior doctor in their care. A replacement Group & Save sample must be taken by the team immediately and labelled with the new ID details, prior to sending to the lab.

Managing Haemorrhage in patients refusing blood transfusion

Please follow the link below to the UHS Guideline ‘Adults who refuse blood transfusion in emergency circumstances’

Key principles:

- Stop bleeding and promote haemostasis – control external haemorrhage (celox, tourniquet, pelvic binder, splint fractures), maintain normothermia, give anti-fibrinolytics (tranexamic acid – 1st dose within 3 hours of injury, repeat dose at 8 hours and consider continuing treatment). Interventional radiology and surgery as appropriate – senior involvement, prompt decisions, meticulous technique. cell salvage

- Conserve blood and reduce oxygen consumption – careful blood sampling, use paediatric bottles where possible, avoid shivering, pain.

- Promote haemopoiesis – discuss with haematologist – may require iron, B12, folate, EPO

- Consider transfusing products which may be acceptable to the patient - Discuss with patient or use information from advance directives to see what clotting factors patient may be prepared to accept as there is considerable variation in beliefs. Specifically consider platelets, FFP, cryoprecipitate, prothrombin complex concentrates (octaplex/beriplex), fibrinogen concentrate, recombinant factor VIIa,

‘Good care for a bleeding patient who refuses blood transfusion is good care for everyone’
Diagram 4.8  UHS Guideline Trauma patients who decline blood 
(Draft)

PROTOCOL OVERVIEW: TRAUMA PATIENTS WHO DECLINE BLOOD: 1 of 2

1. Casualty Handling
   - General
     - Careful movement to avoid clot dislodging
     - Use vacuum mattress for movement to hospital
     - For small child: adult vacuum long leg splint
   - Pelvic Fracture
     - Bi-valve or scoop stretcher
     - Pelvic splint
   - Limbs
     - Early immobilisation
     - Traction Splint for femoral fractures

2. Local Bleeding Control
   - General
     - Direct pressure with a dressing or a pressure dressing (check frequently)
     - Don’t use thick dressing
   - Scalp
     - Use staples or rough sutures
   - Deep Wounds
     - Haemostatic dressing (e.g. Celox)
   - Limbs
     - Consider tourniquets

   For all bleeding (or at risk of bleeding) patients, use Tranexamic Acid (Cyklokapron) within 3 hours of injury (preferably within 1 hour – the earlier the more effective). Doseage: loading dose of 1g infused over 10 minutes. Further 1g intravenous maintenance dose over 8 hours.

3. Haemostatic Resuscitation
   - Crystallloid bolus (250 mL) in patients suspected of bleeding and with absent peripheral pulse. However,
   - Consider low volume resuscitation. Target systolic blood pressure of 80 to 100 mmHg until major bleeding has stopped in initial phase following trauma without brain injury (Grade 1C)

4. Coagulation Control
   - Early involvement of haematologist
   - Early test for coagulopathy (include fibrinogen test)
   - Use thromboelastometry for full haemostasis testing
   - Coagulation Factor Concentrates:
     - Low fibrinogen: use fibrinogen concentrate (Fibrogel)
     - Protamine:
     - Prothrombin Complex Concentrate (Beriplex or Octaplex)
     - fVIIa (NovoSeven)
   - Avoid hypothermia – re-warm patient if necessary to avoid impairment of coagulation function

5. Early Investigation
   - CT pan scan within 30 minutes
   - Early radiological investigation?
   - Early transfer to trauma centre?

6. Definitive Trauma Care
   - Early interventional radiology may obviate need for surgery
   - Damage control surgery, using cell salvage* (with leukocyte depletion filters wherever possible)
   - Haematology – high dose erythropoietin therapy (e.g. Epovor) with IV iron, Vitamin B12 and folate acid

   * These products and procedures are a matter of individual patient choice for Jehovah’s Witnesses

Dr Andy Eynon
Dr Simon Hughes
Dr Elizabeth Shewry

Version 1

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Pre-Hospital blood Transfusion

- The Hampshire and Isle of Wight Air Ambulance, Thames Valley Air Ambulance, and Kent, Surrey and Sussex Air Ambulances carry a minimum of 2 units of O negative blood for pre-hospital patients requiring emergency transfusion.

- Patients receiving pre-hospital blood should be clearly documented by the pre-hospital team and this information handed over to the ED team leader on arrival at hospital.

- Those arriving at UHS via HIOWAA will be issued with a UHS T number (‘unknown unknown’ patient) in the pre-hospital environment.

- As with all T numbers their details must not be change until there is no risk they will require further transfusion.

Patients who have received prehospital blood may still be significantly hypovolaemic. However it is possible that their Haemoglobin may appear normal or even elevated.

This does not necessarily mean that they have been adequately resuscitated-

- Consider administering FFP (or Octaplas as appropriate) as the first resuscitation fluid.

- Aim for Hb of around 100 g/L.

- Include Base Excess and Lactate from blood gas results in your assessment of fluid resuscitation.
Belmont Rapid Infuser

The Belmont rapid infuser is utilised when large volumes of blood need to be given quickly. Training in the device must be undertaken before its use.

**NOTE:** That this is an extremely powerful rapid transfuser. Left unchecked it can deliver huge volumes of blood/fluids within an extremely short period of time.

The default is to administer repeated boluses (e.g. 300 ml) with regular reassessment of the patient. The CODE RED nurse will be in charge of the Belmont and is also responsible for ensuring an accurate running total of the volume and type of fluids / blood products administered. They should regularly liaise with the Anaesthetist and Team Leader as to ongoing requirements.

The benefits of the Belmont include the ability to transfuse when disconnected from a power source. The Belmont will not heat fluids whilst running on battery power and the rate will be reduced to 50ml/minute.

The x-ray lift if used to transport from ED to theatres may allow the Belmont to be plugged in briefly during transfer.

The Belmont should be plugged in when not transported to ensure the battery is charged when required.

**Figure 2.6 Belmont Rapid Infusor**
Tranexamic acid (TXA)

Introduction

- Tranexamic acid is an anti-fibrinolytic that has been shown in major trials (CRASH2) to improve survival from major trauma. It is thought that it also exerts its beneficial role via an anti-inflammatory role and limiting Trauma induced coagulopathy.
- Tranexamic acid should be prescribed to all trauma patients with suspected major haemorrhage. There is a target to administer TXA to all patients who might require blood products within 6 hours of admission.
- Ideally it should be given within 3 hours of injury as this is where the CRASH2 trial showed the most survival benefit. Paramedics carry TXA and may administer it prehospitaly. This will be recorded on their patient report form (PRF) as well as stated in the handover.

Guide to administration

- Tranexamic Acid comes in 100mg/ml in 5ml vials (500mgs) –
  - It is stored in Drug Cupboard Two – ED Resus (Blue Dot on the Door)
    - **Adults**
      Dose: 1000mg (10mls = two vials). Dilute to 20ml by adding 10mls of sodium chloride 0.9%. Administer by a slow IV push.
    - **Children**
      Dose: 15mg per kg diluted to 20 ml by adding sodium chloride 0.9%. Administer by a slow IV push.

A second dose of 1g TXA can be administered if there is concern re significant ongoing bleeding. CRASH2 administered this as an infusion over 8 hours. Local practice is often to administer it as a repeated bolus.
Traumatic Cardiac Arrest

- Survival rates from traumatic cardiac arrest are extremely poor (especially resulting from blunt trauma). The below SOP aims to rationalise treatment into a simple algorithm and also to place appropriate limits on which patients should receive resuscitative thoracotomy.

NOTE: Patients most likely to survive are where the traumatic cardiac arrest is due to tension pneumothorax or from cardiac tamponade (e.g. resulting from cardiac stab wound).

- Consideration should be given to debriefing the team and providing welfare support to members of the team participating in thoracotomy, particularly where unsuccessful, as the procedure can appear dramatic and some team members may be unprepared for such events.

- On page 49 is the UHS SOP for Traumatic Cardiac Arrest and page 60 onwards the Procedure for Resuscitative Thoracotomy in the Emergency Department.
UHS Adult Major Trauma Guidelines 2014

UHS SOP Traumatic Cardiac Arrest

Traumatic Cardiac Arrest Guideline

- Confirm traumatic cause of arrest
- ECG monitoring & defibrillation as appropriate
- Start chest compressions*

Penetrating trauma with loss of vital signs <15 min OR Blunt trauma with loss of vital signs in ED

Simultaneous Interventions:
- Chest compressions need to be paused
- Endotracheal intubation & IPPV
- Bilateral thoracostomies (injured side first)
- Haemorrhage control, large access, code red

ROSIC

- Yes: Secure airway & anaesthesia
- Transfer to theatre/CT

Evidence of cardiac output:
- Myocardial activity on USS or ETCO2 trace

- Yes: Assess cardiac output
- Continue massive transfusion protocol
- Damage control intervention/surgery

- No: Stop

Preparation
- Fast bleep CTS spkr on 9211
- Team brief/mission rehearsal
- Inline pelvic with O neg blood
- Prepare thoracotomy set

1. Bilateral thoracostomies (injured side first)
2. If no ROSC continue to Resuscitative thoracotomy
3. Aims:
   - Treat cardiac tamponade
   - Aortic compression
   - Hilar techniques

*Interventions take priority over chest compressions.

Dr Nitin Jagasia
Version 1. Sept 2013

Figure 2.7 UHS SOP Resuscitative Thoracotony
Procedure for Resuscitative Thoracotomy in ED

- Request the ED thoracotomy set (A4 sized clear Tupperware box kept in ED Resus). Contents:

  1. pair of large shears
  2. pairs of trauma scissors
  1. suture set
  1. foley catheter
  3. 3/0 vicryl sutures
  2. wound staples
  2. 10 blade staples
  1. large artery forceps

- The procedure is carried out immediately within the emergency department, by the major trauma team. Call for the cardiothoracic registrar (fast bleep 9211) and consultant to attend. If the procedure is successful then the surgical team will be integral to continued care.

- Intubation, ventilation, intravenous/intra-osseous access, should be performed by members of the trauma team and not delay the thoracotomy.

- Time should not be wasted on full asepsis but a rapid application of skin preparation such as 2% chlorhexidine/70% alcohol preparation can be used.

- Using a scalpel and blunt forceps make bilateral thoracostomies (breaching the intercostal muscles and parietal pleura) in the 5th intercostal space in the mid-axillary line.

- The procedure is stopped at this point if tension pneumothorax is decompressed and cardiac output returns.

- Connect the thoracostomies with a deep skin incision following the 5th intercostal space (figure 2.8). Ensure the incision extends posteriorly bilaterally to the posterior axillary line – this allows adequate access when opening the clamshell. A skin incision following the 5th intercostal space is made between the posterior axillary lines.
• Insert two fingers into a thoracostomy to hold the lung out of the way while cutting through all layers of the intercostal muscles and pleura towards the sternum using heavy scissors following the skin incision previously made. Perform this on left and right sides leaving only a sternal bridge between the two anterolateral thoracostomies.

• Cut through the sternum or xiphoid using the heavy scissors.

• Open the “clam shell” using one or two gloved assistants. If exposure is inadequate the incisions need to be extended posteriorly.

Aims of Resuscitative thoracotomy

1. Treat cardiac tamponade

• The pericardium is opened longitudinally to avoid damage to the phrenic nerve, which runs along its lateral border. Make a small incision in the pericardium with scissors and then tear the pericardium longitudinally with your fingers - this will avoid lacerating the phrenic nerve. Evacuate any blood and clot from the pericardial cavity. Deliver the heart out of the pericardium.
• Cardiac wounds should be controlled initially with direct finger pressure. Large wounds may be controlled temporarily by the insertion of a Foley catheter with inflation of the balloon. Take care also not to miss posterior cardiac wounds. Examination of the posterior surface of the heart requires displacing it anteriorly, which may obstruct venous inflow.

• Wounds can be directly sutured using non-absorbable 3/0 sutures such as nylon or polypropene. Bypass is unnecessary, even in the beating heart. With wounds in the region of the coronary vessels, mattress sutures are used to avoid obstructing coronary flow. Atrial wounds are sutured using a continuous technique.

2. Descending aorta compression

• The rationale for clamping the aorta is to redistribute blood flow to the coronary vessels, lungs and brain, to reduce exsanguination from injuries in the lower torso.

• Clamp time should ideally be 30 minutes or less.

• Cross-clamping of the descending thoracic aorta should possibly be reserved for patients with potential exsanguinating injuries to the distal torso.

3. Hilar techniques

• Massive haemorrhage from the lung or pulmonary hilum can be temporarily controlled with finger pressure at the pulmonary hilum. This may be augmented by placement of a Satinsky clamp across the hilum. An alternative is to tie off the pulmonary hilum using tracheal tube tie or tape from a laparotomy pack.
2.2 A: Airway

Introduction

Emergency anaesthesia and advanced airway management are frequently required in the Emergency Department for major trauma patients. The 1783 bleep holder provides this cover and is either a consultant anaesthetist or senior anaesthetic trainee.

Securing the airway in these patients can be challenging. The anaesthetist is working under a time pressure, in a remote and unfamiliar area with patients who typically have their cervical spines immobilised. The patient may be combative and have facial, laryngeal or thoracic injuries.

Following a protocol for RSI in these patients is likely to reduce the risk of complications, improve success and improve the trauma team performance, as has been shown using similar protocols in other large Trauma centres\(^1,2\).

Please follow this link for the complete and current guideline on Airway management in Major Trauma-

Trauma airway algorithm (see appendix 2.1)

Services using similar algorithms in pre-hospital care have no recorded cases of patients dying as a result of failed airway management after induction of anaesthesia\(^1\).

Generally there are two groups of patients who require drug assisted intubation:

1. Patients who require emergent and life saving intubation.
2. Patients in whom intubation may be delayed for a short period to allow controlled and careful preparation for the procedure.

The pre-RSI challenge response checklist allows the preparation of equipment and drugs prior to either of the scenarios above (see appendix B). Training should prepare the anaesthetist and anaesthetic practitioner for either situation.

### Indications for RSI

1. Actual or impending airway compromise
2. Ventilatory failure
3. Reduced GCS (< 9 or above this but progressively falling)
4. Humanitarian indications, e.g. severe burns, traumatic amputation
5. Combative or agitated patients, particularly after traumatic brain injury
6. Anticipated clinical course requiring intubation (e.g. Trauma CT or likely ICU or theatre destination)

- The decision to anaesthetise patients should be made on the basis of a risk benefit assessment in every case. The anaesthetist is the airway expert in the trauma team and is usually best placed to make the decision to intubate the patient; however it is important that decisions are channeled via the trauma team leader.
Roles and Responsibilities

The anaesthetic major trauma group: Dr Carin Dear, Dr Simon Hughes, Dr Craig Pope, Dr Elizabeth Shewry, Dr Suzie Kellett and Dr Erica Dibb-Fuller hold the 1783 bleep from Monday-Friday 08:00-18:00. This team is also responsible for the dissemination of information and education relating to airway management in major trauma patients for anaesthetists, intensivists, anaesthetic practitioners, intensive care technicians and ED staff.

i. Major Trauma anaesthetist (bleep 1783)

This is a senior anaesthetist, either a consultant or an experienced trainee that is available to respond to level one trauma calls. They will provide airway management and analgesia depending on the patient’s needs. They assist in the co-ordination of the patient’s care from the trauma call in ED through to radiology and onwards to the destination of their care (intensive care unit, operating theatres or interventional radiology). The ED team leader can request the anaesthetist to attend level two trauma calls if required.

ii. Trauma anaesthetic practitioner (bleep 1784)

This is an experienced anaesthetic practitioner e.g. ODP or an ICU technician that has been orientated to the ED department and is familiar with the principles of managing a major trauma patient. They are available to respond immediately and assist the Anaesthetist. See the trauma anaesthetic practitioner SOP for more details. One of their key duties is the daily check of the adult airway trolleys (Appendix 2.2)
Drugs for the Major Trauma RSI

- The anaesthetist should use the drugs that he/she is most familiar with, however particular caution with doses needs to be taken with hypovolaemic patients. A suggested regime is outlined below.

- There are two different drug packs which the ED nurses will pass to the anaesthetist or anaesthetic practitioner; one for the controlled drugs and induction agents (red/blue – kept in ED Resus Controlled Drugs cupboard) and the other (yellow – kept in ED new Resus Fridge) for muscle relaxants, vasoconstrictors and hypertonic saline, see appendix 2.3.

Figure 2.9 ED Drug packs
Induction agents

- A combination of fentanyl / ketamine / rocuronium should be used because of their relative haemodynamic stability, excellent analgesia and larger therapeutic window. Note however that young fit patients with significant polytrauma may present with compensated shock, which maybe unmasked on induction particularly with injudicious usage of propofol or thiopentone.

- There is a caveat to this for trauma patients with an isolated head injury and thiopentone is used as the induction agent instead of ketamine. It is the gold standard for abolition of seizures, provides cerebral protection from ischaemia and reduces cerebral metabolic rate.

- Rocuronium has a rapid onset and a long duration of action and can be rapidly reversed by the administration of 16 mg/kg of sugammadex. Three vials of sugammadex are kept in the ED resus drug cupboard (this is sufficient to reverse a 95 kg patient).

Suggested induction and sedation agent dosing

A - RSI for shocked, hypovolaemic trauma patients
Fentanyl / Ketamine / Rocuronium “1:1:1 rule”
Fentanyl 1 mcg/kg
Ketamine 1 mg/kg
Rocuronium 1 mg/kg or Suxamethonium 1 mg/kg

B - RSI for haemodynamically stable trauma patients
Fentanyl / Ketamine / Rocuronium “3:2:1 rule”
Fentanyl 3 mcg/kg
Ketamine 2 mg/kg
Rocuronium 1 mg/kg or Suxamethonium 1 mg/kg
C – **RSI for trauma patients with an isolated head injury**

Fentanyl / Thiopentone / Rocuronium

Fentanyl 2 mcg/kg

Thiopentone 3-5 mg/kg

Rocuronium 1 mg/kg

**Ongoing sedation and anaesthesia**

- Following intubation it is imperative to commence ongoing anaesthesia. Typically this is with a propofol infusion with additional boluses of fentanyl. Alternatively dual infusions of morphine and midazolam are possible. If there is cardiovascular instability considering intermittent small boluses of ketamine to maintain sedation.

- Ketamine with midazolam or fentanyl is used for procedural sedation and analgesia. Sedating non-starved trauma patients should be considered very carefully with regard to risk and polypharmacy may be particularly risky.

**Combative trauma patients**

- Combative major trauma patients present a challenging scenario to the anaesthetist and the trauma team, especially if a head and/or spinal injury is suspected from the mechanism of injury. A sedative dose of intramuscular ketamine can be used to gain control, secure intravenous access and allow time for preparation and pre-oxygenation prior to the trauma RSI whilst airway patency, adequate ventilation and haemodynamic stability is maintained.

**IV administration of Ketamine:**

- For analgesia / sedation titrate to effect in 10 – 20 mg boluses, or give half the calculated dose and follow up with titration to effect
For anaesthesia give a single bolus of the pre-calculated dose, 1 mg/kg for shocked patients and 2 mg /kg for stable patients

**IM administration of Ketamine:**

- Typically this is the only time the 100mg/ml preparation is used.
- Use any large muscle mass is suitable for IM injection of Ketamine, i.e. deltoid or quadriceps
- Rub the area vigorously after injection to aid absorption and onset of action

**Ketamine – NOTE DIFFERENT STRENGTHS OF KETAMINE**

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<thead>
<tr>
<th></th>
<th>Analgesia</th>
<th>Sedation</th>
<th>Anaesthesia</th>
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<tbody>
<tr>
<td>IV (10 mg/ml)</td>
<td>0.1 – 0.5 mg/kg</td>
<td>0.5 – 1 mg/kg</td>
<td>1 – 2 mg/kg</td>
</tr>
<tr>
<td>IM (100 mg/ml)</td>
<td>1 – 2 mg/kg</td>
<td>3 – 5 mg/kg</td>
<td>10 mg/kg</td>
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**Oxygen therapy**

Data from the NCEPOD study, ‘Trauma, who cares?’ indicate that <80% of patients sustaining major trauma have oxygen applied in the pre-hospital stages.

**Figure 2.10**

**Oxygen in Major Trauma**
Major Trauma Airway Algorithm


- **Team organisation:**
  Roles should have been pre-allocated prior to the patient’s arrival. Keep noise to a minimum.

- **Access to the patient**
  Establish 360 degree access to the patient. If required move the trolley slightly or instruct team members not directly involved in the RSI to momentarily step away from the patient. Do not attempt intubation or RSI without gaining situational awareness and team cooperation. The ODP should stand to the right of the patient as is standard in the anesthetic room. The Trauma Team Leader (TTL) should call for silence from the rest of the team during RSI. The anaesthetist is responsible for continually communicating their plan and any difficulties to the TTL.

- **Tension pneumothorax**
  Anticipate the rapid development of a tension pneumothorax after intubation in patients with chest injuries. A small simple pneumothorax may rapidly expand upon commencing positive pressure ventilation (PPV). Alert the team leader of this risk in advance and instruct them to prepare a team member to perform immediate thoracostomies. Transthoracic ultrasound may be used to confirm the diagnosis.

- **Confirm full monitoring** is in place and functioning according to the Association of Anaesthetists of Great Britain and Ireland guidelines. Note baseline observations, including pupil diameters and light reflexes, GCS and
presence of movement in all four limbs PRIOR to RSI. End tidal CO₂ monitoring MUST be functioning and attached.

- **Preparation for the RSI**
  Everything should be aimed at optimising the first attempt at intubation. The ODP will provide the standard lay-out of equipment (first drawer of the adult airway trolley) and have the difficult airway trolley immediately available. Before commencing induction, the anaesthetist and ODP should rapidly ‘talk through’ the procedure, performing the pre-RSI challenge-response checklist (see appendix 2) whilst the patient is being pre-oxygenated.

- Allocate *manual in-line cervical spine stabilisation* to a Team Member (most easily performed with this team member standing from the below the patients neck) and when this is in place remove the neck blocks and release the Cervical Spine collar for the intubation. The default is that cricoid pressure is applied and this must be performed by the trauma anaesthetic practitioner. Consider avoiding cricoid pressure where there is a strong suspicion of cervical spinal injury.

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**Figure 2.11 ED Airway Trolleys**

- **Adult airway trolley** - one in each bay of ED resus room
- **Plan A + B drawers** - Airway equipment required for the trauma airway algorithm
- **Circulation drawer** - Arterial line pack, trauma line (8.5fr swann introducer) and CVP line pack
- ‘**Extras**’ drawer - Hudson masks, suction tubing, stethoscope, single transducer pressure kit and pressure bag
**Induction:**

Administer predetermined doses of induction agents. C-spine immobilization worsens the laryngoscopy view therefore intubation should always be performed with the assistance of a bougie. Endotracheal tube position must be confirmed by the following: continuous capnography (ESSENTIAL), direct vision (tube seen passing through cords), and auscultation in both axillae and over the stomach. As a backup colorimetric capnography via the Easycap is available in the adult airway trolley.

**Time to desaturate:**

It is helpful for the ODP to give time prompts to the anaesthetist (10, 20, 30 seconds) to assist the anaesthetist with time managing attempts at intubation, as well as verbalising the SaO₂ reading. The anaesthetist should stop laryngoscopy and re-oxygenate the patient if significant desaturation occurs or 30 seconds elapses.

**Pre RSI sedation**

In agitated patients it may be necessary to use small amounts of sedation to facilitate pre-oxygenation and compliance whilst preparing for the RSI. Small doses (1- 2mg of midazolam +/- 10 – 20 mg of ketamine) can be titrated to effect. Use with extreme caution in hypovolaemic or hypoxic patients. Ketamine boluses (10 -20 mgs titrated to affect) can also be used for analgesia prior to intubation.
Failed first attempt at intubation

- The iGEL LMA is the default device for re-oxygenation and ventilation following a failed intubation attempt. This device reduces gastric inflation and subsequent aspiration. The iGEL LMA and standard LMAs are recommended by the Difficult Airway Society as the first line management to achieve ventilation after failed laryngoscopy\(^4\). iGel LMA’s are successful in the majority of patients. However standard LMA’s with inflatable cuffs are available on the ED difficult airway trolley (kept in the old part of ED Resus).

- Only once re-oxygenation has been achieved can a second attempt at intubation be performed. Always consider use of the C-MAC Videolaryngoscope (often requires the use of a stylet to direct the endotracheal tube) or the Airtraq. Anaesthetists must ensure they have received appropriate training before using these. Videolaryngoscopes (VL’s) - e.g. C-Mac and indirect laryngoscopes (e.g. Airtraq) offer an alternative to standard direct laryngoscopy (DL). There is data which suggests they offer an improved view of the major trauma patient larynx, with better maintenance of cervical immobilisation than DL.

Can’t intubate, can ventilate

- If the second attempt at intubation with the C-MAC VL or Airtraq is unsuccessful then attempt to maintain oxygenation and ventilation with the iGEL LMA until further help arrives. If anatomy / pathology of the neck suggest that a surgical airway will be difficult or the anaesthetist decides that the risks of a surgical airway outweigh the possible benefits, then the iGEL LMA should be left in place.

Can’t intubate, can’t ventilate

- If oxygenation and ventilation via the iGEL LMA fails or bleeding in the airway / soiling of the airway prevents adequate airway protection by the LMA, a surgical airway must be performed.
Intubating via the iGEL LMA

- The iGEL LMA has been chosen instead of a standard LMA because even with adequate muscle relaxation, many major trauma patients require relatively high airway pressures. This device has been demonstrated to leak at higher airway pressures than first generation LMAs.

- An attempt can be made to pass a bougie through the larynx via the iGEL. If the bougie is successfully passed into the trachea a cuffed ETT can be railroaded over the bougie once the iGEL is removed.

- DO NOT HAVE REPEATED ATTEMPTS AT THIS as significant airway trauma can result.

Surgical Cricothyroidotomy

- The fourth national audit project (NAP4) data showed a needle cricothyroidotomy failure rate of approximately 60%, whereas a surgical technique for emergency cricothyroidotomy was almost universally successful\(^3\). Common errors were a lack of ‘planning for failure’ and poor performance in ‘can’t intubate can’t ventilate’ (CICV) situations, despite clear guidelines from the Difficult Airway Society\(^4\).

- This airway guideline details a simple 3-step algorithm with surgical cricothyroidotomy as the final airway rescue technique. Substantial prehospital data showed consistent success for the conduct of anaesthesia and the RSI with a similar algorithm\(^1\), including surgical airway for failed intubation (surgical airway rate of around 2%: half after failed intubation and half as many deliberate primary procedures).

- Naturally this is a high stakes manoeuvre with significant risks both with action and inaction. The Major Trauma Anaesthetic Group offers training to the entire department on this.

NOTE: Needle cricothyroidotomy is now widely recognized as an inappropriate technique for the major trauma setting.
**Surgical Cricothyroidotomy**

A scalpel blade is inserted horizontally into the cricoid membrane using a “stab / rocking” technique.

Leaving the blade in position, the tips of the small curved artery forceps are pushed into the airway incision on either side of the blade and opened.

The scalpel blade is removed and the artery forceps are rotated down through 90 degrees in order to dilate the wound in the horizontal plane.

A lubricated intubating bougie is inserted into the trachea and the artery forceps removed.

A 6.0 mmuffed tracheal tube is then railroaded over the bougie with a rotating / screwing motion and the bevel of the ETT facing posteriorly to aid passage over the bougie.

Once the ETT is inserted approximately 10 cm, the bougie is removed and the cuff inflated.

Tube position is confirmed by capnography and auscultation. The tube is then secured in position with elastoplast and the proximal end taped to the jaw to aid stability.

The whole procedure should only take around 30 seconds.

A purse-string suture can be placed into the skin and pulled tight around the ETT to tamponade any bleeding from the wound and to further secure the tube.

Conversion to a formal surgical airway is required once ENT or Maxillo-facial teams are available and at an appropriate point in the patients course.
IN ED Resus the surgical cricothyroidotomy equipment is present in the airway trolley (2\textsuperscript{nd} drawer) and its use should be anticipated in the following circumstances:

- Facial or upper airway trauma
- Difficult anatomy
- Burns to face and neck precluding jaw movement
- Inhalational burns

**NOTE:** The ENT registrar bleep for emergencies is 1973

**Airway references**

http://www.uk-hems.co.uk/ukhemssops.html (accessed 16/1/13)


http://www.das.uk.com/guidelines/cvci.html (accessed 16/1/13)

APPENDIX 2.1– TRAUMA AIRWAY ALGORITHM

Please follow this link for the current guideline

**Trauma Airway Algorithm**

**Pre-oxygenate**

Pre-RSI checklist → *immediate RSI checklist for urgent airway management*

- Document baseline BP, HR, SpO₂, Pupils / GCS + moving all 4 limbs
- Calculate Fentanyl / Ketamine / Rocuronium doses

**Plan A: Cuffed Endotracheal Tube**

1) Direct Laryngoscopy → Bougie → ETT
   - If difficulty anticipated or encountered
2) Indirect Laryngoscopy with C-MAC VL → Bougie / Stylet → ETT
   - *If unable to intubate, call 30 sec drill + proceed to Plan B*

**Plan B: iGEL LMA**

- Confirm EtCO₂, good seal and chest rise with ventilation
  - If adequate Oxygenation & Ventilation → consider 2nd attempt at plan A
  - If intubation unsuccessful → Proceed with iGEL or consider elective crico
  - If no EtCO₂ or unable to ventilate with iGEL → BVM with OP+/ NP airway
  - **If unable to Oxygenate & Ventilate**
    - → call 30 sec drill + Proceed to Plan C without delay

**Plan C: Rescue Airway**

- Check anatomy, communicate plan clearly to team
- Surgical Cricothyroidotomy

---

*Authors: Anaesthetic Trauma Group*  
*Review: June 2013*
**UHS Anaesthetic Department – Trauma Group**

**Trauma pre-RSI challenge-response check list**

Note: This checklist is for stable patients. Time should not be wasted on agonal patients who require precipitant RSI, where pre-oxygenation and performing the full checklist may not be possible – see reverse side for immediate RSI Checklist.

**Indication for RSI - confirm RSI required and trauma team leader informed**

**Pre-oxygenation**
- Oxygen mask on tight & reservoir bag moving with ventilation **Check**
- Tubing attached to Oxygen on high flow **Check**
- BVM / Waters circuit available and attached to O2 **Check**
- Mask size checked and correct **Check**
- Sidestream EtCO2 attached to monitor and working **Check**

**Airway**
- Tube size ‘x’ **size ‘x’ Check**
- Tube cuff tested, correct length & connector secure **Check**
- Syringe for cuff **Check**
- Alternate tube size ‘x’ **size ‘x’ Check**
- Bougie **Check**
- Tube tie **Check**
- Catheter mount **Check**
- HME Filter **Check**
- Sidestream EtCO2 connected to HME **Check**

**Laryngoscopes**
- Mac 3/4 ‘x’ & bulb working **Check**
- C-MAC D-blade & light/screen working **Check**
- Stylet preformed for D-blade **Check**
- OP + NP airways **Check**
- iGEL LMA size ‘x’ **size ‘x’ Check**
- Airtraq size ‘x’ **size ‘x’ Check**
- Difficult airway trolley available **Check**

**IV / Drugs**
- Cannula connected to fluid and run easily **Check**
- Spare cannula in situ **Check**
- Induction: Fentanyl / Ketamine / Roc 3:2:1 – calculate doses **Check**
- Other drugs: Propofol infusion / Phenytoine / Morphine / HTS **Check**
- Suction working and positioned **Check**
- In-line immobiliser briefed **Check**
- Cricoid pressure person briefed **Check**
- Baseline BP, HR, SpO2 noted **Check**
- Pupils Sizes + all 4 limbs moving? **Check**

V2 Sept 2012  Anaesthesia Trauma Group  Review date: June 2013
### IMMEDIATE RSI Checklist

NB - Only to be used for patients requiring immediate definitive airway, where pre-oxygenation is NOT feasible.

**Indication** - confirm immediate RSI required and trauma team leader informed

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<tbody>
<tr>
<td><strong>Oxygen + Ventilation</strong></td>
<td></td>
</tr>
<tr>
<td>BVM or Waters circuit attached to high flow Oxygen</td>
<td>Check</td>
</tr>
<tr>
<td><strong>ETT size ‘x’</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Bougie</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>iGEL size ‘x’</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Difficult airway trolley</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Suction</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>IV in-situ and flushed</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Drugs</strong></td>
<td></td>
</tr>
<tr>
<td>Fentanyl / Ketamine / Rocuronium</td>
<td>Check</td>
</tr>
<tr>
<td>Dose: 3:2:1 or 1:1:1?</td>
<td>Check</td>
</tr>
<tr>
<td><strong>EtCO₂</strong></td>
<td></td>
</tr>
<tr>
<td>Sidestream EtCO₂ connected + working or “Easicap”</td>
<td>Check</td>
</tr>
<tr>
<td><strong>BP, HR and SpO₂?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Pupils – HTS required?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Tension - Immediate thoracostomies required after RSI?</strong></td>
<td>Check</td>
</tr>
<tr>
<td><strong>In-line immobilisation</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td><strong>Cricoid pressure</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
</tbody>
</table>

V2 Sept 2012  Anaesthesia Trauma Group  Review date: June 2013
APPENDIX 2.2

Anaesthetic Adult Trauma Bay Checklist

Note: This checklist is to be completed prior to the arrival of the trauma patient and should be performed in a challenge-response manner by ED Nurses and ODP. All crosses should then be re-checked once equipment gathered.

“Back” shelf

<table>
<thead>
<tr>
<th>Item</th>
<th>✔</th>
<th>✗</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-rebreathing Oxygen mask</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>BVM with appropriate sized mask available</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Waters circuit available</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Suction tubing + Adult Yankauer + tested</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Monitoring: ECG cable, BP cuffs, SaO2 probe, EtCO$_2$ line (monitor)</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Oxylog 3000 with ventilation tubing [adult (clear) / paed (blue)]</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

- Anaesthetic Trolley top surface to be kept completely clear and clean at ALL times

1st drawer- PLAN A

<table>
<thead>
<tr>
<th>Item</th>
<th>✔</th>
<th>✗</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face masks- size 4 and 5</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>ETT sizes 6,7,8</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>10 ml Syringe for cuff</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Catheter mount + HME filter</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Tube tie</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Laryngoscope handles x 2 with batteries</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Laryngoscope blades: Mac 3, Mac 4</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Sachets of KY gel x 4</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Gauze swabs</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>OP airways: green, orange, red</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>NP airways: sizes 6, 7</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Roll of tape – inch pink x 1, transpore x 1</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Scissors x1</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>
### 2nd drawer – PLAN B

<table>
<thead>
<tr>
<th>Item</th>
<th>✓</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult McGill's forceps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stylet</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>EtCO$_2$ sidestream sampling sets x 2 (Propaq nasal, COETT)</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Easicap</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>lGEL LMA: sizes 3, 4, 5</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Surgical Crico kit: 6.0 ETT, Scalpel 22, small curved artery forceps</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

### 3rd drawer – CIRCULATION

<table>
<thead>
<tr>
<th>Item</th>
<th>✓</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterile gloves; size 6, 7, 8</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Paed CVC insertion pack x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Chloraprep sticks x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Art lines: Radial arterial pack x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Jelco 20 G x 4</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Leadercath 20 G short x 1, 20 G long x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>CVC: Quad lumen CVP line x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>“Trauma line” (Swann-introducer set) x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Jelco 14 G x 2, 16 G x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Abbocath 14G long x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Silk 2.0 suture with straight needle x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>3-way tap with short extension x 2</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

### 4th drawer – EXTRA KIT

<table>
<thead>
<tr>
<th>Item</th>
<th>✓</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure monitoring set (single) x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>500 ml Pressure bag x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>0.9% sodium chloride 500ml bag x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Temperature probe x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Stethoscope x 1</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Spare suction tubing x 1 and Yankauers x 2</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

### Side of trolley

<table>
<thead>
<tr>
<th>Item</th>
<th>✓</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bougies: sizes 15 x 2</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Soft Suction catheters: Orange x 3, green x3</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>
Drip stand / IV infusion

500 ml warmed Saline with giving set run through  √  X
500 ml pressure bag  √  X
Belmont transfusion set available  √  X
Belmont plugged in  √  X
Syringe driver pump with cable  √  X

Drugs packs: yellow + CD present, checked and sealed?  Y / N

Difficult airway trolley present?  Y / N

Paediatric airway trolley present?  Y / N
APPENDIX 2.3

Emergency Department RSI Anaesthetic Drug
Pack Contents

<table>
<thead>
<tr>
<th>Anaesthetic Drug Pack 1</th>
<th>Item</th>
<th>Item size</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drug dose aide memoire</td>
<td>A4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Suxamethonium</td>
<td>50mg/ml, 2ml vial</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Rocuronium</td>
<td>10mg/ml, 5ml vial</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Phenylepherine</td>
<td>10mg/ml, 1ml vial</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ephedrine</td>
<td>3mg/ml, 10ml syringe</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Adrenaline mini-jet</td>
<td>100mcg/ml, 10ml syringe</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lorazepam</td>
<td>4mg/ml, 1ml vial</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ondansetron</td>
<td>4mg</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Water for injection</td>
<td>10ml vial</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0.9% saline pre-drawn flush</td>
<td>10ml</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>0.9% saline</td>
<td>10ml vial</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.9% saline</td>
<td>100ml bag</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2.7% saline</td>
<td>500ml bag</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1ml syringe</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2ml syringe</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5ml syringe</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>10ml syringe</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>20ml syringe</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fentanyl sticker</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Morphine sticker</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ketamine sticker</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Propofol sticker</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Item</td>
<td>Quantity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiopentone sticker</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suxamethonium sticker</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocuronium sticker</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midazolam sticker</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenylepherine sticker</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain stickers</td>
<td>large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol wipes</td>
<td>large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spike with non-return valve and bionector</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needles 18G (green)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50ml syringe</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200cm extension set</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 way tap</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Anaesthetic Drug Pack 2

<table>
<thead>
<tr>
<th>Drug</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine</td>
<td>10mg/ml, 20ml vial</td>
<td>1</td>
</tr>
<tr>
<td>Thiopentone</td>
<td>500mg, powder</td>
<td>1</td>
</tr>
<tr>
<td>Propofol (1%)</td>
<td>50ml vial</td>
<td>1</td>
</tr>
<tr>
<td>Morphine</td>
<td>10mg/ml, 1ml vial</td>
<td>1</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1mg/ml, 5ml vial</td>
<td>1</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>50mcg/ml, 10ml vial</td>
<td>1</td>
</tr>
</tbody>
</table>
2.3 B: Breathing

Introduction

‘Breathing’ in the primary survey should be assessed by either the anaesthetist or ED Doctor 1. There is an advantage if it is the anaesthetist performing this as they will benefit from first hand information on A + B in respect of whether the patient needs intubation and ventilation however it may be that the ED doctor is more experienced. A quick discussion prior to patient arrival should determine this. In practice there may be benefit to both clinicians performing the examination.

A. Assessment

1. Inspection – general inspection includes assessment of chest expansion, respiratory pattern, respiratory rate, any evidence of bruising, wounds or deformity.

2. Palpation – feel for position of trachea (deviation is a late sign of mediastinal shift and is unreliable in bilateral chest trauma), gently palpate both clavicles (important to diagnose displaced fractures of the clavicle that may distort or injure vascular structures for the placement of central access) and assess chest expansion again with both hands on the chest, palpating around the chest as far posterior as possible, then gently palpate the sternum. In awake patients, gentle pressure on the sternum may elicit thoracic spine tenderness, which can point towards thoracic spinal injury or posterior rib fractures.

3. Percussion - percussion note may be very difficult to appreciate and misleading in the trauma room, but should nonetheless be performed comparing left and right sides anterior (for hyper resonance) and postero-lateral (for stony dullness).
4. **Auscultation** — be aware of right bronchial intubation in ventilated patients, which may mimic a left pneumothorax with decreased breath sounds and chest movement on the left. Fine crepitations could be an early sign of a developing pneumothorax, before reduced air entry becomes audible. Accurate auscultation is difficult in the trauma room and the anaesthetist / primary survey doctor should ask for a few seconds of silence if deemed appropriate.

5. **Monitoring and adjuncts** - Assess Oxygen saturation (SpO₂) with reference to inspired Oxygen concentration (FiO₂), trace and partial pressure of expired end-tidal carbon dioxide (EtCO₂), and perform a chest radiograph in the severely unstable patient (refer to Guideline for Chest Decompression in adult major trauma - Appendix 2).

Where there is an appropriately trained clinician to perform an extended FAST Scan, this can be used to diagnose or exclude Pneumothorax (however there are limitations with test sensitivity and specificity).

**NOTE:** Treatment of suspected tension pneumothorax is an emergency and requires immediate decompression.
B. Tension pneumothorax – awake

Features (may be delayed):

1. **Inspect:** chest pain, hyperinflated hemithorax, splayed ribs, extreme respiratory distress (consistent; refractory to reassurance), distended neck and upper arm veins (inconsistent sign in hypovolaemia)

2. **Palpate:** trachea deviated away from the affected side (late sign), reduced-absent movement on the affected side, crepitus / surgical emphysema may be present over the chest or supraclavicular area

3. **Percuss:** Hyperresonance

4. **Auscultate:** Reduced or absent breath sounds

5. **Monitoring and adjuncts:** Low SpO₂, hypotension, CXR may show deviation of the trachea and mediastinum and hyperinflation with depression of the diaphragm.

- This post-mortem film taken in a patient with severe blunt trauma to the chest and a left tension pneumothorax illustrates the classic features of a tension:

- With this degree of tension pneumothorax, it is not difficult to appreciate how cardiovascular function may be compromised by the tension, due to obstruction of venous return to the heart.

- A massive tension pneumothorax should indeed be detectable clinically and, in the face of haemodynamic collapse, be treated with emergent thoracostomy, needle or otherwise.

Figure 2.12
A tension pneumothorax may develop while the patient is undergoing investigations, such as CT scanning or during operation. Whenever there is deterioration in the patient's oxygenation or ventilatory status, the chest should be re-examined and tension pneumothorax excluded. Specifically if there are thoracostomies in situ these can be rapidly 're-fingered' to exclude occlusion allowing re-accumulation of extrapleural air.

UHS Guideline for Chest Decompression in Adult Major Trauma – see Appendix 2.4.1

Needle decompression:

- Classical management of tension pneumothorax is emergent chest decompression with needle thoracostomy. A 14-16G intravenous cannula is inserted into the second rib space in the mid-clavicular line. The needle is advanced until air can be aspirated into a syringe connected to the needle (small amount of saline will allow bubbles to escape as a visual aid).

- The needle is withdrawn and the cannula is left open to air. An immediate rush of air out of the chest indicates the presence of a tension pneumothorax. The manoeuvre essentially converts a tension pneumothorax into a simple pneumothorax.
• Many texts will state that a tension pneumothorax is a clinical diagnosis and should be treated with needle thoracostomy prior to any imaging. Recently this dogma has been called into question. Needle thoracostomy is probably not as benign an intervention as previously thought, and often is simply ineffective in relieving a tension pneumothorax. If no rush of air is heard on insertion, it is impossible to know whether there really was a tension or not, and whether the needle actually reached the pleural cavity at all. Some heavy-set patients may have very thick chest walls and standard cannulae are therefore too short.

• Needle thoracostomies are also prone to blockage, kinking, dislodging and falling out. Thus a relieved tension may re-accumulate undetected. More important is the possibility of lung laceration with the needle, especially if no pneumothorax is present initially. Air embolism through such a laceration is also a real concern (Refer to Thoracostomy and chest tube placement below).

SURGICAL THORACOSTOMIES have by and large replaced NEEDLE thoracostomies as the treatment of choice.

• This may or may not be followed by chest tube placement. An added advantage of the surgical approach is the direct palpation of whether the lung is ‘up’ or ‘down’.
C. Tension pneumothorax – intubated patient

Features:

1. **Inspect** — Affected side showing reduced mobility with overexpansion (splayed ribs), distended neck / upper arm veins (inconsistent sign if hypovolaemic)
2. **Palpate** — late sign of tracheal deviation away from the affected side, reduced mobility of the affected side, surgical emphysema
3. **Percuss** — increased resonance
4. **Auscultate** — reduced / absent breath sounds
5. **Monitoring and adjuncts** — low saturation, hypotension, high inflation pressures, decreasing EtCO₂ indicates haemodynamic compromise

**NOTE:** In the presence of haemodynamic compromise, immediate decompression of the chest by needle thoracostomy (as described for awake patients above) or surgical thoracostomy (for anaesthetised, ventilated patients) is required.

- In the absence of haemodynamic compromise or hypoxia it may be prudent to wait for the results of an emergent imaging (CT, chest X-ray or chest ultrasound) prior to intervention.
- *Note that in supine patients pneumothoraces can be difficult to determine on plain X-Rays.* This will avoid patients where a right upper lobe collapse due to endobronchial intubation and resultant hypoxia and tracheal deviation - mimicking a tension pneumothorax on the opposite side - from receiving an unnecessary left chest tube.

**NOTE:** Patients with head injuries and suspected raised ICP need a much lower threshold for treatment of suspected pneumothorax (due to limitations on cerebral venous drainage by raised intrathoracic pressure)
Thoracostomy and chest tube placement

- Chest tube placement is the definitive treatment of traumatic pneumothorax. Intercostal drain insertion kits with underwater seal systems are immediately available in the resuscitation room. In cases of tension pneumothorax the emergency treatment of choice is thoracostomy. Once the pleura is entered (blunt dissection), the tension is decompressed.

- In patients who are being manually ventilated with positive pressure, surgical thoracostomies without chest tube placement is a perfectly reasonable option to allow rapid progress to diagnostic imaging. Delayed chest tube placement can be performed following completion of diagnostic imaging or other emergent interventions, provided the patient’s clinical condition, SpO$_2$ and airway pressures are continuously assessed in case the thoracostomies become occluded. Any deterioration in the patient’s condition should prompt immediate exploration (‘fingering’) of the thoracostomies to exclude recurrence of the tension pneumothorax with a sterile gloved finger. Establish whether the chest wall wound is patent and the lung is fully inflated.

- Beware also the patient with bilateral tension pneumothoraces. The trachea is central, while percussion and breath sounds are equal on both sides. These patients are usually haemodynamically compromised or in traumatic arrest. Emergent bilateral chest decompression should be part of the procedure for traumatic arrest where this is a possibility.

*(Refer to Traumatic Cardiac Arrest guideline – 2.1 Catastrophic Haemorrhage)*

- Tension pneumothorax may also persist if there is an injury to a major airway, resulting in a bronchopleural fistula. In this case a single chest tube cannot cope with the major air leak. Two, three or occasionally more tubes may be needed to manage the air leak. In these cases thoracotomy is usually indicated to repair the airway and resect damaged lung.
D. Simple Pneumothorax

- A simple pneumothorax is a non-expanding collection of air around the lung. The lung is collapsed, to a variable extent. Diagnosis on physical examination may be very difficult. The classical signs of reduced air entry and resonance to percussion are often difficult or impossible to appreciate. Careful palpation of the chest wall and apices may reveal subcutaneous emphysema and rib fractures as the only sign of an underlying pneumothorax. Most simple pneumothoraces will require placement of an intercostal chest drain as definitive treatment.

Chest Radiograph (CXR):

- **CXR is not routinely performed following the primary survey.** Stable patients are transferred directly to CT for the diagnostic trauma scan which delivers several diagnostic advantages over the simple CXR. The CXR will only be performed in the ED trauma room if the patient is too unstable for transfer to CT, whilst resuscitation and life saving interventions are in progress.

- A CXR may miss small pneumothoraces, especially with the patient supine. The presence of rib fractures on a chest X-ray should prompt a careful search for a pneumothorax. One side of the chest may appear more radiolucent than the other. This may represent an overlying pneumothorax, or alternatively an underlying haemothorax on the opposite side. A deep sulcus sign is indicative of an anterior pneumothorax.

**Deep sulcus sign of an anterior pneumothorax**
• Small pneumothoraces, especially those visible only on CT, may be watched expectantly. The decision to observe is based on the patient's clinical status and subsequent planned procedures. Chest tube placement may be appropriate in these cases if there are multiple injuries, if a patient is due to undergo prolonged anaesthesia, or if a patient is due to be transferred a significant distance - where detection of an increasing or tension pneumothorax may be difficult or delayed.

**Trauma CT Scan:**

• CT Scanning is more sensitive for the presence of pneumothorax than plain CXR. However the significance of these small pneumothoraces is unknown. Many of these 'occult pneumothoraces' may be managed without chest tubes, even in the presence of positive pressure ventilation. However a strong suspicion needs to remain and vigilant monitoring of the patient in case of deterioration which should prompt urgent treatment.

**Chest ultrasound:**

• Ultrasound has shown promise in the diagnosis of pneumothoraces, although evaluation is difficult and very operator dependent. Serial ultrasound of the chest may be a useful adjunct in the monitoring of ventilation and oxygenation in a patient with a known small pneumothorax. Any deterioration in the patient’s condition should prompt emergent re-assessment and placement of a chest drain.
E. Haemothorax / Massive haemothorax

- Haemothorax is a collection of blood in the pleural space and may be caused by blunt or penetrating trauma. Most haemothoraces are the result of rib fractures, lung parenchymal and minor venous injuries, and as such are self-limiting. Less commonly there is an arterial injury, which is more likely to require surgical repair. Most small to moderate haemothoraces are not detectable by physical examination and will be identified only on CXR, FAST or CT scan. However, larger and more clinically significant haemothoraces may be identified clinically. If a large haemothorax is detected clinically it should be treated promptly.

- Chest examination may indicate the presence of significant thoracic trauma with external bruising or lacerations, or palpable crepitus indicating the presence of rib fractures. There may be evidence of a penetrating injury over the affected hemithorax.

**NOTE:** Don’t forget to examine the back in penetrating chest trauma (after log rolling if appropriate)!

Unlike blunt trauma, penetrating chest trauma ideally dictates an immediate erect CXR upon arrival in the ED (in those without suspected spinal injuries), as part of the primary survey.

- The classic signs of a haemothorax are decreased chest expansion, dullness to percussion at the base and reduced breath sounds in the affected hemithorax. There is no mediastinal or tracheal deviation unless there is a massive haemothorax. All these clinical signs may be subtle or absent in the supine trauma patient in the emergency department, and most haemothoraces will only be diagnosed after imaging studies.
• **CXR** in the erect patient (penetrating injury), may show the classical picture of a fluid level with a meniscus. Although the erect film is more sensitive, it takes approximately 400-500mls of blood to obliterate the costo-phrenic angle on a chest radiograph.

• **CT** is invaluable in determining the presence and significance of a haemothorax, especially in the blunt, supine trauma patient who may have multiple thoracic injuries. Small amounts of blood are detectable and can be localised to specific areas of the thoracic cavity. The significance of CT-only detectable haemothoraces is not entirely clear, and certainly some of these will require no treatment. CT is also useful in differentiating haemothorax from other thoracic pathology such as pulmonary contusion or aspiration.

• **Chest tube placement** is the first step in the management of traumatic haemothorax. The majority of haemothoraces have already stopped bleeding and simple drainage is all that is required. All chest tubes placed for trauma should be of sufficient calibre to drain haemothoraces without clotting.

**The smallest acceptable size for an adult patient is 32F, and preferably 36F tubes should be placed.**

• Chest drains for simple haemothorax can be placed posteriorly. However if there is concomitant pneumothorax, or patients have multiple rib fractures with positive pressure ventilation, drains should be placed anteriorly to avoid tension pneumothorax for an obstructed chest tube.

**Figure 2.15**
F. Open pneumothorax

**Management**

1. Cover the defect with a sterile occlusive dressing – the dressing should be large enough to overlap the wound’s edges and then taped on THREE sides to produce a flutter-valve effect.

2. An Asherman chest seal may also be used over the wound

![Asherman Chest Seal](image)

i. **Figure 2.16**

3. As the patient breathes in, the dressing occludes the wound, preventing air from entering. During exhalation, the open end of the dressing allows air to escape.

4. Place a chest drain as soon as possible

5. Patients may require intubation and ventilation

6. Patients usually require management on HDU or ICU
G. Rib fractures and Flail chest

- Multiple rib fractures will often be associated with an underlying pulmonary contusion (refer to Pulmonary Contusion 2.4.9), which may not be immediately apparent on initial imaging.

- Fractures of the lower ribs may be associated with diaphragmatic tears and spleen or liver injuries. A first rib requires a significant amount of force to cause a fracture and indicates a major energy transfer. A fracture of the first rib should prompt a careful search for other injuries (both underlying the rib and other injuries).

- Note also that the rib cage and sternum provide a significant amount of stability to the thoracic spine. Severe disruption of this ‘fourth column’ may convert what would otherwise be a stable thoracic spine fracture into an unstable one.

Features

- a. Respiratory distress
- b. External signs of chest injury
- c. Chest pain
- d. Crepitus, fractured ribs, surgical emphysema
- e. Paradoxical movement
- f. Low SpO2

Refer to the Management of rib and sternal fractures and Lignocaine patches for rib fractures – Section 2.7: Pain Control
Management

Largely aimed towards the treatment of pain and supportive therapy for the underlying pulmonary contusion.

i. Intubation and ventilation is often required, but may be avoided by adequate analgesia. Awake patients frequently require CPAP but refractory pain management may also include regional anaesthesia via paravertebral, intercostal nerve blocks, intrapleural or epidural anaesthesia either as single shot or preferably continuous nerve block catheter).

ii. Patients with multiple rib fractures and/or a flail segment should usually be managed on HDU or ICU.

• Management of chest wall injury is directed towards protecting the underlying lung and allowing adequate oxygenation, ventilation and pulmonary toilet. This strategy is aimed at preventing the development of pneumonia, which is the most common complication of chest wall injury.

• Note that while a young fit patient will easily manage one or two rib fractures with simple analgesia, the same injury in an elderly patient is regarded as major and will frequently lead to pneumonia and respiratory failure if not appropriately managed.
H. Pulmonary Contusion

- Pulmonary contusion is an injury to lung parenchyma, leading to oedema and blood collecting in alveolar spaces and loss of normal lung structure & function. This blunt lung injury develops over the course of 24 hours, leading to poor gas exchange, increased pulmonary vascular resistance and decreased lung compliance. There is also a significant inflammatory reaction to blood components in the lung, and 50-60% of patients with significant pulmonary contusions will develop bilateral Acute Respiratory Distress Syndrome (ARDS).

- Pulmonary contusions occur in approximately 20% of blunt trauma patients with an Injury Severity Score (ISS) over 15, and it is the most common chest injury in children. The reported mortality ranges from 10 to 25%, and 40 to 60% of patients will require mechanical ventilation. The complications of pulmonary contusion are respiratory failure, atelectasis, pneumonia and as mentioned ARDS.

- Pulmonary contusions are rarely diagnosed on physical examination. The mechanism of injury may suggest blunt chest trauma, and there may be obvious signs of chest wall trauma such as bruising, rib fractures or flail chest (refer to 2.4.6). These suggest the presence of an underlying pulmonary contusion. Crackles may be heard on auscultation but are rarely heard in the emergency room and are non-specific.

- Severe bilateral pulmonary contusions may present with hypoxia and high inflation pressure following the trauma RSI, and can be confused with or may co-exist with haemo/pneumothoraces. Immediate ED CXR may assist to exclude the latter and confirm correct endotracheal tube placement in the trachea (excluding endobronchial intubation) and is to be considered in the pa-
tient who becomes unstable following the trauma RSI, prior to transfer to trauma CT.

- **CT** is very sensitive for identification of pulmonary contusion, and may allow differentiation from areas of atelectasis or aspiration. CT also allows for 3-dimensional assessment and calculation of the size of contusions. CT will accurately reflect the extent of lung injury when pulmonary contusion is present.

**Management**

- **Management of pulmonary contusion** is supportive while the pulmonary contusion resolves. Most contusions will require no specific therapy. However large contusions may affect gas exchange and result in hypoxaemia. As the physiological impact of the contusions tends to develop over 24 to 48 hours, close monitoring is required and supplemental oxygen should be administered.

- The classic management of pulmonary contusion includes fluid restriction. Much of the data to support this comes from animal models of isolated pulmonary contusion. However, while relative fluid excess and pulmonary oedema will augment any respiratory insufficiency, the consequences of the opposite – hypovolaemia are more severe and long-lasting. Prolonged episode of hypoperfusion in trauma patients will result in inflammatory activation and acute lung injury, and may result in ARDS and multiple organ failure. Hence the goal for management of patients with pulmonary contusion should be eu-volaemia
J. Chest trauma and the use of Prophylactic Antibiotics

Refer to UHS Antibiotic Protocol for Adult Major Trauma regarding initial prophylactic antibiotic dose. 

Section 2.7: Exposure and Environment: UHS Antibiotic protocol in Major Trauma
Appendix  2.4.1

Guideline for the management of chest injuries and chest decompression in Adult Major Trauma

Please follow this link for the complete and current guideline


Introduction

This guideline primarily addresses the management of blunt thoracic trauma with resultant ventilatory compromise.

- Major Trauma patients are frequently admitted with blunt chest injuries for which a needle decompression or a thoracostomy (intubated and ventilated patients only) had been performed in the pre-hospital field, for a suspected pneumothorax. Blunt chest trauma may also cause the insidious formation of a simple pneumothorax, which can then rapidly result in a tension pneumothorax upon the introduction of positive pressure ventilation following a trauma RSI.

- The trauma RSI may have been indicated for ventilatory failure as a result of diagnosed chest injuries, but may also have been performed for an unrelated indication such as a decreased level of consciousness in the head injured patient.

- Following a guideline for the assessment and management of patients with blunt chest trauma is likely to reduce the risk of complications, improve rapid diagnosis and treatment and improve the trauma team performance and avoid unnecessary delays in obtaining diagnostic imaging, which will in turn improve outcomes.
Definitions

- **Simple pneumothorax:** Pneumothorax is the collection of air in the pleural space. Air may come from an injury to the lung tissue, a bronchial tear, or a chest wall injury allowing air to be sucked in from the outside.

- **Haemothorax:** a collection of blood in the pleural space and may be caused by blunt or penetrating trauma. Most haemothoraces are the result of rib fractures, lung parenchymal and minor venous injuries, and as such are self-limiting. Less commonly there is an arterial injury, which is more likely to require surgical repair.

- **Tension Pneumothorax:** Tension pneumothorax is the progressive build-up of air within the pleural space, usually due to a lung laceration which allows air to escape into the pleural space but not to return. Positive pressure ventilation may exacerbate this ‘one-way-valve’ effect. Progressive build-up of pressure in the pleural space pushes the mediastinum to the opposite hemithorax, and obstructs venous return to the heart. This leads to circulatory instability and may result in traumatic cardiac arrest.

- **ICD:** intercostal chest drain
- **RSI:** rapid sequence intubation
- **CXR:** chest radiograph – usually AP in the supine, recumbent and immobilised trauma patient
- **FAST:** focused assessment by sonography in trauma
- **ED:** Emergency Department
Guideline for the management chest injuries and chest decompression in Adult Major Trauma

Pre-alert and team brief

- If the pre-alert indicates likely chest trauma or that needle thoracostomy / surgical thoracostomies have been performed, two chest drain packs should be immediately available on arrival of the patient in the Emergency Department.

Primary survey

- Ideally the Primary Survey should include the use of the extended FAST scan with chest ultrasound.
- Immediate CXR in ED should be reserved for unstable polytrauma patients, as the supine CXR is not sensitive, nor specific for the diagnosis of either pneumothorax or haemothorax in trauma. It can however aid the confirmation of correct positioning of the endotracheal tube (i.e. exclude endobronchial intubation) and may show rib fractures and subcutaneous emphysema to aid correct side diagnoses. It is usually performed in conjunction with a pelvic Xray in patients too unstable for transfer to trauma CT, to aid the diagnosis of immediately life threatening injuries and sources of potential major haemorrhage.

- Awake and self ventilating patients who are stable (or abnormal, but deemed stable for transfer) may proceed to trauma CT to confirm diagnoses.

- There should be a lower threshold for early intervention in intubated and ventilated patients, as positive pressure ventilation can rapidly lead to a tension pneumothorax.

NOTE: In patients with suspected head injuries, pneumothoraces should be treated without delay to ensure optimal oxygenation and ventilation and prevent any impediment to cerebral venous drainage as a result of raised intrathoracic pressure.
• In cases where a pneumo / haemothorax is suspected, but the patient remains well oxygenated and haemodynamically stable, it is reasonable to proceed to trauma CT.

• Trauma CT remains the most specific and sensitive tool for the correct diagnoses and treatment of chest injuries. However, interventions to the chest inside the CT suite should be avoided.

**Needle thoracostomy**

• Needle thoracostomies are not without morbidity. Lung lacerations may result or a pneumothorax / tension pneumothorax may remain untreated.

• Current evidence suggests that there is no place for chest decompression via needle thoracostomy in hospital, unless the patient is in extremis and it is performed whilst preparing for the RSI and surgical thoracostomy.

• Unstable patients, i.e. A, B, C or D failure, should be treated urgently – perform RSI followed by immediate chest decompression via surgical thoracostomy and re-assess. The person performing the surgical thoracostomy and ICD insertion should be scrubbing and preparing for the procedure whilst the RSI is being executed.

• Self ventilating patients on whom a needle decompression had been performed in the pre-hospital phase and who present with ongoing ventilator failure, should get an immediate CXR in ED. Large pneumothoraces should be treated by ICD insertion prior to proceeding to Trauma CT, consideration should be given to the anticipated clinical course of the patient and performing a RSI and general anaesthesia prior to chest decompression.
Surgical thoracostomy

- Any major trauma patient with chest trauma and cardiovascular instability and/or difficulty ventilating should have immediate bilateral chest decompression via surgical thoracostomy and ICD insertion.

- Ventilated patients who have received a surgical thoracostomy pre-hospital, should have the thoracostomies decontaminated (Betadine / Iodine surgical solution) and explored with a sterile gloved finger to ascertain that the thoracostomy is patent and the lung fully inflated. If there is a release of air or blood from the thoracostomy site or the lung remains partially inflated, insertion of an ICD should be performed immediately. The person performing the ICD insertion should advise the anaesthetist to ensure vigilance about the early diagnosis of a possible tension pneumothorax subsequently.

- In exceptional cases, the urgency of the diagnostic imaging may outweigh the risk of a tension pneumothorax occurring in the CT suite. If following exploration of the thoracostomy site, the lung is fully inflated, the incision is patent and the patient is stable, the team leader may then decide to transfer to Trauma CT without ICD insertion. The patient MUST then return to ED and ICD insertion (or closure of the thoracostomy wound) performed immediately after the CT and prior to any further referral or transfer of the patient.

**NOTE:** ICD insertion should be performed through THE SAME incision as the original surgical thoracostomy, even if it was performed pre-hospital. The only exception is in obviously soiled wounds or where the pre-hospital team handed over a concern regarding soiling and subsequent infection.
• Note an incorrectly placed endotracheal tube in the right main bronchus, may result in the unnecessary and/or wrong sided insertion of a chest drain. This may occur due to right main bronchus intubation with relative hyperinflation of the right lung and left lung collapse, or obstruction of the right upper lobe bronchus with relative decreased air entry in the right upper lobe. Breath sounds can be difficult to determine in the ED and should not be relied upon.

• In the event of ventilatory instability or deterioration following the RSI, thoracostomy and/or ICD insertion, an immediate CXR should be considered prior to transfer for the trauma CT. Though the supine CXR is a non-specific diagnostic test in major trauma and may not provide definitive diagnoses, it will diagnose endobronchial intubation and may reveal significant haemo- or pneumothoraces that should be treated promptly.

• Small pneumothoraces may only be apparent on the trauma CT. Not all require formal drainage, but a low threshold should exist for all patients who are ventilated and/or going to theatre. If a decision is made NOT to drain the pneumothorax, this information must be handed over clearly to the team responsible for ongoing care.

• Seldinger chest drains have NO place in the management of chest injuries in major and/or polytrauma. A large bore 28F or above drain should be used in adult major trauma.

\[\text{NOTE: With ventilatory compromise, there should be a lower threshold for intervention and decompression of the chest in patients with suspected head trauma}\]
Executive Summary

- Two chest drain packs should be immediately available on arrival of a patient with suspected chest trauma in ED

- The Primary Survey should whenever possible include the use of the extended FAST scan with chest ultrasound

- CXR in ED as part of the primary survey, should be reserved for unstable polytrauma patients

- The diagnostic investigation of choice in chest trauma is the Trauma CT

- Where a head injury has not been sustained and ventilation is satisfactory, it is reasonable to proceed to Trauma CT even if a pneumo-/haemothorax is diagnosed/suspected

- Surgical thoracostomy is the preferred technique for decompression of the chest in hospital, needle thoracostomy is reserved for patients in extremis whilst preparing for RSI and/or the surgical decompression

- All pre-hospital thoracostomies should be explored with a sterile gloved finger and the wound decontaminated as part of the primary survey

- Insertion of the ICD may follow the Trauma CT in cases where the thoracostomies are patent and the patient’s ventilator status is satisfactory. If there are any ventilator concerns in patients with thoracostomies, ICD insertion should be performed prior to Trauma CT

- Subsequent ICD insertion should proceed through the same incision as the pre-hospital thoracostomy, unless there is obvious soiling or concerns re infection handed over by the pre-hospital team

- All patients with thoracostomies MUST either have the thoracostomy wound closed if no ICD is required, or the ICD inserted and correct positioning confirmed by CXR or CT prior to transfer from ED.
2.4 C: Circulation

Introduction To Circulation

- Step 1  Stop external bleeding
- Step 2  Assess cause of hypovolaemic shock
- Step 3  Assess severity of shock
- Step 4  Replace fluid immediately for class II, III, IV shock – blood!
- Step 5  Splint unstable pelvic fractures
- Step 6  Apply traction splint for fractured femur

IV access including trauma line

- Large bore IV access should be obtained to resuscitate the patient, ideally in a large vein proximal to any site of likely haemorrhage. The subclavian vein is ideal, be cautious with femoral / lower limb access if there are suspected pelvic or abdominal injuries.

- Trauma lines (8.5 French gauge Swann Sheath introducer lines) are kept in the circulation drawer of the airway trolley and on the catastrophic haemorrhage trolley.

- Trauma lines are the technique of choice for hypovolaemic patients due to their large gauge. However in untrained hands significant complications can occur. Therefore they should normally only be inserted by anaesthetists and specifically those who have experience with them.

![Subclavian Vein anatomy](image)
Intraosseous (IO) access

Indications for use

1. Difficulty in obtaining intravenous access
2. First line circulatory access in patients in traumatic cardiac arrest

Equipment

Kept in major haemorrhage trolley in the emergency department

a) EZ-IO drill driver
b) Pink needle those weighing 5kg to 39kg
c) Blue needle for those weighting more than 40kg
d) Yellow needle for >40 kg
e) Forceps
f) Tape

Ensure that distal black line on the needle should be visible at or above the skin once inserted correctly.

Transfusion via IO (Intraosseous)

- Attach the 10cm 3 way tap from the circulation drawer of the airway trolley to the IO needle. This will enable rapid injection via the 3 way tap using 50ml syringes. The resistance to flow to too great to use a ‘Level One’ or Belmont rapid infuser directly.
- The 50ml syringes can be filled via the Belmont or fluid ranger to allow rapid filling and warming of fluid.

Figure 2.21 BD connecta

Contra-indications to IO insertion

a) Fracture of target bone or bone proximal to the target bone
b) Previous IO in same bone in previous 24 hours
c) Infection at insertion site
d) Inability to locate landmarks
A. Procedure of inserting intra-osseous access in the tibia

(Staff must receive appropriate training before use)

1. Locate the tibial tuberosity on the anteromedial aspect of the tibia. The insertion site for IO access is 2 finger breadths below the tibial tuberosity. Clean the skin overlying the tuberosity.

2. Stabilize the lower leg and place the EZIO drill with appropriate needle at 90 degrees to the insertion site.

3. Lightly hold the driver in your dominant hand and press the driver button. Gently guide the needle into the bone. Do not press hard, allow the driver to do the work. Carefully feel for the “pop” or “give” indicating penetration into the medullary space. STOP drilling at this point.

4. Stabilise the needle and remove the central stylet. The needle should be firmly seated and stand unsupported.

5. Connect the extension set and withdraw bone marrow to assess location. Flush the IO needle, easy flow and no extravasation suggest correct location.

6. Fix the IO needle with a pair of forceps and tape the forceps to the shin.

B. Procedure of inserting intra-osseous access in the humerus:

1. With the patient in the supine position, place the patients hand on their umbilicus. This causes the humerus to internally rotate.

2. Palpate and identify the mid-shaft humerus and continue palpating toward the proximal aspect or humeral head. As you near the shoulder you will note a small protrusion. This is the base of the greater tubercle and is the insertion site for IO access. Clean the skin overlying the tubercle.
3. Stabilize the arm and place the EZIO drill with appropriate needle at 90 degrees to the insertion site.

4. Lightly hold the driver in your dominant hand and press the driver button. Gently guide the needle into the bone. Do not press hard, allow the driver to do the work. Carefully feel for the “pop” or “give” indicating penetration into the medullary space. Stop drilling at this point.

5. Stabilise the needle and remove the central stylet. The needle should be firmly seated and stand unsupported.

6. Connect the extension set and withdraw bone marrow to assess location. Flush the IO needle, easy flow and no extravasation suggest correct location.

Fix the IO needle with a pair of forceps and tape the forceps to the arm.

Figures 2.19 and 2.20 Insertion of IO into the humerus
Hypovolaemic Shock

- Shock occurs when tissue perfusion is inadequate of the tissues metabolic requirements leading to organ dysfunction. The most likely cause of cardiovascular instability in a Major Trauma patient is hypovolaemia secondary to blood loss. Other traumatic causes of ‘shock’ must not be ignored including tension pneumothorax, tamponade and shock caused by spinal cord injury. Other causes of shock include- cardiogenic (cardiac contusion or pre-existing cardiac disease), septic shock, anaphylactic shock.

- For patients remaining unresponsive to volume resuscitation undiagnosed causes of bleeding should also be considered (e.g. pelvic, or multiple different sites).

- Shock may be categorised using the following chart below.

<table>
<thead>
<tr>
<th>Class of Shock</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood loss</td>
<td>Up to 750ml &lt;15% lost</td>
<td>750–1500ml 15–30% lost</td>
<td>1500–2000ml 30–40% lost</td>
<td>&gt;2000ml &gt;40% lost</td>
</tr>
<tr>
<td>Heart rate</td>
<td>&lt;100/min</td>
<td>&gt;100/min</td>
<td>120–140/min</td>
<td>&gt;140/min</td>
</tr>
<tr>
<td>Systole/ BIP</td>
<td>Normal</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased/ unrecordable</td>
</tr>
<tr>
<td>Pulse pressure</td>
<td>Normal</td>
<td>Narrowed</td>
<td>Narrowed</td>
<td>Very narrow/ absent</td>
</tr>
<tr>
<td>Capillary refill</td>
<td>Normal</td>
<td>Prolonged</td>
<td>Prolonged</td>
<td>Prolonged/ Absent</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>16–20/min</td>
<td>20–30/min</td>
<td>&gt;30/min</td>
<td>&gt;35/min</td>
</tr>
<tr>
<td>Urine output</td>
<td>&gt;50ml/hr</td>
<td>20–30ml/hr</td>
<td>5–20ml/hr</td>
<td>Negligible</td>
</tr>
<tr>
<td>Cerebral function</td>
<td>Normal/ slightly anxious</td>
<td>Anxious</td>
<td>Confused</td>
<td>Confused/ unresponsive</td>
</tr>
</tbody>
</table>

Neurogenic Shock

Hypotension and/or bradycardia may occur in high spinal cord injuries caused by sympathetic disruption. Resuscitation and treatment of any hypovolaemia should occur first followed by spinal cord protection with the potential need for vasopressors. In patients with hypotension of unknown cause hypovolemic shock should always excluded first, but other causes of shock must also be considered to avoid overtransfusion in this patients.
FAST protocol

- FAST” is an acronym for Focused Assessment with Sonography in Trauma and has become synonymous with beside ultrasound in trauma. The FAST exam, per ATLS protocol, is performed immediately after the primary survey of the ATLS protocol. Ultrasound is the ideal initial imaging modality because it can be performed simultaneously with other resuscitative cares, providing vital information without the time delay caused by radiographs or computed tomography (CT).

- The concept behind the FAST exam is that many life-threatening injuries cause bleeding. It has a role in identifying intraperitoneal bleeding in hypotensive patients and assisting in management decisions as to emergent laparotomy. Within the chest it is also useful for diagnosing cardiac injuries from penetrating trauma (e.g. tamponade).

- Recently, research studies have shown that bedside ultrasound is equivalent to, or better than, chest radiography for identifying a hemothorax or pneumothorax in trauma patients. An extended FAST exam (EFAST), evaluates for pneumo- and hemothorax in addition to intraperitoneal injuries.

Clinical scenarios where the FAST is most useful:

1. Haemodynamically unstable patients, when the cause of hypotension is unclear.
2. Patients who need an emergent bedside procedure.
3. Patients with penetrating trauma with multiple wounds or unclear trajectory, especially with wounds in upper abdomen or lower chest
4. Patients with a concerning mechanism of injury but no indication for CT. Consider a period of observation and serial FAST exams.
Management of the exsanguinating pelvic fracture

- The Management of Pelvic Fracture SOP (figure 2.22, page 117) is to be used in the management of shocked patients who are thought to have an unstable exsanguinating pelvic fracture as one or their only injury.

- Haemorrhage in this situation is usually from fractured bone and disrupted arteries and particularly veins.

**NOTE:** NEVER spring the pelvis as part of the clinical examination.

- If the patient comes in with a pelvic binder on this should be kept in place and not removed. If no binder is in situ, a T-pod pelvic splint should be applied as soon as possible. SAM pelvic splints (amongst others) may also be used in the prehospital environment.

![T-pod Pelvic Binder](image1)

![SAM Pelvic Splint](image2)

- A common mistake is for the pelvic splint to be applied too ‘high’ (cephalad). The midpoint of the splint should lie directly over the greater trochanters. Adjust any binders that have been incorrectly applied.

- There is no evidence that orthopaedic external pelvic fixation confers any benefit over a pelvic binder, and because it can cause opening up of posterior
pelvic fractures, can increase bleeding. **There are no indications for its application in the resus room.**

- Generally patients will be judged haemodynamically unstable if non-responders or temporary responders to fluid challenge.

- The decision to transfer or not for Trauma CT prior to control of haemorrhage in an unstable patient will be the decision of the Trauma Team leader, and will take into account factors such as time to CT, distance to CT, degree of instability etc.

Intra-peritoneal bleeding will be judged on FAST scanning. It must be remembered that small amounts of intra-peritoneal fluid may be seen with retroperitoneal bleeding, so small amounts of intraperitoneal fluid on FAST may not be an indication for transfer to theatre.

- Major intra-thoracic bleeding will be judged on clinical findings, after chest drain insertion, and X-ray findings.

**NOTE:** If the patient is in extremis, even without firm evidence of intra-peritoneal or intra-thoracic blood, consider *immediate* transfer to theatre.

- UHS does not currently have an agreed SOP as to which surgical specialty will perform intraperitoneal packing. In this situation the Trauma Team Leader should liaise with the T&O consultant initially. Further discussions should be from the T&O consultant to determine the appropriate operator.

- Please also refer to the *Wessex Pelvic and Acetabular Reconstruction Referral Form* on page 111
Figure 2.22

Unstable Patient, Unstable Pelvis

Apply Pelvic Binder

Haemodynamics Stabilize

Major intraperitoneal, intrathoracic or external bleeding

No

Interventional radiology available < 30 mins

No

Angio-Embolization

Yes

Operating Room
Extra-peritoneal packing
Damage control Laparotomy

Yes

ICU Definitive Imaging

Definitive Fixation
# Wessex Pelvic and Acetabular Reconstruction Referral Form

<table>
<thead>
<tr>
<th>Patient Information:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surname:</td>
<td>First Name:</td>
</tr>
<tr>
<td>Date of Birth:</td>
<td>Age:</td>
</tr>
<tr>
<td>Sex: M / F</td>
<td></td>
</tr>
<tr>
<td>Referring Consultant (With Mobile No.):</td>
<td>Referring Hospital:</td>
</tr>
<tr>
<td>Name of Referring Clinician:</td>
<td>Name of Accepting Clinician:</td>
</tr>
<tr>
<td>Date of Injury:</td>
<td>Time of Injury:</td>
</tr>
<tr>
<td>Mechanism of Injury:</td>
<td></td>
</tr>
</tbody>
</table>

| PELVIC FRACTURE CLASSIFICATION (PLEASE CIRCLE): | PELVIC FRACTURE / ACETABULAR FRACTURE |
| MECHANISM (Young / Burgess): | AP COMPRESSION   LATERAL COMPRESSION   VERTICAL SHEAR   COMBINATION |

| HIGH MAJOR HAEMORRHAGE RISK: | (please circle) |
| OPEN FRACTURE | Y / N |
| APC III INJURY (3 vertical lines on diagram) | Y / N |
| VERTICAL SHEAR (unequal hemi-pelvic height) | Y / N |
| COMBINED MECHANISM INJURY | Y / N |
| UNSTABLE FRACTURE (obvious clinically) | Y / N |
| UNSTABLE POSTERIOR ELEMENTS (2 vertical lines) | Y / N |

| ACTION: IMMEDIATE REFERRAL IF MAJOR HAEMORRHAGE RISK: | Y / N |
| PELVIC BINDER APPLIED (pelvic fractures only): | Y / N Date: Time: |
| SKIN TRACTION APPLIED (acetabular fractures only): | Y / N |

| VTE PROPHYLAXIS: | i. TED STOCKINGS ii. FOOT PUMPS (if possible) iii. Chemical (If LOW haemorrhage risk) |
| Drug: | Dose: |

## 2. Injury Details:

| Associated Injuries: | AIRWAY / CHEST: | HEAD: | SPINE: |
| ABDOMEN: | EXTREMITY: |

| Treatment to date: |  |
| Comorbidities: |  |
| Blood Results: | (FBC / Clotting) |

---

FULL SPINAL HANDLING / TRANSFER TECHNIQUES UNTIL OTHERWISE ADVISED
Management of catastrophic maxillofacial haemorrhage

- Exsanguinating haemorrhage from maxillofacial fractures is an uncommon but potentially remediable problem. The Management of Catastrophic Maxillofacial Haemorrhage SOP (Figure 2.25, Page 121) is for use in the control of major, life threatening haemorrhage from known or presumed facial fractures, usually Le Fort II or III.

- The patient must have their airway secured by RSI, prior to formal attempts at haemorrhage control as outlined in the algorithm below.

- If required a temporary control of haemorrhage may be obtained by pulling the midface forward manually.

- It should be remembered that whilst the measures outlined below will lead to haemorrhage control in the majority of cases, they can also cause a worsening of bleeding. In this case the epistat balloons should be deflated with a view to removal of epistats and bite blocks if it is felt necessary.

**NOTE:** The *Major Haemorrhage Trolley* is located in the ‘NEW’ ED Resus
Figure 2.24  Bite Blocks and Epistats

- Call the OMF/ ENT Surgeon - this should be the Consultant however the Registrar may attend pending the Consultant arrival (bleep 1973 Airway Registrar until 17:00)
Figure 2.25 Management of catastrophic maxillofacial haemorrhage
Interventional radiology and haemorrhage control

Interventional radiology may be indicated in the following situations

a. Transient haemodynamic responder with abdominal solid organ injury
b. Stable great vessel injury
c. Unstable pelvic injury with haemorrhage and no further life-threatening injury
d. Penetrating proximal vessel injury

- If interventional radiology (IR) required, contact x4067 during office hours. Out of hours, contact duty IR consultant via switchboard. Note that the IR room may take 30 minutes to be fully activated out of hours.

- IR is an isolated site and hence extra preparation should be considered. Extra staff may be required to set up if time allows.

- If an unstable trauma patient is taken to the IR suite then the trauma team including appropriate surgeon should accompany the patient at all times. The team must be prepared to move to theatre urgently if the haemorrhage cannot be controlled by IR.

- Blood must be taken with the patient from ED if ongoing resuscitation is required, as well as other resuscitation equipment required (consider blood track device).
Suggested Protocol for the use of OCTAPLEX

Introduction

- This is a plasma derived, virally inactivated concentrate of clotting factors II, VII, IX and X. It also contains the naturally occurring anticoagulants Protein C and Protein S plus Heparin. Indications
- Urgent reversal of Warfarin or another coumarin anticoagulant such as Non-coumalone or Phenindione e.g. major or life threatening bleed, emergency surgery
- Management of bleeding or surgery in patients with congenital Factor II or X deficiencies

Contraindications

- Allergic reactions to Octaplex or Heparin
- Previous Heparin induced Thrombocytopenia

Cautions

- Liver disease
- History of thromboembolic events
- Disseminated intravascular coagulation

Octaplex use varies, please contact haematology/ blood transfusion for advice and up to date information. The following guidance may also be helpful:


II. http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/MajorHaemorrhageProtocol/MajorHaemorrhageProtocol.doc

III. http://www.neuroicu.org.uk/index.html
UHS A to Z of trauma:
Making up Octaplex and infusion rates

- 500 iu of Octaplex is dissolved in 20 mls of sterile water.

- Start the infusion rate at 1 ml per minute for the first 5 minutes and if there is no allergic reaction the infusion rate can be increased by 1 ml per minute every 1 to 2 minutes up to a **maximum rate of 8 mls per minute**. Studies have shown that the latter faster rate is safe with Octaplex.

### Dosing

<table>
<thead>
<tr>
<th>INR</th>
<th>&lt; 2.5</th>
<th>2.5 to 3.0</th>
<th>3.1 to 3.5</th>
<th>&gt; 3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose (mls/kg)</td>
<td>0.9 to 1.2</td>
<td>1.3 to 1.6</td>
<td>1.7 to 1.9</td>
<td>&gt; 1.9</td>
</tr>
</tbody>
</table>

However many hospitals use a standard dose of 30 iu / kg for all patients regardless of the INR. If the patient’s weight is not known and as long as the patient is not significantly obese a dose of **2000 iu for the majority of women** and **2500 iu for the majority of men** would be appropriate.

Please note - **The maximum dose would be 3000 iu at any one time.**

In cases of warfarin / coumarin anticoagulant reversal suggest combining Octaplex with up to 5 mg of IV Vitamin K for full and sustained correction.

### Monitoring

- Check an INR immediately pre and 20 to 30 minutes post-treatment with Octaplex in order to assess the response. If the INR remained too high then additional doses of Octaplex can be given after discussion with the on call Haematology SpR or Consultant.
2.5 D Disability

Initial management

The priority for patients with potential brain or spinal cord injury is to prevent further harm. The severity and duration of secondary insults have a significant impact on outcome. It is essential that these are anticipated and prevented by all those involved in the care of the patient.

Assessment

1. Glasgow Coma Scale
The frequency required for reassessment of GCS depends on the risk of deterioration. Patients can go from being fully conscious to unconscious over a few minutes. Never assume that alterations in consciousness are due to alcohol or other drugs.

The GCS comprises of three components:

---

Eye opening response:

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>To speech</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Eye closed due to swelling</td>
<td>C</td>
</tr>
</tbody>
</table>

---

Best motor response:
Obeys commands 6
Localisation to painful stimuli 5
Normal flexion to painful stimuli 4
Spastic flexion to painful stimuli 3
Extension to painful stimuli 2
None 1

Best verbal response:

Oriented 5
Confused 4
Inappropriate words 3
Incomprehensible sounds 2
None 1
Intubated T

Painful stimuli are best applied as a squeeze of the trapezius. Do not crush the nail beds or perform sternal rubs.

2. Localising signs

The GCS records the best motor response.

**NOTE:** It is essential that the both sides are compared and that the presence or absence of limb movements are noted and documented before patients are sedated and given therapeutic paralysis. Also check pupil size/ reaction before induction of anaesthesia.
3. Pupillary signs

A unilateral fixed and dilated pupil is most commonly due to raised intracranial pressure. Less commonly it may result from direct trauma. Bilaterally fixed and dilated pupils most commonly result from coning due to raised intracranial pressure. Rapid resuscitation (ABC) with administration of a hypertonic solution such as mannitol or hypertonic saline may allow emergency imaging and neurosurgical intervention.

NOTE: Check for coloured cosmetic contact lenses. These are difficult to see unless specifically looked for and can give rise to misinterpretation of both pupillary signs and reactivity.

4. Anal tone

Absent anal tone implies loss of tone of the involuntary sphincter (smooth muscle) and a potential spinal cord injury. Anaesthetic agents reduce anal tone. Muscle relaxants abolish the tone of the voluntary sphincter (striated muscle). Where a spinal injury is suspected and time/clinical situation perform a PR prior to induction of anaesthesia and intubation if possible.

5. Priapism

In male trauma patients, the presence of priapism implies a spinal cord injury. This is an important clinical sign that may disappear within minutes. Its presence should be noted and documented.
Minimising secondary brain injury

All of the following can cause deterioration in patients with traumatic brain or spinal cord injury:

1. **Hypoxia;**
   Aim PaO$_2$ >13kPa

2. **Hypo or hypercarbia:**
   Aim PaCO$_2$ 4.5-5kPa

3. **Hypotension;**
   Aim MAP> 90mmHg (or cerebral perfusion pressure > 60mmHg when ICP monitor placed)

4. **Hypo or hyperthermia:**

5. **Fitting:**
   Patients with severe head injury are generally loaded with 1g phenytoin IV

In addition, the patient’s neck should be in a neutral position and the cervical collar checked to ensure venous outflow is not obstructed. **Loosen** cervical collar in intubated patients while keeping the head immobilised (e.g sand bags and tape).

**NOTE:** In the absence of hypotension the whole bed should be placed on a 30° head up tilt for patients with severe head injury. This simple manoeuvre can significantly help in reducing raised intracranial pressure.

Scoop stretchers are for extrication of patients and are used to facilitate transfers. They are uncomfortable and present a significant risk of pressure damage for all patients but particularly those with spinal cord injuries.

**NOTE:** It is the responsibility of the team leader to ensure that the scoop stretcher or spinal boards are removed as soon as possible.
Initial management of traumatic brain injury ventilated patients

Rapid assessment of patient including pupils and monitoring parameters

**Airway**: ET tube type & length at lips. Confirm CO$_2$ via capnography.

**Breathing**: FiO$_2$, respiratory rate, tidal volume. Bilateral air-entry with SpO$_2$>97%

**Circulation**: HR, BP (MAP>90mmHg), presence and position of arterial line

**Disability**: Pupils (remove contact lens), sedation, muscle relaxation

**Environment**: Temperature, glucose

Ensure adequate sedation and determine level of pre-existing neuromuscular blockade using a Nerve stimulator/ TOF device.

All patients should be assumed to have unstable spinal injury unless the spinal algorithm has been completed and consultant radiology report confirms the absence of any acute spinal injury. Transfer patient onto Neuro ICU bed maintaining spinal alignment.

- Patient should be placed in hard collar
- Transfer of patient will require spinal turns or use of scoop.
- 30$^\circ$ head up tilt to whole bed

Neurosurgical team should be alerted to arrival of patient (as an emergency if either pupil is fixed or dilated)
Transfer to Neuro ICU ventilator and monitoring (settings as per transfer)

**Targets:**

- SpO$_2$ >97%
- PEEP 5cm H$_2$O
- EtCO$_2$ 4.0-4.5 - Measured EtCO$_2$ is generally lower than PaCO$_2$
- MAP > 90mmHg

Ensures cerebral perfusion pressure (CPP)>60mmHg in patients with ICP<30mmHg
- Hb>10 g/dL

Suspect hypovolaemia in all trauma patients where MAP target is not achieved with low dose phenylephrine to offset the vasodilatory effect of propofol.

Beware patients that may have bled from scalp or facial fractures (blood loss at scene, or concealed e.g. in stomach) prior to admission, and resuscitate all hypotensive patients as if hypovolaemic.

**NOTE:** In patients with small extradural haematoma not causing midline shift, raising the BP may expand the haematoma. Therefore, discuss management with Neuro ICU consultant.
Sedation & analgesia

Adequate sedation: propofol 2-4mg/kg/hr

Appropriate analgesia according to injuries: fentanyl 50-200mcg/hr

On arrival to Neuro ICU handover team, including:

- Mechanism of injury
- Extraction time
- Initial and post resuscitation GCS scores, with breakdown of score (Eyes, Voice & Motor). Pupils & lateralising signs.
- Episodes of hypoxia / hypotension
- Grade / difficulty with intubation
- Management prior to arrival on Neuro ICU, including all medication and fluids given.
- CT Findings
- Premorbid history, drug & allergy history
- Antibiotics / tetanus / pregnancy test
- Details of patient and relatives if known.

Management of self ventilating patient with head injury

Rapid assessment of patient including:

- **Airway**: Maintained and clear. No signs of upper airway obstruction
- **Breathing**: Adequate rate and depth of respiration with SpO$_2$>97%
- **Circulation**: Assess HR & BP
• **Disability**: GCS, pupils, lateralising neurology. (Including dysphasia)

All patients should be assumed to have unstable spinal injury unless spinal algorithm has been completed.

- Patient should be placed in hard collar
- Transfer of patient will require spinal turn or use of scoop, maintaining spine alignment
- 30° head up tilt to whole bed

Patients should not be triple-immobilised once on the bed without the scoop. (Triple immobilisation keeps the patient’s head still, but the rest of their body may move resulting in malignment of their C-spine.)

Neurosurgical team should be alerted to arrival of the patient (as an emergency if either pupil is fixed)

**Phenytoin**

Consider phenytoin (1g loading dose) in all patients with traumatic brain injury, especially in presence of:

- History of seizures
- Skull fracture
- Extradural haematoma managed conservatively
- Temporal lobe damage (eg contusions)
- Tetanus, if open wound (Revaxis 0.5ml IM)
- Pneumovax, if intracranial air is present
- Pabrinex 1 pair IV bd for 72 hrs for all suspected alcohol abusers
- Antibiotic treatment of any open skull fracture, with Ceftriaxone 4g (as stat dose)
- Variable rate insulin infusion, if appropriate

**NOTE:** Any patient with a head injury who is sedated to a level that they cannot be clinically assessed should be discussed with the neurosurgeons for consideration of ICP monitoring.
Management of Spinal Injury

History
On admission / transfer, ensure that these points are made clear by the referring and/or transferring team:

- Nature and mechanism of injury.
- Complete / incomplete / absent spinal cord injury at referring hospital.
- Methylprednisolone given / not given. The consensus opinion from the Wessex Neurological Centre is that steroids should not be given.
- Other injuries

Examination

- ABCD
  
  A  Airway and Cervical spine immobilisation.
  
  B  Adequacy of ventilation.
  
  C  Fluid resuscitation (presume hypotension secondary to blood loss, not spinal shock).
  
  D  GCS, pupil size.

- Associated injuries including pressure areas.

- Level of spinal injury
  
  A. Radiologically
  
  B. Clinically
  
  C. Complete / incomplete / absent
Investigations

- Spinal imaging (see protocol).
  - Is further imaging needed at the level of injury?
  - Has the entire spine been adequately imaged (10-15% of patients with traumatic spinal injuries have another injury at another level)?

- Arterial Blood Gases.

- On Neuro ICU non-ventilated patients require regular measurement of vital capacity.

Management

- Oxygen.
  
  - Most patients with lesions below C4 are able to make sufficient respiratory effort to avoid ventilation, but do need supplemental humidified oxygen. Aim for SaO2 > 98%.

- Ventilation

  A. Look for signs of fatigue.
  
  B. BD Vital capacity.
  
  C. Tetraplegic patients find it easier to breathe when supine.
  
  D. Consider elective ventilation in high cervical injuries with RR > 30/min, worsening ABGs, vital capacity < 1200 ml.
  
  E. Patients with cervical injuries at C2, C3 will require invasive ventilation. Patients with injuries below this level can be managed in many cases with non-invasive ventilation.
F. Suxamethonium can be used up to 48 hours post-injury, but after that time may cause a sudden onset of profound hyperkalaemia that will result in cardiac arrest.

- **Haemodynamic management**

  - Ensure blood pressure is adequate to allow normal mentation (in non-TBI patients) and urine output >0.5ml/kg/hr. Where there is concern about spinal cord perfusion (eg evidence on imaging of compression of spinal cord) consider maintaining a higher MAP eg ≥ 80mmHg.

  - Spinal shock may produce hypotension, bradycardia and poikilothermia. This results especially from injuries above T6.

  - Presume hypotension due to blood loss until proven otherwise.

  - Increased vagal activity may cause cardiac syncope (often triggered by airway manipulation such as intubation or changing tracheostomy). Responds to O2 and atropine but better prevented by prophylactic glycopyrronium PRN.

- **GI management**

  A. Paralytic ileus is common with spinal cord injury. Patients are commonly kept NBM for first 48 hours.

  B. Thereafter, establish early enteral feeding ± prokinetics.

  C. Proton pump inhibitors as prophylaxis for stress ulceration.

  D. Where nasogastric feeding has failed, consider placement of nasojugal tube.
E. If prolonged nasogastric feeding is likely to be required, consider early placement of a PEG.

F. Early commencement of active bowel care is essential, with daily manual evacuations where required.

- **DVT prophylaxis**
  
  A. Full length intermittent pneumatic compression devices (IPCs) and anti-embolic stockings (AES).
  
  B. Enoxaparin 40 mg SC nocte, once risk of increasing intraspinal haemorrhage is considered unlikely.

- **Pressure areas and contractures**
  
  A. Need suitable pressure-relieving mattress.
  
  B. Two hourly turns.
  
  C. Minimise hypotension, hypoxia, oedema.
  
  D. Ensure adequate nutrition.
  
  E. Orthopaedic casts should be removed regularly to prevent development of plaster sores.
  
  F. Joint contractures develop rapidly following spinal cord injury. Liaise with the physiotherapists regarding passive movements and splinting.

- **Immobilisation**
  
  A. Patients should be removed from scoop stretchers as soon as possible.
  
  B. Triple immobilisation should continue utilising a hard cervical collar and a firm mattress before the application of traction or definitive stabilisation.
C. Cervical collars

- Two-piece collars such as the Philadelphia or Aspen models are used for longer-term use as they are more comfortable and cause less skin problems. Soft collars have no role.

**NOTE:** Once immobilised, the decision to remove protection should only be made after appropriate investigations have been completed and reported. The decision to remove immobilisation must be clearly documented in the notes, signed and dated.

- Collars may be removed or loosened in cases of raised ICP, in patients that are sedated & paralysed. The decision should be clearly documented in the notes.

D. Patients being transferred for short periods such as for imaging may be moved on a spinal board for convenience. Ideally a pressure-relieving gel mattress should be placed between the patient and the board.

E. Most spinal boards and scoop stretchers cause minimal artefact for CT and MRI.

F. Modern scoop stretchers are non-magnetic and can be used to transfer patients on to MRI tables.

G. Seven staff are necessary if a sliding board transfer is required. Four are required to perform a log-roll with a fifth to position the board.

H. Skull callipers, unless MRI compatible, will have to be removed and a hard cervical collar should be in place before traction is released.

I. It is inappropriate for patients to be left on spinal boards for prolonged periods (e.g. operative procedures or for hospital transfer).
Steroid Treatment in Acute Spinal Cord Injury

- There is ongoing debate regarding the efficacy of steroids in acute spinal cord injury. The consensus opinion from the Wessex Neurological Centre is that steroids should not be given.

Mannitol and hypertonic saline

Mannitol

- Mannitol is a low molecular weight solute that can be added to crystalloid solution to make it hyperosmolar. It is commonly used as a 20% solution (1098 mosm/kg).

- The European Brain Injury Consortium and the Brain Trauma Foundation recommended mannitol as the osmotic drug of choice in brain injured patients.

**NOTE:** The Brain Trauma Foundation recommends 2 ml/kg of 20% mannitol, infused over twenty minutes, for patients with clinical signs of raised intracranial pressure or deteriorating neurological function.

- Mannitol reduces intracranial pressure within a few minutes.

- Distribution is rapid with a half life of approximately 10 minutes. Its diuretic action occurs within 1–4 hours such that its beneficial effects cannot result from it being an osmotic diuretic.
• Serum osmolarity is increased following mannitol administration. This draws water in to the vascular compartment from all tissues (including the brain) resulting in a temporary increase in blood pressure.

• If autoregulation is intact, the increase in cerebral perfusion pressure will cause cerebral vasoconstriction and consequent reduction in ICP. The haematocrit is reduced following mannitol administration. This may also increase cerebral blood flow and oxygen delivery.

• Mannitol also decreases cerebrospinal fluid production, which leads to a reduction in cerebral volume and consequently a reduction in ICP. Mannitol is also a free radical scavenger.

**Hypertonic saline**

• Hypertonic saline (HTS) is an attractive alternative to mannitol as an osmotic agent. The BBB permeability to sodium is low thus producing an osmotic gradient where the BBB is intact.

• Administration of HTS produces an increase in circulating blood volume and consequent rise in CPP. HTS may also modulate the inflammatory response by reducing leucocyte adhesion to the endothelium.

• HTS does not have the diuretic properties of mannitol thus reducing the risk of hypotension and volume depletion following its usage.

A variety of concentrations of HTS are available. The most appropriate solution for acute use in emergency is 2.7% saline.

**NOTE:** If used for raised ICP with fixed pupils, 3ml/kg should be used for 1 fixed & dilated pupil and 6ml/kg should be used for 2 fixed & dilated pupils.

This will provide an equivalent osmolar load to 0.5g/kg & 1g/kg of mannitol respectively, already established for fixed & dilated pupils.
UHS Guideline for Initial Spinal Management

Guidelines for initial spinal management of sedated and ventilated trauma patients

UHS Adult Major Trauma Guidelines 2014

Version 1

Dr Andy Eynon
Dr Simon Hughes
Dr Elizabeth Shewry

1. Full spinal precautions
   - Unknown mechanism of injury or fall greater than patient's own height or high energy impact or age >50
     - Yes
       - Full Trauma CT or CT Head & Cervical spine & thoracolumbar imaging
     - No
       - Bony injury of C-spine
       - Thoracolumbar imaging

2. Consultant radiologist report
   - Report of spinal imaging to include:
     - Any inadequacy of imaging
     - Fracture
     - Alignment (dislocation)
     - Soft tissue swelling indicative of spinal injury

3. Cervical (C-spine) imaging report
   - Consultant name:

4. Thoracolumbar (T&L spine) imaging report
   - Consultant name:

5. Injury reported on imaging of spine
   - Yes
   - No

6. Consultant spinal surgeon
   - Management plan / nursing care to ensure alignment maintained

7. A normal CT does not exclude ligamentous injury.
   - Stable C-spine
   - Stable T&L spine

8. Stabile C-spine
   - No hard collar
   - Patient sat up
   - Normal turns

9. Stable T&L spine
   - No hard collar
   - Bed tilted head up
   - Full spinal turns

10. C-spine stable in hard collar
    - Stable T&L spine
    - Hard collar
    - Patient sat up
    - Normal turns with head hold
    - Unstable C-spine
    - Unstable T&L spine

11. D
    - Hard collar
    - Bed tilted head up
    - Full spinal turns

Mark identical box A-D over the page
Management plan for when sedation is reduced

A
No hard collar
Patient sat up
Normal turns

Sedation reduced, allowing patient to move

Evidence of vertebral fusion due to degenerative disease or operation, or extremely high velocity injury?

No

No Hard Collar
See Note 1

Yes

Hard Collar
Patient requires hard collar until MRI or patient is GCS 15 with no distracting injuries, allowing clinical assessment, followed by flexion extension views.

B
No hard collar
Bed tilted head up
Full spinal turns

Extubate

High spinal cord injury?

No

Extubate

Yes

Change to T&L logroll turns i.e. no head hold
See Note 1

Yes

Bed flat once patient spontaneously ventilating, including after extubation

Extubate

C
Hard collar
Patient sat up
Normal turns with head hold

Spinal consultant management plan

Name of spinal consultant:

Comments

Hard collar for _______ weeks

Halo jacket

Extension brace

D
Hard collar
Bed tilted head up
Full spinal turns

Extubate

Change to Normal turns

Continue with full spinal turns

ALL PATIENTS
Side lie all patients to prevent pressure sores, unless specifically contra-indicated. Eg unstable pelvis

Contra-indicated
Reason:

ICU Consultant signature:
Print:

Date:
Time:
2.6. Exposure and environment

Initial Antibiotic administration in Major Trauma

Please follow these links for the current protocol:

http://staffnet/TrustDocsMedia/DeptDivSpecific/Major-trauma-centre/Adult-Major-Trauma-Prophylactic-Antibiotics-policy/Adult-Major-Trauma-Prophylactic-Antibiotics-.docx


Figure 2.26 Adult Major Antibiotic Prophylaxis
Temperature control

Temperature control is of vital importance in Major Trauma patients. Patients begin to lose heat from the moment of injury.

Pre-hospital temperature control

- Heat loss is affected by environment factors and focus on temperature control at the scene of the accident is vital. Patients should have minimal scene time whilst ensuring life-threatening injuries are treated. Effort should be made to decrease temperature loss by use of blankets/wrapping etc. Minimal crystalloids are given to trauma patients. Many ambulance services have started to utilised pre-hospital blood and this should be accompanied by warming methods such as the ‘buddy lite’.

- Chemically activated warming blankets such as ‘Ready heat’ have also been introduced but care must be taken to ensure that there is a barrier between these and the skin (there have been case reports of skin burns possibly associated with high flow oxygen accelerating the exothermic reaction)

Temperature control in the Emergency Department

- As patients may already be hypothermic there should be a definitive focus on avoiding heat loss and restoring heat in these patients.

- Temperature should be measured on arrival in the emergency department and at regular intervals until normothermia is maintained. The environment itself may cause heat loss and the ambient temperature in the resuscitation department is often low.

- Patients should be ‘skin to scoop’ but if this has not occurred all wet clothing should be removed on arrival in the resuscitation area. Efforts should be made to keep the patient covered at all times except during the initial assessment. Interventions should preferably be performed at the same time to
avoid repeated occurrences of exposure leading to heat loss. Heat loss from the head can be considerable and should always be considered.

**Temperature measurement**

Please see p140 for the current UHS Best Practice Guidelines for Temperature Monitoring in Major Trauma.

**NOTE:** The patient’s temperature should be regularly measured. Intubated Major Trauma patients should have an oesophageal/ nasopharyngeal probe for continuous monitoring (caution with nasopharyngeal probes and possible base of skull fractures)
**Take**

- Arrival temperature and record:
  - Ear-based in conscious patients (*clearance of tympanic membrane).
  - Oesophageal probe in intubated patients unless contraindicated by injury
    - as soon as practical.

**Evaluate**

Effectiveness of rewarming and heat loss prevention strategies

- Record Tc trend every 30 minutes. \( (Tc = \text{core Temp}) \)
- Document Tc measuring device used.
- Document warming/heat loss strategies.
- Document ongoing plan for temperature management.
- Commence rewarming if Tc drops below 35º C.

Core temperature (Tc) should be returned to 35º C when practical and safe to do so

- *Continuous haemodynamic monitoring is required.
- Aim to maintain Tc between 36 – 37º C.

Record Tc on leaving resus room

**Maintain**

- Heat loss-prevention strategies (arrival T equal to or>35º C)

  - Minimise exposure at all times.
  - Remove wet clothing / bandages.
  - Warm environment.
  - Warmed blankets.
  - Warmed Intravenous (IV) fluids (pre-arrival preparation of equipment, warming device is on, primed IV ready).

Rewarming and heat-loss prevention strategies (T < 35º C)

  - All of the above plus
  - Apply bair hugger – forced air warming device.

**Plan**

- Rewarming or heat-loss prevention strategies are not interrupted by:

  - Radiological investigations.
  - Computed tomography (CT) investigations.
  - Intra-hospital transfers (CT, Operating Suite, and Intensive Care).

Support staff to ensure:-

Warming devices are available throughout the entire emergency phase of care.
In hospital warming methods

1. Fluids

All fluids should be warmed. A fluid warmer such as a Ranger should be used for small volumes and a rapid infuser with heating ability such as the Belmont or Level 1 infuser for large volumes. Please remember that the warmer on the Belmont only works when the Belmont is connected to mains electricity.

2. Forced Air warmer

Forced air warmers such as ‘Bair Hugger’ should be used to keep the patient warm. These may be transported to CT scan with the patient on the transfer trolley. We are now using a dedicated under body Bair Hugger blanket that is placed under the scoop stretcher and secured to wrap around on top of the patient.

3. Bubble wrap

Bubble wrap is used in the pre-hospital environment to keep the patient warm, plus avoid fluid contamination of the vehicle. It can continue to used on the patient in the hospital environment.
Immobilisation of the Major Trauma Patient

All major patients should remain immobilised until their spine has been cleared by someone trained in this procedure. Those trauma patients within significant mechanism, signs or symptoms or spinal injury should in particular remain immobilised until their imaging and clinical assessment are complete.

The cervical spine should be triple immobilised utilising a hard collar, blocks and a board in those able to tolerate this. Particular attention must be paid to unconscious / anaesthetised patients who are not able to describe symptoms of spinal injuries.

These patients should continue to be log-rolled unless they are immobilised on a suitable transport board such as a scoop stretcher.

Scoop Stretchers

- All major trauma patients should remain on the scoop stretcher during their immediate phase for ease of transport and spinal protection. The standard scoop utilised by South Central Ambulance Service is the yellow Ferno scoop.

- The scoop is extremely useful for transporting patients on/off the CT scanner table and/or straight to theatre or Intensive Care whilst ensuring spinal protection.

Figure 2.28: Ferno Scoop

NOTE: The yellow Ferno scoop is CT compatible.
A. Insertion of the Ferno Scoop

B.

A. The head is positioned at the wide end of the scoop.

B. There are two halves to the stretcher and each side is inserted carefully then clipped together at each end.

C. The patient only required minimal log-rolling of approx 10 degrees to insert each side.

NOTE: Efforts should be made to remove the scoop as soon as possible as there is potential for pressure sores to occur with prolonged use. They should remain immobilised unless the spine has been cleared.

C. Removal of the Ferno Scoop:

A. The patient is braced.

B. The scoop is unclipped at the top and bottom.

C. Each side of the scoop then can then be removed in turn.

D. The patient should only require bracing during removal of the scoop, rather than a full logroll

Occasionally other makes of Scoops are utilised by other ambulance services. These scoops are not CT compatible and the patient needs transferring onto the yellow Ferno scoop.
D. Procedures for transfer onto the yellow FernoScoop:

1) From Aluminium scoops

A. Place yellow scoop with pelvic binder on at the appropriate level (if the patient does not have one) below the aluminium scoop.

B. This would require a straight lift of a few inches of the patient on the aluminium scoop.

C. Then when the aluminium scoop is on the ferno scoop unclip the aluminium scoop and with the patient braced on the opposite side slide out one side and then with reverse bracing the other side.

D. This approach negates the need for a log roll but does require vertical lifting and support for the patient.

2) Green solid scoop boards

(Often utilised by South West Ambulance Service Trust)

A. With the log roll team, a 10 - 20 degree modified log roll, and place one side of the Ferno scoop under the patient but on top of the green board.

B. Repeat the other side, clip together.

C. Vertical lift of patient on Ferno scoop and remove green board.
Section 2.7  Pain management

Introduction

- Pain management is one of the most important components in patient care, which is why it is given such a high priority in the BAEM ‘Clinical Standards for Emergency Departments’ and the National Triage Scale.

- Pain is commonly under-treated and treatment is often delayed

- Recognition and alleviation of pain should be a priority when the treating ill and injured.

- This process should start at triage, be monitored during their time in ED and finish with ensuring adequate analgesia at, and if appropriate, beyond discharge.

- The BAEM Clinical Effectiveness Committee standard of analgesia for moderate & severe pain within 20 minutes of arrival in ED should be applied in all Emergency departments. An audit against these standards should be done annually.

- Consider using a multi-modal approach to pain management and early involvement of the acute pain team (bleep 2974) or on call Anaesthetist (bleep 2265).

Pain assessment

- Using this method of pain scoring and the practitioner’s clinical judgement, it should be possible to adequately assess into one of four categories and treat pain appropriately.

- Once the category has been established, appropriate analgesia may be prescribed according to the guidance.
• In all cases it is important to think of using other non-pharmacological techniques to achieve analgesia, which may include measures such as applying a dressing or immobilising a limb etc.

• Following reassessment if analgesia is still found to be inadequate, stronger / increased dose of analgesics should be used along with the use of non-pharmacological measures.

• Opioids should be given when other methods of analgesia are ineffective or the patient is unable to receive those types of analgesia e.g. NBM.

**Lignocaine patches**
Lignocaine patches are recommended for patients with chest injuries (Figure 2.29: page 153).

**Regional Anaesthesia**
In some patients a regional procedure (+/- iv infiltration) of local anaesthetic may be of benefit e.g. those with isolated neck of femur or wrist fractures. Anaesthetists may be able to help on an individual basis, please contact bleep 1903 or 1646 (daytime only). Contact the Anaesthetic co-ordinator for advice outside the above hours (bleep 2265).

**Chronic pain**
Major trauma patients are at high risk of developing chronic pain. These patients may benefit from early commencement of drugs such as Gapapentin and/or Amitryptilline to both treat acute pain and reduce the incidence of chronic pain avoid such problems. This should be done in conjunction with the acute pain team.

**UHS Acute Pain team**
The Acute Pain Team is available Monday to Friday and will deal with all acute pain issues. Acute pain policies including those for epidurals are available on the intranet. Referrals to them may be made by e-quest. Urgent referrals are via the bleep 2974.
Use of 5% Lidoceaine Medicated Plaster (Versatis) for Management of Traumatic Rib Fractures

**Indications**
Age > 18yrs AND
Confirmed diagnosis of 1 or more of the following:
>3 rib consecutive rib fractures
OR Flail chest OR Bilateral rib fractures OR Failed Oral Analgesia

**Ensure Simple Analgesia Prescribed**
Paracetamol 1g QDS
+/- Ibuprofen or Naproxen (if NO contraindications)
+/- Simple oral opioid (Codeine based analgesia)

**5% Lidoceaine Plaster Application**
Apply to the most painful area on the skin surface directly overlying rib fractures
Use a maximum of 3 patches per patient
Apply to non-irritated skin
Remove hairs in affected area with scissors (do not shave)
Apply a new patch every 12 hrs
Treatment can last up to 2 weeks

**Contraindications**
Not to apply to broken skin
Allergy to Lidoceaine or Local Anaesthetics
Patients Intubated & Ventilated

**Acute Pain Team Referrals For All Patients Using 5% Lidoceaine medicated plaster**
Bleep 2974 or via E-Quest Mon-Fri 09:00-16:00

*Please seek advice from Acute Pain Team or the on-call anaesthetist (bleep 2265) before applying plaster to patients already receiving local anaesthetic nerve catheter infusions or blocks*

Authors: Aparna Cockrell, Simon Hughes, Jacqui Trim  Review date: 29th Jan 2014

**Figure 2.29**
Use of lignocaine patches with traumatic rib fractures


2.8: Indications for Multi-Trauma CT scans

Introduction

- There is formal agreement that certain categories of trauma can proceed to CT without discussion with a radiologist.

- It is expected that this decision is made by the most senior member of the trauma team (usually the ED Consultant).

- If a patient is a level 1 trauma call, the C Level CT room should be notified Ext 8002/5047 with details of the likely time of arrival. It is crucial to give CT an accurate ETA of the patient, as well as updating them if this changes.

Patients requiring CT for trauma include those where-

1. There is haemodynamic instability. The critical decision making is whether the patient can be stabilised to a sufficient degree to safely allow CT scanning or whether it is time critical to proceed direct to theatres. CT gives vital information to the surgical teams as to which operation to perform. Therefore (relative) haemodynamic instability is not always a contraindication to CT. One option is to proceed to CT once a modicum of stability has been achieved with the option to rapidly divert to theatres if the patient deteriorates.

2. FAST (Focused Abdominal Sonography for Trauma) ultrasound has demonstrated intra-abdominal fluid

3. The mechanism of injury suggests that there may be occult severe injuries that cannot be excluded by clinical examination or plain films

4. Any Acute Injury Severity score (AIS) 3+ in the head, thorax or abdomen

5. Any head injury and age between 16 and 66 and GCS on arrival in the ED < 13
6. Age between 16 and 66 and GCS falls below 15 within 2 hours of arrival

7. Age between 1 and 16 and GCS on arrival in the ED < 14

8. Age less than 1 and GCS on arrival in ED < 15

**Preparation for CT**

1. Reducing the time to CT for multi-trauma patients is essential.

2. Nothing should be undertaken in the ED that delays transfer unless it will immediately affect the outcome for that patient

   **This includes NOT performing:**

   1. Plain X rays
   2. Invasive lines (arterial line or CVP line). If the NIBP is recording a BP this is sufficient monitoring for the Trauma CT.
   3. Urinary catheterisation

   **The aim is for all major trauma patients to be in the CT scanner within 30 minutes of arrival in the hospital.**

4. Ensure polytrauma CT request form completed. Contact CT (on 8002/5047)

5. Take the NAME of the RADIOGRAPHER

6. 2 x IV access (one for CT contrast and other for use by trauma team). Cannula for contrast is ideally in the left antecubital fossa. If arm vein access is not possible a central line can be used (not ideal) if it can accept >4mls contrast /second via a power injector.
7. If a pelvic fracture is suspected, a binder must be in situ prior to CT

8. Limb fractures should be immobilised in an air cast. Only immediately limb conserving manipulations/ splinting should be done prior to CT

9. Be aware of pregnancy status in women of childbearing age – the mother’s health takes priority over the foetus.

10. No plain films are usually undertaken prior before CT unless there is severe haemodynamic stability or concern re tension pneumothorax.

11. No central line / arterial line unless absolutely necessary

12. No urinary catheter is inserted performed prior to CT

13. Unmanageable patients must be made manageable (this may mean that they require intubation and ventilation). As a rule sedation is not performed to allow CT. The options are either patient fully awake (no sedatives) or fully anaesthetised (intubated/ventilated)

14. No unnecessary interventions

15. Trauma team leader and Surgeon are to attend and liaise with anaesthetist, as well as the scribe to continue documentation in the trauma booklet.

16. Phone the on call Neurosurgical registrar via the baton mobile phone 07554223539 or bleep 2877 from the CT scanner if head injury suspected so they can attend and review images as they appear.

17. Contact Neuro ICU or GICU from CT scanner if bed likely to be required to allow them to prepare.

18. Consider destination post CT scan (default is ED Resus to allow completion of initial resuscitation)
Appendix 1: CT Major Trauma Hot Report Form

CT Multi trauma Primary Assessment: UHS

**Patient Name:**

**Date of Scan:**

**Reporting Radiologist:**

*Formal detailed report will follow on Results Server.*

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# UHS Adult Major Trauma Guidelines 2014

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## Clinician Contact

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Section 3: Admission & discharge criteria for patients with major trauma

3.1 Admission criteria for UHS major trauma patients

Introduction

The following have been written to aid clinical decision making for patients requiring admission to UHS following major trauma. These are UHS specific and do not necessarily apply at other hospitals. Clinical judgment should be used to determine which level of care would be most appropriate based on the criteria below.

Although a lower level of care will usually require a lower nurse to patient ratio or reduced critical care support, this may not apply in all circumstances and the aim should be to be flexible in the provision of staff resources to meet the needs of the patient. The level of care assigned to a patient will influence, but not determine, staffing requirements.

The location of patients does not determine their level of care.

Please refer to ‘Levels of care from the Intensive Care Society Guidelines for adult patients 2009’ for further information regarding levels of care within a UK hospital.

Patients requiring immediate surgery

- The named anaesthetic consultant carries bleep 1646 from 08:00-18:00 and is part of the major trauma team alert. Coordination of theatres should be through them to ensure we do not unnecessarily delay or cancel other cases.

- The 1783 Trauma Anaesthetist bleep or senior anaesthetist on call (bleep 2265) should be contacted out of hours.

- If a patient requires immediate surgery and a theatre is not available, the patient should be transferred to F level recovery pending the next available theatre. Ongo-
ing care will be the responsibility of the trauma team and the named anaesthetic consultant.

**Which adult ICU?**

- UHS has three adult ICUs – general (GICU), neuro (NICU) and cardiac (CTICU).
  - **Age:** The age cut-off between adult and paediatric ICU is usually taken as 16 years. If a 16 year old is currently in full time education they will generally be accepted by PICU. If they have left full time education they will generally go to the most appropriate ICU. The exception is for patients already known to PICU such as patients with congenital heart disease or cystic fibrosis when discussion should be held with the PICU consultant in addition to the appropriate adult ICU.
  - **Multiply injured:** Patients with brain or spinal injuries that require the specialised care of NICU should generally be admitted there. The exceptions are those who are haemodynamically unstable due to other injuries where GICU may be more appropriate until they are stabilised.
  - **Chest injuries:** Patients with thoracic trauma who require level 3 care are managed on GICU. Consider early consultation with general ICU for patients with flail chests, pulmonary contusions especially in the elderly or with other co-morbidities even if no immediate need for ICU care.

**Should they go to High dependency?**

- Err on the side of caution. Involve outreach / GICU for advice as to whether a patient requires HDU or can be managed in a ward bed.
Patient Destination and Receiving Team

The major trauma working group of UHS has been tasked with clarifying which team is responsible for the ongoing management of certain patients:

i. Agitated patients
   - Agitated (possible head injury) patient requiring intubation for management or investigation
   - Agitated trauma patients who require intubation for management or investigation (e.g. CT scan) where imaging does not identify injury requiring specific management by another team should be admitted to GICU under the care of the duty orthopaedic trauma consultant
   - Following extubation, they should be transferred to an orthopaedic trauma bed

ii. Spinal fractures
   - Any patient with spinal injury requiring admission for treatment or investigation should be admitted under the care of the duty spinal team (rotates weekly between neurosurgery and orthopaedic spinal teams)
   - Patients with spinal injury requiring level 2 or 3 care are generally admitted to NICU. These include patients with injury to the cervical region of the spinal cord who are at risk of respiratory and cardiovascular problems.

iii. Chest injuries
   - Isolated chest injuries requiring admission are admitted under the care of the duty cardiothoracic consultant
   - In hours, consider alerting the regional analgesia service (via the acute pain team bleep 2974 or 1903) for advice and consider using a lignocaine patch as part of the patient’s multi-modal analgesia.
iv. **Unsurvivable injuries identified in ED or on CT scan**

- Generally the ED is not the most appropriate place to withdraw care for patients or to provide the support required for their families.
- Ideally an ICU bed should be identified on GICU or NCCU to allow controlled withdrawal of therapy.
- The patient should be admitted under the care of the consultant who has decided that ongoing care is futile although coded as an inevitable death.

v. **Maxillofacial injuries**

- Patients with significant isolated maxillofacial injuries must be assessed as to their risk of airway compromise or neurological deterioration.
- Patients should be admitted to an appropriate ward (usually F level) under the care of the maxillofacial surgeons, if there is no risk of either of these. Nursing staff on the maxilla-facial ward should be able to perform neurological observations.

---

The cardiothoracic registrar (bleep 9211) should be informed immediately if there is:

- Haemothorax likely to require thoracotomy (initial drainage over 1500mls or continued bleeding over 200mls/min)
- Haemodynamic instability
- Likelihood of injury to major intrathoracic structure
- Profuse air leak following intercostal drain insertion resulting in lowered SaO2
3.2 MTC Admission and Repatriation Protocol
Major Trauma Centre

Admission and Repatriation Protocol

1. **AIM**

1.1 This protocol provides formal arrangements to address the difficulties admitting and repatriating patients with major trauma to Southampton General Hospital.

1.2 For the protocol to be effective it is important that all Hospitals within the Wessex Trauma Network sign up to its requirements.

2. **RESPONSIBILITIES**

2.1 Southampton General Hospital will undertake to admit all major trauma cases immediately on request from either a general hospital or from the ambulance service.

2.2 Patients referred to Southampton General Hospital for specialist treatment of major trauma will be accepted by the Emergency Department. It will be the responsibility of Southampton General Hospital to alert the relevant specialist teams and to arrange an appropriate bed for the patient.

2.3 All patients with major trauma will be received by the Emergency Department at Southampton General Hospital to ensure that they have been stable during transfer and for any necessary resuscitation.

2.4 It is the responsibility of the referring hospital to ensure that all necessary documentation and radiological imaging either accompanies the patient or is available electronically (e.g. via the EPR/PACS system).

2.5 In the case of direct admission to Southampton General Hospital, Southampton General Hospital will undertake to notify all general hospitals of the presence of one of their catchment population within 24 hours of admission with an outline timescale for likely repatriation. For cases of secondary transfer it is expected that the referring hospital will make their local bed manager aware of the transfer. Southampton General Hospital will endeavour to inform the bed manager of the likely timescale for repatriation.
2.6 Southampton General Hospital will adopt the responsibility of providing adequate notification of impending repatriations. Patients transferred to Southampton General Hospital for specialist treatment MUST be repatriated to their local hospital within 48 hours of the request in the case of ICU/HDU cases, or within 24 hours of the request in the case of ward patients.

2.7 Benefit for all concerned will be obtained by identifying relevant patients promptly and preparing for the repatriation in advance of clinical approval.

2.8 There are varying protocols with regard to MRSA screening and some current hospital policies and practice could delay an otherwise clinically appropriate and desirable repatriation. Whilst there is a strong case to work towards a more consistent approach to MRSA across the region, hospitals should ensure that constraints imposed by MRSA screening DO NOT prevent them from meeting their obligations outlined in this protocol.

2.9 The time limit for repatriation should be observed at weekends as well as during the week, although it is recognised that local bed management arrangements and the availability of the accepting clinical team might have an influence.

2.10 Southampton General Hospital will undertake to provide a personalised assessment and prescription of likely rehabilitation needs of the patient (to accompany the patient) and to have made initial contact with the local rehabilitation specialist(s). At present it remains impossible for the Major Trauma Centre to undertake specialist rehabilitation for all patients.

3. **THE PROCESS**

3.1 The duty Major Trauma Consultant will make contact with the host hospital clinical team and agree the transfer and acceptance of care. Ideally each General Hospital will agree a single point of contact for all referrals (preferably the site manager – see below).

3.2 Liaison thereafter should be between the relevant bed managers, providing all relevant clinical and social information.

3.3 The host hospital identifies an available bed within the appropriate timeframe and informs Southampton General Hospital.

3.4 Transport is organised by Southampton General Hospital providing any necessary escort arrangements, together with all necessary documentation including a formal typed discharge summary to accompany the patient.

**Date of Policy:**

**Prepared by:** Dr. Andy Eynon, Director of Major Trauma, UHS
Wessex Trauma Network – Repatriation Protocol

Figure 3.1: WTN Repatriation Protocol
3.3 Admission criteria for Major Trauma patients to The Neurosciences Intensive Care Unit

Adequate resuscitation of all CNS injured patients is essential to maximise their chance of survival and recovery. The avoidance of secondary brain injury is the most important aspect of management of all major trauma patients with CNS involvement.

All patients with major trauma and CNS injury that could benefit from specialist neurosurgical and neurointensive care are eligible for admission, once they have been resuscitated to:

- Secure airway
- Adequate ventilation and treated pneumothorax (when present)
- Cardiovascular stability with all haemorrhage controlled
- MAP > 90 mmHg
- Hb > 10 g/dl
- PaO₂ > 13 kPa
- PaCO₂ > 4.5 < 5.0 kPa
- 30 degree head up tilt
- Seizures controlled
- Abnormal coagulation corrected

Any deviation from these parameters requires full discussion with the Neuro ICU duty consultant before consideration of transfer for admission.

Any patient > 75 years old with any significant co-morbidity and a motor score of 1, would be unlikely to benefit from specialist neurosurgical or neurointensive care management, so should be thoroughly discussed with the neurosurgeons prior to consideration of transfer for admission.

Limitations to resuscitation in the Wessex Neurological Centre:

1. No blood is stored
2. No rapid transfusers are present
3. No anaesthetists are present on NICU out-of-hours
4. No operating theatre nor recovery staff are present out-of-hours
Section 4: Specific management guidelines

4.1 Thrombo-embolism Prophylaxis in Major Trauma patients

Risk Factors:

- Deep vein thrombosis (DVT) is caused by reduction in deep venous blood flow, changes in blood composition, trauma to walls of deep veins, or more often to a combination of these mechanisms.

- A number of clinical factors causing such changes increase the risk of DVT. These include: increasing age, prolonged immobility, stroke or paralysis, previous DVT, cancer and cancer treatment, major surgery and trauma, obesity, varicose veins, cardiac dysfunction, indwelling central venous catheters, inflammatory bowel disease, nephrotic syndrome and pregnancy or oestrogen use.

- Surgical patients have additional risk factors specific to the type of procedure and anaesthesia, mainly due to the duration of surgery and the prolonged postoperative immobilisation.

- Thrombophilic disorders also increase the risk of DVT. These disorders are: activated protein C resistance; prothrombin variant 20210A; antiphospholipid antibodies; deficiency or dysfunction of antithrombin, protein C, protein S, or heparin co-factor II; dysfibrinogenemia; decreased levels of plasminogen and plasminogen activators; heparin induced thrombocytopenia; hyperhomocystine- mia; and myeloproliferative disorders such as polycythemia vera and primary thrombocytosis.

- The most recent guidelines for prevention of thromboembolism in patients are available on the UHS intranet. Please see diagram 4.1 below as an example.
Diagram 4.1  Thromboprophylaxis for Trauma and Orthopaedic Patients

Thromboprophylaxis for Orthopaedic Surgery and Trauma

- **Elective hip (THR) or knee replacement (TKR)**
  - Offer IPC in recovery and continue for as long as tolerated.
  - Continue mechanical prophylaxis until mobility no longer significantly reduced

- **Hip fracture (including #NOF)**
  - Offer IPC at admission (in Emergency Department) and continue for as long as tolerated.
  - Continue mechanical prophylaxis until mobility no longer significantly reduced.
  - If surgery is not planned on day of admission and VTE risk outweighs bleeding risk offer Enoxaparin or Heparin as per renal function and body weight.

- **Other orthopaedic surgery and trauma**
  - Upper limb (surgery or trauma)?
    - Yes
      - Do not routinely offer VTE prophylaxis
    - No
      - If VTE risk increased and after assessing risks and discussing with patient:
        - Consider offering mechanical VTE prophylaxis and/or Enoxaparin or Heparin as per renal function and body weight.

- **Lower limb plaster casts (without Surgery)**
  - Offer Rivaroxaban 10mg OD if the patient has any of the additional VTE risk factors specified on the plaster request form. Continue until plaster cast removed.
  - Rivaroxaban is not recommended if eGFR < 15 ml/min/1.73m². Use with caution in patients with eGFR 15-29 ml/min/1.73m².
  - Patients with an epidural/spinal catheter, or contra-indication to Rivaroxaban: offer Enoxaparin or Heparin as per renal function and body weight. Continue Enoxaparin for 28 days for THR, and 10 days for TKR.
  - Consider switching to Rivaroxaban at least 1 day after removal of the epidural/spinal catheter.
4.2 Prophylactic IVC Filters for Trauma Patients

Introduction

- To provide guidance on the prophylactic insertion of inferior vena cava filters in patients suffering traumatic injury.

Background

- Trauma patients are at increased risk of venous thromboembolism (VTE) and VTE has been reported as the third most common cause of in-hospital death following trauma.¹ Patients thought to be at particularly high risk include those suffering fractures of the spine, pelvis or lower extremity; patients aged over 45 years; those requiring more than 3 days of bed rest, and patients with previous venous repair.²

- Recommended standard measures for VTE prophylaxis are similar to those for other at risk patients: subcutaneous heparin, graduated compression stockings, pneumatic compression devices and early mobilisation. Whilst these remain the standard of care, there are often practical reasons why their implementation may be delayed following trauma. Chemoprophylaxis may be contraindicated in patients with ongoing bleeding or intracranial haemorrhage and mechanical prophylaxis may be impossible in patients with lower limb trauma.

- Prophylactic inferior vena cava (IVC) filters have been used to address this problem by preventing the embolisation of thrombi from the lower part of the body to the heart and lungs. However, in contrast to the accepted use of IVC filters in patients with known DVT, large PE and critical pulmonary hypertension, this prophylactic use of IVC filters has proved controversial.

- Practice management guidelines published in 2002 by the US Eastern Association for the Surgery of Trauma³ recommended that IVC filters should be considered in "very high-risk trauma patients who cannot receive anticoagulation because of increased bleeding risk and have injury patterns rendering them immobilised for a prolonged period of time".

¹ Medical device guidelines recommend this. ² This is a consensus view. ³ Eastern Association for the Surgery of Trauma.
• In contrast, guidelines produced by the American College of Chest Physicians in 2008 and 2012 were much less in favour of the prophylactic use of IVC filters in trauma. The authors highlighted the lack of randomised trials to demonstrate efficacy and expressed concern over potential complications including increased DVT risk below the level of the filter and vascular injury from filter erosion.

• Modern, retrievable filter systems address some of these concerns, but rates of successful removal are often low and good-quality evidence of clinical benefit remains lacking.

Recommendations

• In the majority of trauma patients, subcutaneous heparin should be started within 48 hours of the initial injury. Likely exceptions include patients with intracranial haemorrhage or cervical spinal cord injury. All patients should receive mechanical prophylaxis

• Prophylactic IVC filters should be considered in trauma patients at high risk of VTE, in whom neither subcutaneous heparin nor bilateral mechanical prophylaxis can be started within 72 hours of injury.

• Prophylactic IVC filters should not be inserted in trauma patients where VTE prophylaxis can be achieved with subcutaneous heparin or mechanical prophylaxis within 72 hours of injury.

• The requirement (or otherwise) for an IVC filter should be assessed within 24 hours of the initial injury and, where indicated, the filter should be inserted within 36 hours of the injury.

• All patients receiving retrievable IVC filters should have a plan made for removal at the time of insertion, with the aim to remove all retrievable IVC filters prior to hospital discharge and within 4-6 weeks of insertion.
IVC Filters References


Diagram 4.2: Summary of indications for prophylactic IVC filter insertion following trauma

1. Trauma patient at high risk of VTE
2. SC Heparin contraindicated for first 72 hours post-injury
3. Unable to Use TEDS & Flowtrons for first 72 hours post-injury
4. Consider IVC filter insertion
**4.3 Management of specific Orthopaedic Injuries**

**Diagram 4.3  Management of Schatzker type IV-VI fractures and suspected knee dislocations**

**PROTOCOL FOR THE MANAGEMENT OF SCHATZKER TYPE IV-VI Tibial Plateau Fractures and Suspected Knee Dislocations (Knee Trauma Pathway)**

**Admission routes:**
- Emergency Department
- ITU/HDU
- Inter-Hospital Transfer

**NEUROVASCULAR STATUS – INITIAL ASSESSMENT**

1. Clinical Examination > Motor / Sensory / Vascular > Emergency Department
2. Capillary refill time compared to uninjured limb > Emergency Department
3. Doppler confirmation of palpable pulses > Orthopaedic Registrar* (within 1 hour of referral/ request)
4. Ankle Brachial Pressure Index (ABPI) > Orthopaedic Registrar* (within 1 hour of referral/request)

**PATHWAY A  ABNORMAL VASCULAR STATUS**

- All suspected knee dislocations or documented h/o knee dislocation

**SCHATZKER TYPE IV-VI FRACTURES**
- No pulses found (clinical & Doppler)
- Weak pulse felt clinically & reduced Doppler signal confirmed.
- ABPI < 0.9
- Delayed capillary refill time compared to unaffected limb.
- Worsening of motor power or sensation since admission
- Obvious arterial compromise or suspected arterial injury
- Unexplained deterioration in patient

**URGENT* referral for vascular surgical opinion**
*To be reviewed by vascular surgeon within 2 hours

**URGENT** CT Angiogram
*To be completed within 2 hours

**Continual** assessment of limb obs with Doppler pulse monitoring
Hourly observations

If change in neurovascular status (or CT Angiogram abnormal): RE-ASSESS using PATHWAY A

**PATHWAY B  NORMAL NEUROVASCULAR STATUS**

**OR STATUS UNCONFIRMED BY ABPI**

- Normal capillary refill times < 2 seconds
- Normal pulses (clinical & Doppler)
- No motor or sensory deficit

**OR NORMAL CLINICAL EXAMINATION BUT UNABLE to measure ABPI due to patient discomfort or presence of plaster.**

**CT Angiogram within 24 HOURS**
Routine inpatient MRI scan at request of Trauma Consultant

**Continual** assessment of limb obs with Doppler pulse monitoring
Hourly for first 24 hours after admission then 2-hourly for next 24 hours.
Frequency of ongoing assessment to be determined by Consultant after patient review

If change in neurovascular status (or CT Angiogram abnormal): RE-ASSESS using PATHWAY A

*Within 1 hour of request/referral from Emergency Department, ITU area or within 1 hour of admission to Orthopaedic ward for inter-hospital transfers.

**Maximum of 2 nurses to complete observations throughout any one shift.**
4.4 Angiogram Protocol for Major Trauma Patient with Distal Vascular Injury

Diagram: Angiogram Protocol for Level 1 Trauma Patient with distal vascular injury

Disclaimer: It is your responsibility to check against Staffnet that this printout is the most recent issue of this document.
4.5 Initial management of significant burn injuries and the referral process

**Burns Triage Tool: Trauma Centre & Trauma Units**

Airway / breathing problem?  NO  YES

Major trauma + burn?  NO  YES

Is burn:  NO  YES
- >30% in adults?
- >20% in children?
- Excluding erythema

Is burn:  NO  YES
- >5% in adults?
- >1% in children?
- Excluding erythema
- Complex?

Contact

Adult: Salisbury Burns Unit (01722 345507)
Child: Southampton PICU (02380 775502)

If need ICU bed but not available:
Burns Bed bureau (01384 215576)

**Complex Burn**

- **Site**: Face, hands, perineum, feet, circumferential
- **Mechanism**: Chemical, Radiation, High pressure, Electrical
- **Toxic shock**: Delayed onset of High temp, rash, D&V, systemically unwell

**Contact**

Adult: Salisbury Burns Unit (01722 345507)
Child: Southampton PICU (02380 775502)

- will conference call with:
  - Salisbury Burns Consultant / Reg
  - Bristol Burns Consultant Surgeon / Childrens Burns HDU

If need ICU bed but not available:
Burns Bed bureau (01384 215576)

Follow Trauma Secondary Transfer Tool

Ensure airway secured before leaving ED

Trauma Unit / Major Trauma Centre

Manage locally

If not showing signs of improvement at 2-3 day review
4.6 Plastic surgery service at UHS

To follow

4.7 End of Life Care

- In situations when continuing treatment is not thought to be in the interests of the patient, an ethical decision may be made to withdraw active therapy that does not relieve symptoms. This decision should always involve two consultants.

- Typically for Major Trauma patient’s withdrawal of therapy would occur in one of the Intensive Care Units. The Emergency Department is not an ideal environment to provide end of life care, but on occasions there may be no alternative location.

Where end of life care and/or organ transplantation is being considered the on call Consultant for either GICU or NICU (as appropriate) should be contacted for advice and assistance. In addition the SNOD’s (specialist nurses in Organ Donation contactable via Switch) will provide excellent help with the withdrawal process and counselling relatives with all patients who are being considered for organ donation, (even when the patient does not subsequently go on to donate organs).

- Guidelines on end of life care are available from both NICU and GICU. The aims of such guidance are to ensure that terminally ill patients die with dignity and without suffering.
4.8 Organ and Tissue Transplantation

This chapter considers the management of the patient for organ donation following either brain stem death or circulatory death.

The General Medical Council (GMC) guidance ‘Treatment and care towards the end of life: good practice in decision making’ requires that consultant staff who have clinical responsibility for patients who are potential donors exercise a duty to consider organ donation as part of end-of-life care. The legal framework that allows donation after death is described in the Human Tissue Act 2004.

Donor Identification and Referral

Early identification of patients for donation is advised. NICE have published guidance. University Hospital Southampton is still in the process of developing its own guidelines. There should be early liaison with the Specialist Nurse in Organ Donation (SNOD).

When organ donation occurs, it follows either cardiac or brainstem death of the donor:

- **Donor after Cardiac Death (DCD):**
  When the medical team and family agree that continuing medical treatment is not in the best interests of the patient, e.g. poor neurological outcome, then the decision may be made to withdraw active medical treatment, e.g. stop invasive ventilation. If the patient dies within a few hours of being extubated, then organ donation may be possible.

- **Donor after Brain Death (DBD):**
  This refers to organ donation after brainstem testing has demonstrated that the patient is brainstem dead.
Contraindication to Organ Donation

Absolute Contraindications to organ donation

- Any cancer with evidence of spread outside affected organ (including lymph nodes) within 3 years of donation (however, localised prostate, thyroid, in situ cervical cancer and non-melanotic skin cancer are acceptable).
- Age >85 years
- Melanoma (except completely excised Stage 1 cancers)
- Choriocarcinoma
- Active haematological malignancy (myeloma, lymphoma, leukaemia)
- Definite, probable or possible case of human Transmissible Spongiform Encephalopathies, including CJD and vCJD, individuals whose blood relatives have had familial CJD, other neurodegenerative diseases associated with infectious agents
- TB: active and untreated
- HIV disease (but not HIV infection)

Organ specific contraindications

In addition to the absolute contraindications a number of organ specific contraindications have been developed by each NHSBT Advisory Group to assist in the assessment of a potential organ donor; these are listed below. Each contraindication is specific to the organ listed and does not preclude the donation of any other organ. In some cases, individual transplant units have developed further contra-indications.

**LIVER**

Acute hepatitis (AST>1000 IU/L)

Cirrhosis
Portal vein thrombosis

**KIDNEY**

- Chronic kidney disease (CKD stage 3B and below, eGFR<45)
- Long term dialysis (that is, not acute relating to acute illness)
- Renal malignancy (prior kidney tumours of low grade and previously excised would not exclude donation)
- Previous kidney transplant (> 6 months previously)

**PANCREAS**

- Insulin dependent diabetes (excluding ICU associated insulin requirement)
- Any history of pancreatic malignancy

**HEART**

- Age >65
- Documented coronary artery disease (e.g. confirmed history of MI, CABG or percutaneous stenting)
- Median sternotomy for cardiac surgery
- LVEF≤30% on more than one occasion
- Massive inotropic or pressor support, but only if adequate circulating volume has been confirmed by monitoring

**LUNGS**

- DCD donor age >65; DBD donor age >70 years
- Previous intra-thoracic malignancy
- Significant, chronic destructive or suppurative lung disease (those with controlled asthma are suitable donors)
- Chest X-ray evidence of major pulmonary consolidation

**Consent**

Registration on the Organ Donor Register is now seen as a lawful consent under the Human Tissue Act 2004. If a patient is not registered the next of kin should be ap
Discussion with the family about organ donation must be kept separate from the initial discussions considering withdrawal of treatment because of poor prognosis.

If these two issues are not kept separate, the relatives may end up with the impression that the withdrawal of treatment is being considered to facilitate organ donation.

Organ Donation following Brainstem Death

Management of the patient being considered for organ donation following Brain Stem Death.

Monitoring

All patients:

- Temperature (nasopharyngeal)
- SpO₂
- ECG (continuous and printed 12-lead)
- Arterial blood pressure (left radial line)
- Urine Output (urinary catheter)
- Chest radiograph (CXR)

The following may also be considered necessary:
Central venous pressure (right internal jugular triple lumen catheter)

- Trans-thoracic or trans-oesophageal echocardiography
- Fibre-optic bronchoscopy
- Pulmonary artery catheter (Rarely required)

**Basic Management**

- Once declared brain dead the donor requires active management to maintain optimal physiology in preparation for multi-organ retrieval. Regular review by the ITU team (doctors, nurses, physiotherapists and the transplant co-ordinator) is vital, as is the communication with the transplant centre accepting the organs on offer.

- Keep the donor warm at 37°C with a warming blanket, bair hugger and warmed intravenous fluids.

- Maintain an optimal fluid balance (neutral balance to +500 ml) with crystalloid in the form of 5% dextrose to avoid hypernatraemia (secondary to diabetes insipidus) and to maintain hepatic glucose stores. For colloid administration use packed red cells to maintain the Hb > 10g/dl.

- Hourly nasogastric tube suction to minimise the risk of aspiration. 1-2 hourly turning and endo-tracheal/bronchial suctioning using the standard aseptic technique. Two hourly chest physiotherapy for secretion clearance and recruitment manoeuvres.

**Drug therapy**

- Methylprednisolone 15mg/kg bolus dose immediately after declaration of brain death.

- Vasopressin 2 unit bolus followed by 1 to 10 unit/hour infusion to maintain MAP > 70 mmHg and SVR 800 – 1200 dyn.s.cm-5. Wean down/off all existing catecholamine infusions after starting vasopressin.

- Tri-iodothyronine 4mcg bolus followed by 3mcg/hour infusion.

- Insulin infusion 1 unit/hour then adjust to maintain glucose of 4-8 mmol/l

- Supplement K⁺ and Mg²⁺

- Broad spectrum antibiotics (as per local ITU protocol).
Ventilation and airway management

- Minimise FiO$_2$ to maintain PaO$_2$ 11 – 14 kPa
- PEEP 5 – 10 cmH$_2$O
- Tidal volume 10 mls/kg but Peak Airway Pressures < 35cmH$_2$O
- Repeat PaO$_2$ on 100% FiO$_2$ every 2 hours – should be >40 kPa for the lungs to be considered ideal for retrieval. If the gas exchange deteriorates acutely to < 40 kPa on 100% FiO$_2$ (despite optimal physiotherapy, endobronchial suctioning and anaesthetic review) inform the transplant centre and retrieval team. Selective pulmonary venous blood gas analysis is then considered to identify regional defects within the lungs.
- Overhydration must be avoided because of the risk of precipitating or potentiating pulmonary oedema.
- Fibre-optic bronchoscopy may be performed to check the endobronchial anatomy and to exclude the presence of aspiration and/or infection. Proximal tracheal secretions are aspirated and a bronchoalveolar lavage (BAL) performed. The 3 samples (tracheal aspirate, left lung BAL and right lung BAL) are sent to microbiology for M,C+S to help guide the antibiotic treatment of the post-transplant recipient. The discovery of abnormal anatomy (e.g. tracheal RUL bronchus), severely inflamed mucosa and/or copious mucopurulent secretions coming from the airways are adverse features and must be reported directly to the transplant surgeon.
- Hourly turning and bronchial suction using aseptic technique and 1 to 2 hourly chest physiotherapy for secretion clearance and recruitment manoeuvres. A CXR is taken at the declaration of brain death and 3-4 hourly thereafter particularly when there has been an acute deterioration in the gas exchange.
## Optimal donor target parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Target Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>37°C</td>
</tr>
<tr>
<td>pH</td>
<td>7.36-7.44</td>
</tr>
<tr>
<td>PaO₂ (FiO₂ 1.0)</td>
<td>&gt;40 kPa</td>
</tr>
<tr>
<td>PaCO₂</td>
<td>3.8-6.0 KPa</td>
</tr>
<tr>
<td>PEEP</td>
<td>5-10 cmH₂O</td>
</tr>
<tr>
<td>Tidal volume</td>
<td>10 ml/Kg</td>
</tr>
<tr>
<td>Peak airway pressure</td>
<td>&lt;35 cmH₂O</td>
</tr>
<tr>
<td>CXR</td>
<td>NAD</td>
</tr>
<tr>
<td>Bronchoscopy</td>
<td>NAD</td>
</tr>
<tr>
<td>HR</td>
<td>60-90 sinus rhythm</td>
</tr>
<tr>
<td>MABP</td>
<td>65-85 mmHg</td>
</tr>
<tr>
<td>ECG</td>
<td>SR. No ST changes or Q waves. No LVH</td>
</tr>
<tr>
<td>Fluid balance</td>
<td>0 to +500 ml</td>
</tr>
<tr>
<td>Maintenance crystalloid</td>
<td>1 ml/Kg</td>
</tr>
<tr>
<td>Urine output</td>
<td>0.5 ml/Kg/hour</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>&gt;10.0 g/dl</td>
</tr>
<tr>
<td>CVP</td>
<td>3-8 mmHg</td>
</tr>
<tr>
<td>CI</td>
<td>&gt;2.6 l/min/m²</td>
</tr>
<tr>
<td>PAWP</td>
<td>&lt;10 mmHg</td>
</tr>
<tr>
<td>SVR</td>
<td>800-1200 dyn.sec.cm⁻⁵</td>
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<tr>
<td>TTE/TOE</td>
<td>Normal EF. No valvular pathology. No LVH</td>
</tr>
<tr>
<td>Dopamine</td>
<td>&lt;5 µg/Kg/min</td>
</tr>
<tr>
<td>Noradrenaline</td>
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<tr>
<td>Adrenaline</td>
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<tr>
<td>ADH</td>
<td>1-10 IU/hour</td>
</tr>
<tr>
<td>T3</td>
<td>3 µg/hour</td>
</tr>
<tr>
<td>Insulin</td>
<td>As per BM 4-8 mmol/l</td>
</tr>
</tbody>
</table>
Non-heart beating organ donation

- Organ donation following death by cardiorespiratory criteria.
- Donor after Cardiac Death (DCD).
- Patients are those who have irrecoverable brain damage but who do not satisfy formal brain stem criteria for the diagnosis of death.
- After consensus between the medical / nursing staff and the family that further medical intervention is futile and that active treatment should be withdrawn, consideration is made as to whether the patient is suitable to donate solid organs. Document consensus in notes.
- There is potential for donating liver, lungs and pancreas (when time between withdrawal of treatment and death is < 1 hour) and kidneys (< 5 hours), in addition to tissues.
- Patients should be treated in the same way as any other patient for whom active treatment is withdrawn. They should continue to receive appropriate medical and nursing care. This includes adequate analgesia and other symptom relief. Withdrawal of life-support measures may occur in the unit or in the anaesthetic room depending on the relatives.
- Continue active nursing and physiotherapy care.
- Continue monitoring of ECG, pulse oximetry and invasive blood pressure monitoring if possible. These can be monitored from the nurses’ station if relatives are distressed at watching the monitor.
- Keep normothermic.
- Do not attempt to resuscitate the patient if they deteriorate unexpectedly. It may prove impossible for organs to be donated and this is explained to the relatives during the initial discussions with the transplant Co-ordinator. If death has not occurred within 1 hour of treatment withdrawal, liver, lung and pancreas donation is not possible. There is a cut off of 5 hours for kidney donation. The transplant Co-ordinator will advise if donation is still feasible.

When death does occur, it is important that the patient is certified promptly. This should be by a physician who is not part of the transplant team and should be after 5 minutes of asystole. Thereafter, the relatives can have a further 5 minutes at the bedside. If the relatives wish for more time, donation will not go ahead, and this is explained to the next of kin during initial discussions with the transplant Co-ordinator.
4.9 Consent in young adults

- Adults; are 18 years and over: presumed to be competent, since 1969.

- Young people; 16 & 17 year olds: presumed competent, since 1969

- Children <16y: presumed to be incompetent, but may prove their competence via the Gillick doctrine (1985).

For young people aged 16 and 17 years of age, refusal of life-saving treatments can be challenged. Their parents may over-rule their decision, or an application may be made to the courts to over-rule them (usually in cases where the parents also refuse the life-saving treatment.

**Clinical steps:**

- If doubtful, challenge capacity, questions must be relevant to subject matter; Mental Capacity Act 2005
- If young person lacks capacity, act consistently with young person's best interests
- If parents persistently disagree with your assessment of best interests, consider specific issue order under s8 Children’s Act 1989
- But always use the least restrictive option available to you, and ensure that your proposed action is necessary
- If young person has capacity, explore all viable clinical alternatives; and try and establish their reason for refusal…(may make you revisit their capacity)
- If young person maintains his position, and his parents support him, specific issue order.
- (If his parents provide you with consent, question becomes more moral than legal)
- Either way, use least restrictive option, and ensure that your proposed action is necessary

There is no recorded action in English Law against a doctor saving a child’s life.
4.10 Nutritional Management of Major Trauma Patients

The aim of this document is to provide specific guidelines for the nutritional management of major trauma patients. This document should be used in conjunction with the following USHFT policies and guidelines relating to the nutritional management of patients (available on StaffNet):

- Screening of Adults for Malnutrition Policy
- Nutritional Management of Adult General Surgical Patients: Guidelines
- Enteral Feeding: Guidelines
- Management of the Refeeding Syndrome in Adult Patients
- General and Cardiac Intensive Care Units Enteral Nutrition Feeding Flowchart
- Wessex Neurosciences Intensive Care Unit Enteral Feeding Algorithm

1. Importance of nutrition for major trauma patients

- Nutrition has a key role to play in the treatment and recovery from major trauma.
- Malnutrition increases the risk of developing infections, delays wound healing, prolongs ventilator dependence and length of ICU admission, and extends the duration of hospital stay.
- Major trauma often precipitates rapid malnutrition, even in those considered well-nourished on admission. Traumatic injuries have the potential to significantly disrupt nutritional intake, as well as increasing energy expenditure and protein losses putting trauma patients at high risk of becoming malnourished very rapidly.
- The aim of nutrition support in major trauma is to minimise muscle wastage and weight loss, avoid complications, support wound healing, promote a fast recovery, and allow full participation in rehabilitation therapy.
- Nutritional requirements in trauma vary significantly according to injuries and clinical conditions. Patients should have their individual requirements assessed by a dietician - general feeding protocols will not meet the needs of most trauma patients.
2. **Dietetic service for the Major Trauma Centre**

- The Major Trauma Centre has a full-time Band 6 dietician who can assess and review any major trauma patients within the hospital.
- All Major trauma patients requiring Dietetic input (see referral criteria below) should be referred electronically via eQuest. Please contact the dietician if you would like to discuss a patient or are unsure if they would benefit from dietetic input.
- Major Trauma patients admitted to the critical care units should be proactively assessed by the dietician with 1 working day of receipt of the MTC admission list. Please note that critically unwell and unstable patients may not be appropriate for immediate nutritional intervention within 24h.
- Contact details: Dietician: **Jacqui Couch**
  - Bleep: **1200**
  - Extension: **6072**
  - Email: [Jacqueline.couch@uhs.nhs.uk](mailto:Jacqueline.couch@uhs.nhs.uk)
  - Referrals: eQuest/Consultations/Service – Clinical Support /Dietetics
  - Working hours: **Mon-Fri 0800-1600**

3. **Nutritional screening for major trauma patients**

- The ‘Malnutrition Universal Screening Tool’ (MUST) should be completed by nursing staff for all patients as per the ‘Screening of adults for malnutrition Policy’ (SGH 2012).
- Where possible, patients should be weighed on admission and at least once a week thereafter – consider hoist scales or the weigh bridge on AMU if the patient is bed-bound. If patients are not able to be moved/hoisted (e.g. critically unwell), a mid-upper arm circumference measurement should be documented.
- Patients with a MUST score of 2 or more should be referred to the Dietician as per trust policy. In addition, owing to the nature of major trauma patients who are often relatively well-nourished on admission but are at risk of becoming malnourished,
4. Feeding Major Trauma Patients on Intensive Care Units

When to feed:

- It is vital that feeding is established quickly in trauma patients – within 24-48 hours of admission if haemodynamically stable.
- Early, enteral nutrition is associated with a reduced infectious complications and reduced morbidity and mortality.
- Neither the presence nor absence of bowel sounds or evidence of passage of flatus and stool is required for the initiation of enteral feeding.
- If the patient has suffered abdominal trauma and/or there is a suspicion of bowel perforation, advice should be sought from the general surgeons regarding the initiation of enteral feeding – consider early parenteral feeding in these patients.
- If a patient is considered high risk of refeeding syndrome, feeding should start slowly alongside very close monitoring of electrolytes and generous provision of vitamin...
and mineral supplements – please refer to the SGH ‘Management of the Refeeding Syndrome in Adult Patients’ policy for details.

**How to feed:**

- If a patient is able to eat and drink orally, a food chart should be commenced and oral nutritional supplements should be considered.
- Patients who are not able to eat and drink should have an enteral feeding tube placed as soon as possible. A nasogastric or orogastric tube should be placed initially, and feeding commenced according to the ICU feeding algorithms.
- Patients should be positioned in a semi recumbent position (at least 30°) if clinical condition permits. If this is not possible, consider small bowel feeding.
- Patients should normally be fed continuously over 24-hours to allow more stable blood glucose levels, reduce the risk of aspiration and improve gastric tolerance.
- Once stable, feeding time can be adjusted to suit the individual patient and allow weaning back onto oral diet.
- Consider any drug–nutrient interactions, for example, phenytoin and ciprofloxacin (feeding should be stopped 2h before and after administration), sucralfate, warfain or tetracyclines – please discuss with a pharmacist.

**Early consideration of small bowel feeding is recommended in patients at high risk of intolerance to gastric feeding or those at high risk of ventilator-associated pneumonia, such as:**

- Patients on high dose inotropes and/or continuous infusion of sedation
- Patients receiving paralysing agents
- Patients with severe traumatic brain injury
- Patients being nursed in supine or prone position.

➢ This applies to a significant proportion of major trauma patients.
• Patients on non-invasive ventilation will often be able to eat and drink at least small amounts orally but are likely to require supplementary feeding via an enteral feeding tube. A gastric tube should be placed initially to allow gastric residual volumes to be monitored. If gastric feeding is not tolerated, small-bowel feeding should be considered.

What to feed:

• Patients should have their individual requirements calculated by a dietitian to avoid under- or over-feeding. However, when establishing feeding prior to dietetic assessment, a target feed rate of 1ml/kg/h is recommended (as per ICU feeding algorithms).

• Consideration should be given to non-feed sources of calories (e.g. IV Dextrose and drugs administered in lipid emulsion). Propofol provides 1.1kcal/ml and can contribute significantly to calorie intake. Higher protein feeds may be required to meet nitrogen requirements while avoiding overfeeding in these patients – please consult the dietitian for further information.

• Types of enteral feed:
  o All Nutrison feeds are gluten free, lactose free, and most are nutritionally complete for vitamins and trace elements in 1500kcal (note, other feeds which are complete in 800, 1000 and 1200kcal are available).
  o Specialist feeds are available, such as soya, peptide-based feeds, concentrated feeds and feeds that are nutritionally complete in fewer calories – please discuss these with a dietitian.
  o Patients with traumatic brain injury may have increased metabolic requirements and often have interruptions to their feed. Energy feed (1.5kcal/ml) should be considered rather than standard feed in these patients (please refer to NICU Feeding Algorithm).
  o Patients with traumatic brain injury should not be switched to a low-sodium feed without prior discussion with a NICU consultant and dietitian.
Enteral feeding issues:

- **Poor gastric tolerance – vomiting or large gastric residual volumes:**
  - Large gastric aspirates (>250ml) are common in trauma patients. However, feed should not be stopped or reduced based on a single large gastric aspirate.
  - Avoid fibre feeds in patients with high gastric aspirates. Standard, low-osmolarity feeds (e.g. Nutrison Standard) may be better tolerated and should be trialled before stopping/reducing the feed rate.
  - If two large aspirates are obtained, prokinetics (metoclopramide and erythromycin) should be trialled according to unit policy.
  - If aspirates remain high after 24 hours despite prokinetics, small bowel feeding may be indicated (e.g. NJ or OJ tube). Place early to avoid large feeding deficits.
  - Parenteral nutrition should only be used in patients with inaccessible or non-functioning GI tracts. Delayed gastric emptying alone is not an indication for parenteral nutrition.

- **Diarrhoea:**
  - Feed should not be stopped due to diarrhoea.
  - Diarrhoea is rarely feed-related in major trauma patients.
  - The dietician should be informed so that the osmolarity and fibre content of feed can be reviewed.

- **Constipation:**
  - It is common for major trauma patients to suffer with constipation. Fibre feeds should be introduced early (once gastric tolerance is established).
  - Most patients will require aperients. Please refer to local policy.

- **Poor tube tolerance:**
  - Confused, agitated patients often struggle to retain an NG/NJ tube.
  - Tubes should always be secured to the side of the patient’s face using appropriate tape (E.g. Hypafix), ensuring that it is outside of the patient’s field of vi-
sion (e.g., under nasal nares, along top lip and under cheek bone to prevent a loop).

- The follow options are available:
  - Bolus feeding (reduces the risk of tube displacement during feeding)
  - Mittens (at the discretion of the consultant)
  - Nasal loops/bridles (at the discretion of ICU consultants)
  - If patient is likely to require enteral feeding for several weeks, a gastrostomy tube should be considered. Please discuss with the dietician and Nutrition Clinical Nurse Specialist.

5. ICU step-down

- Enteral feeding tubes should not be removed until reviewed by the dietician. Even if patients are starting to eat and drink they often require supplementary feeding (e.g. overnight feeding) to meet their requirements, especially if they are at energy/nitrogen deficit from their time on critical care.
- Patients should remain on the same feeding regime as used on the intensive care unit (often 24-h feeding) until review by the dietician. The feeding regimen should be transferred with the patient and handed over by nursing staff. Once patients are on the ward, 24-h regimens are usually adjusted by the dietician to feed over 20-h initially.
- Close monitoring at ward level is vital – MUST tools should be updated and food charts should be in place.

6. Ward-based care

- All ward-based patients with enteral feeding tubes should be referred to the dieticians immediately.
- All patients requiring dietetic input (see Section 3 – Nutritional Screening for Major Trauma Patients) should be referred immediately via eQuest.
- Nutrition care plans should be implemented for all patients scoring 1 or more on the MUST tool.
Maximising oral nutrition:

- If no oral nutritional supplements are prescribed but you are concerned about your patient’s oral intake, Build-Up Shakes should be offered as per MUST care plans.
- Snacks are available at all beverage rounds and should be offered to all patients.
- The Steamplicity menu indicates ‘high energy’ meal options – patients should be encouraged to order these options.
- The dietician will often prescribe oral nutritional supplements (e.g. Fortisip Compact, Fortijuce, Calogen Extra, Fresubin Stage 2) to supplement a patient’s diet. These should normally be given between mealtimes and unless otherwise stated, should be served chilled to improve their palatability. Oral supplements can contribute significantly to a patient’s nutritional intake and can therefore aid recovery and shorten length of hospital stay.
- All patients on flat bed rest should be on a ‘Red Tray’ (assistance with all food and drink).
- ‘Hydrant’ bottles can enable patients to be more independent and improve hydration levels, and should be considered for all patients who may have difficulty reaching for a drink (on normal fluids). A supply of these bottles is kept on ward F3 – please speak to the ward manager or dietician if you think your patient would benefit from one.
- Patients with chewing or swallowing difficulties (e.g., flat bed rest, collars, facial/jaw fractures, head injuries, spinal cord injuries) may require a modified texture diet initially. SUHFT has a range of options (see below). The dietician and Speech and Language Therapist can advise on the most appropriate texture on an individual basis:
  - Normal (Steamplicity) diet
  - ‘Softer’ diet (Steamplicity – softer options from the standard menu, extra sauce/gravy available)
  - ‘Soft E’ diet (fork mashable)
  - Puree C diet (thick, smooth puree)
  - Puree B diet (thin, smooth puree)
7. Long-term nutrition support

- Patients who are likely to require longer-term nutrition support should be referred for an appropriate feeding tube. The dietician and Nutrition Clinical Nurse Specialist can advise on the most appropriate tube for each patient.
  - PEG Referrals should be made via eQuest to Endoscopy. Please see the Trust’s Enteral Feeding Guidelines for further details.
  - Referrals can be made regardless of the location of the patient within the hospital.
  - In traumatic brain injury patients, gastrostomy placement should be considered at the same time as tracheostomy. PEGs can be placed in the intensive care unit.

8. Nutrition References

Screening of adults for malnutrition Policy (2012)
http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/Malnutrition-forthescreeningofadults/ScreeningofadultsformalnutritionPolicy.doc

http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/NutritionalManagementofAdultGeneralSurgical/NutritionalManagementofAdultGeneralSurgicalPatientsGuidelines.doc

http://staffnet/TrustDocsMedia/DocsForAllStaff/Medicines/EnteralFeedingGuidelines/EnteralFeedingGuidelines.doc

http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/ParenteralNutrition-forprescribingofadult/ParenteralNutrition-forprescribingofadultGuideline.doc

Management of the Refeeding Syndrome in Adult Patients (2006)
http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/RefeedingSyndromeinAdultPatients-management/RefeedingSyndromeinAdultPatients-managementofGuideline.doc
Nutritional Management of Major Trauma Patients - Summary

- **Feeding Route:**
  - Does the patient have a functional and accessible GI tract? (Patients with abdominal trauma should be discussed with the surgeons on an individual basis)
  - **Parenteral nutrition**
  - **Enteral nutrition**

- **Able to eat and drink?**
  - **Yes**
    - Discuss with dietitian, pharmacist and/or nutrition support team. Aim to establish enteral feeding as soon as possible
  - **No**
    - Parenteral nutrition

- **Is patient likely to tolerate gastric feeding?**
  - **Yes**
    - Commence feeding as per unit protocol
  - **No**
    - Consider early placement (within 24-48h) of jejunal feeding tube (NJ/JG), obtain gastric tube for medications/decompression and monitoring of gastric aspirates

- **Dietitian to assess adequacy of oral intake and consider prescribing oral nutritional supplements and/or enteral tube feeding**

- **Poor tolerance likely in TBI patients with ICP monitoring sedated with high-dose morphine and midazolam, or patients at high risk of aspiration pneumonia (e.g. spinal patients nursed flat with ventilatory support)**

- **MUST screening within 24 hours, repeated at least weekly**
  - **MUST = 0**
    - Routine clinical care
  - **MUST = 1**
    - Observe/ward-based support
  - **MUST = 2**
    - (including all enteral feeds)
      - Treat - refer to Dietitian

- **Maximise oral intake (unless NBM):**
  - Offer Build Up Shakes BD and/or Build Up Soups
  - Offer regular snacks
  - Food record charts
  - Encourage high-energy meals
  - Optimise positioning for mealtimes
  - Consider ‘red tray’
  - Consider ‘hydrant bottle’

- **Regular review by dietitian**

**Contact details**
- Trauma Dietitian: Bleep 1200; x672
- Nutrition CNS: x8356
- Endoscopy: x4392
- Interventional Radiology: x4067

All referrals for Dietitian and for PEG/KIG placement should be made via e-Quest.
Section 4.10 Appendix 1
Southampton General and Cardiac Intensive Care Units Enteral Nutrition (EN) Feeding Flow chart

Southampton General and Cardiac Intensive Care Units Enteral Nutrition (EN) Feeding Flowchart

Nutritional assessment within 24 hours of admission to unit - MUST score, current weight obtained and approximate energy requirements (1kcal per kg/hour, actual body weight) calculated.
Dietetic referral to be made following SUHT referral guide

- Able to meet nutritional needs via oral route? NO
  - Consider oral diet
    - Commence on appropriate diet, commence food chart

- Contraindications to enteral feeding? YES
  - Consider parenteral nutrition (PN)

- Consider enteral tube feeding
  - Check tube placement as per protocol
  - Start feed at 25 ml/hr
  - Aspirate feeding tube 4 hourly. Is aspirate > 250mls
    - Replace 250mls only and maintain rate
      - Aspirate feeding tube 4 hourly. Is aspirate > 250mls
      - Replace 250mls only and decrease rate by 25mls/hr to a minimum of 10mls/hr
      - Commence prokinetics

- Has full rate been achieved for 24 hours? NO
  - Commence continuous 24 hour feeding regimen

- Replace aspirate 4 hourly. Increase feed rate by 25mls until 1kcal/kg/hr achieved

- Is EN required for > 3 days
  - YES
    - Replace wide bore tube with a fine bore tube
    - Consider commencing oral diet
  - NO
    - After 4 doses of IV metoclopramide consider small bowel feeding or PHi.
      Discuss with Consultant and Pharmacist

EIH GICU Enteral Feeding Guidelines July 2009

Version 1
Dr Andy Eynon
Dr Simon Hughes
Dr Elizabeth Shewry
Wessex Neurosciences Intensive Care Unit Enteral Feeding Algorithm

- Aim to start enteral nutrition as soon as patient is haemodynamically stable
- Check position of NG/OG enteral feeding tube as per Adult Enteral Feeding Guidelines
- Start feeding Nutrition Standard (Energy in Traumatic Brain Injury patients) at 50ml/hr
- Monitor gastric feeding tube aspirate 4 hourly
- Aspirate gastric feeding tube prior to chest physiotherapy and turning.

Is gastric aspirate >250ml? (Replace up to 250ml and discard remainder)

Feed at 50ml/hr for further 4hrs. Is aspirate > 250ml?

Yes

Add Metoclopramide 10mg tds IV Continue at same rate for further 4hrs. Is aspirate > 250ml?

Yes

Continue Metoclopramide 10mg tds IV Add Erythromycin 250mg qds NG/OG Continue feed for 4hrs. Aspirate 4hly Is aspirate > 250ml?

Yes

Is abdomen distended with absent bowel sounds?

Yes

Consider abdominal X-ray Put NG/OG on free drainage for 24hrs Aspirates and drainage still > 250ml (every 4hrs)?

Yes

Consider Parenteral Nutrition with NICU consultant/pharmacists/dietitian/nutritional support team Needs to be ordered by 11.00am Bleep 1582

Yes

No

No

No

Increase rate to a maximum rate of 1ml/kg/hr (max rate 100ml/h) Continue to aspirate 4hly. Is aspirate > 250ml?

Yes

No – feed at 1ml/kg/hr (maximum 100ml/h)

Continue feeding at 30ml/hr for 24hrs. Review after 24hrs. Is aspirate >250ml/4hrs

Yes

Place NJ/NJ tube. Check position with X-ray. Feed continuously via jejunal tube without aspirating for turns or physiotherapy at 1ml/kg/hr

No

If bowel sounds are present start feeding at 50ml/hr and return to start of algorithm.
Section 5: Appendices

5.1 Wessex Trauma Network Rehabilitation Prescription: Patient Copy

5.2 Wessex Trauma Network Rehabilitation Prescription: Records Copy

5.3 Rehabilitation Prescription Guidance Notes

5.4 Wessex Trauma Network booklet
Rehabilitation Prescription
Patient Copy

Note for the patient: This document is to help you understand the rehabilitation care that you require in order to make the best possible recovery. This information should help empower you to ensure that you receive the appropriate care.

1. Surname and Forename:  
2. Address:

3. NHS Number:  
4. Date of Admission:  
5. Date of Discharge:

6. Rehabilitation Prescription – Update:  
(Please date and circle as appropriate)  
6a. Date:  
6b. Version:  
1 2 3 4 5 6 7 8 9 10

7. Lead Consultant (Name and Contact and SpR Bleep):

8. Therapists (Name and Contact): (Currently responsible for, involved in the patient's care / rehabilitation and / or patient's family)

9. Nurse Specialist/Major Trauma Coordinator (Name and Contact): (Contact for questions/Coordination of care)

10. Type of injury: (Please circle all applicable)

- Head injury
- Spinal injury
- Spinal cord injury
- Complex musculoskeletal
- Lower extremity
- Upper extremity
- Burn
- Cardiac
- Other?

12. Ongoing Impairments, Goals and Treatment Plan:

<table>
<thead>
<tr>
<th>Ongoing Impairments</th>
<th>Goals</th>
<th>Treatment Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
</tr>
</tbody>
</table>

Version 1

Dr Andy Eynon  
Dr Simon Hughes  
Dr Elizabeth Shewry
### 13. Referral:

<table>
<thead>
<tr>
<th>Services Referred To</th>
<th>Contact Details (incl name / person)</th>
<th>Transfer Date (incl date requested) / Appointment Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 14. Additional Information:

- Have you reviewed your driving status? [ ] No, [ ] Yes, [ ] Not applicable
- Do you need to inform the DVLA? [ ] No, [ ] Yes, [ ] Not applicable
- Have you received return to work advice? [ ] No, [ ] Yes, [ ] Not applicable
- Do you require a fitness to work certificate for your employer? [ ] No, [ ] Yes, [ ] Not applicable
- Have you received mobility advice? [ ] No, [ ] Yes, [ ] Not applicable
  (For example when you will be able to walk, or play sport?)
- Have you received advice regarding when you can fly? [ ] No, [ ] Yes, [ ] Not applicable
- Have you received advice regarding what benefit entitlement? [ ] No, [ ] Yes, [ ] Not applicable
- Have you been offered an appointment with the legal service? [ ] No, [ ] Yes, [ ] Not applicable

List of benefits (if appropriate):

### 15. Useful Contacts:

<table>
<thead>
<tr>
<th>PALS:</th>
<th>Current Rehab Lead:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone:</td>
<td>Name:</td>
</tr>
<tr>
<td>Email: <a href="mailto:pals@uhs.nhs.uk">pals@uhs.nhs.uk</a></td>
<td>Telephone:</td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
</tbody>
</table>

### 16. Rehab Prescription Received and Explained: [ ] No, [ ] Yes, [ ] Not applicable

---

**IMPORTANT PATIENT INFORMATION:**

Please retain this document and present it to the person identified in Section 17 above and/or your GP

**IMPORTANT STAFF INFORMATION:**

*TARN Team, Regional Centre for Trauma and Specialist Services, University Hospital Southampton NHS Foundation Trust, D Level, North Wing, Mailpoint 46, Southampton General Hospital, Southampton, SO16 6YD*
**EQ-5D**

**Patient Copy**

To be completed by/with the patient

Under each heading, please circle the number in the ONE box that best describes your health TODAY.

<table>
<thead>
<tr>
<th>Mobility / Usual activity / Pain/discomfort / Anxiety/depression</th>
<th>Score on discharge from UHS (Please Circle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have no problems in walking about</td>
<td>1</td>
</tr>
<tr>
<td>I have slight problems in walking about</td>
<td>2</td>
</tr>
<tr>
<td>I have moderate problems in walking about</td>
<td>3</td>
</tr>
<tr>
<td>I have severe problems in walking about</td>
<td>4</td>
</tr>
<tr>
<td>I am unable to walk about</td>
<td>5</td>
</tr>
<tr>
<td>I have no problems washing or dressing myself</td>
<td>1</td>
</tr>
<tr>
<td>I have slight problems washing or dressing myself</td>
<td>2</td>
</tr>
<tr>
<td>I have moderate problems washing or dressing myself</td>
<td>3</td>
</tr>
<tr>
<td>I have severe problems washing or dressing myself</td>
<td>4</td>
</tr>
<tr>
<td>I am unable to wash or dress myself</td>
<td>5</td>
</tr>
<tr>
<td>I have no problems doing my usual activities</td>
<td>1</td>
</tr>
<tr>
<td>I have slight problems doing my usual activities</td>
<td>2</td>
</tr>
<tr>
<td>I have moderate problems doing my usual activities</td>
<td>3</td>
</tr>
<tr>
<td>I have severe problems doing my usual activities</td>
<td>4</td>
</tr>
<tr>
<td>I am unable to do my usual activities</td>
<td>5</td>
</tr>
<tr>
<td>I have no pain or discomfort</td>
<td>1</td>
</tr>
<tr>
<td>I have slight pain or discomfort</td>
<td>2</td>
</tr>
<tr>
<td>I have moderate pain or discomfort</td>
<td>3</td>
</tr>
<tr>
<td>I have severe pain or discomfort</td>
<td>4</td>
</tr>
<tr>
<td>I have extreme pain or discomfort</td>
<td>5</td>
</tr>
<tr>
<td>I am not anxious or depressed</td>
<td>1</td>
</tr>
<tr>
<td>I am slightly anxious or depressed</td>
<td>2</td>
</tr>
<tr>
<td>I am moderately anxious or depressed</td>
<td>3</td>
</tr>
<tr>
<td>I am severely anxious or depressed</td>
<td>4</td>
</tr>
<tr>
<td>I am extremely anxious or depressed</td>
<td>5</td>
</tr>
</tbody>
</table>

**EQ-5D Score**
**EQ-VAS**

We would like to know how good or bad your health is TODAY.

This scale is numbered from 0 to 100.

100 means the best health you can imagine.

0 means the worst health you can imagine.

Mark an X on the scale to indicate how your health is TODAY.

Now, please write the number you marked on the scale in the box below.

Your Health Today -
# Rehabilitation Prescription

**Records Copy**

1. **Name**
2. **NHS Number**

Ensure a Copy of the Patient Rehabilitation Prescription is Attached

---

### 3. TARN minimum dataset RETURN: (this section MUST be completed)

- **1.** Rehabilitation prescription (completed or not required):  
  - No □ Yes □ Not required □
- **2.** Presence of physical factors affecting activities or participation  
  - No □ Yes □ Unable to assess □
- **3.** Presence of cognitive/mood factors affecting activities or participation  
  - No □ Yes □ Unable to assess □
- **4.** Presence of psychosocial factors affecting activities or participation  
  - No □ Yes □ Unable to assess □

### 4. Date of Admission:  5. Date of Discharge:  6. Rehabilitation Prescription – Update / Version:  

(please date and circle as appropriate)

- **6a.** Date:  
  - 1 2 3 4 5 6 7 8 9 10

### 7. Current Hospital / Ward / ICU Area:  8. Lead Consultant (Name and Contact and SpR Bleep):  

---

### 9. Therapists (Name and Contact): (Currently responsible for, involved in the patient care / rehabilitation and / or patient’s family)  

### 10. Nurse Specialist/Major Trauma Coordinator (Name and Contact): (Contact for questions/coordination of care)

---

### 11. Pre Injury Illness: (Medical, social and emotional)

---

### 12. Injury Type: (Please circle all applicable):  

- Head injury □
- Spinal cord injury □
- Musculoskeletal □
- Spinal injury □
- Complex musculoskeletal □
- Gunshot or knife wound □

**Other? Please specify:**

---

### 13. Summary of interventions: (Please include date)

1.  
2.  
3.  
4.  
5.  
6.  
7.  
8.  
9.  
10.  

---

**Appendix 5.2 Wessex Trauma Network Rehabilitation Prescription: Records Copy**

Dr Andy Eynon  Dr Simon Hughes  Dr Elizabeth Shewry

205
## 14. Rehabilitation Complexity Scale - Extended Trauma (RCS-ET)

### 14.1 Medical Needs: (Describe the approximate level of medical environment required for medical/surgical/trauma management)

- **M1** Basic investigation - monitoring/treatment
  - On-site acute hospital care
  - Could be delivered in a community hospital/day time medical care

- **M2** Specialist medical / psychiatric intervention
  - For diagnosis or management/procedures
  - Inpatient hospital care (DGH or specialist)

- **M3** Potentially unstable medical / psychiatric condition
  - (Requiring 24 hr availability of on-site acute medical / psychiatric care)
  - Type of medical / surgical intervention required:
    - Medical
    - Surgical
    - Trauma
    - Psychiatric

- **M4** Post-acute general medical / surgical problem
  - (Requiring general emergency medical / surgical intervention, but can be managed in DGH setting)
  - Orthopaedic/trauma
  - Neurology
  - Urology
  - Vascular
  - Abdominal/Cardiothoracic
  - Rehabilitation Medicine
  - Plastics/burns

- **M5** Post acute care - with acute trauma needs
  - (Requiring acute step-down coordinated trauma care)

- **M6** Hyper-acute trauma needs - extended care trauma care
  - (Requiring hyper-acute trauma care only available in VTC)

### 14.2 Basic Care and Support Needs: (Describe the approximate level of intervention required for basic self-care or level of risk)

<table>
<thead>
<tr>
<th>CARE: Standard rehab needs</th>
<th>RISK: Cognitive behavioural needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largely independent in basic care activities</td>
<td>High risk</td>
</tr>
<tr>
<td>Requires help from 1 person for most basic care needs</td>
<td>Low risk - standard observations only</td>
</tr>
<tr>
<td>Requires help from 2 people for most basic care needs</td>
<td>Medium risk - above standard observations OR managed under MHA section</td>
</tr>
<tr>
<td>Requires help from 23 people for basic care needs</td>
<td>High risk - above standard observations AND managed under MHA section</td>
</tr>
<tr>
<td>Requires constant 1:1 supervision for safety or behavioural management</td>
<td>Very high risk</td>
</tr>
</tbody>
</table>

### 14.3 Skilled Nursing Needs: (Describe the level of intervention required from qualified or allied rehab nursing staff)

- **N0** No needs for skilled nursing

- **N1** Requires intervention from a qualified nurse (e.g. for monitoring, medication, dressing, etc)
  - General registered nursing
  - ITU nurse
  - Specialist trauma nurse (e.g. orthopaedic, impuets etc)
  - Rehab-trained nurses
  - Mental health (PMH)
  - Other

- **N2** Requires intervention from rehabilitation nursing staff and/or mental health nurses

- **N3** Requires specialist nursing care (e.g. for exacerbation of mental illness, etc)

- **N4** Requires high dependency specialist nursing (e.g. medially unattended, very frequent monitoring, intervention by qualified nurse - hourly or more often)

### 14.4 Therapy Needs: (Specify the approximate number of therapy disciplines required in the patient’s treatment)

<table>
<thead>
<tr>
<th>Therapy disciplines/state number of different therapy disciplines required</th>
<th>Total therapy disciplines required</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1 disciplines only</td>
<td>Physo  Physiotherapy</td>
</tr>
<tr>
<td>2-5 disciplines</td>
<td>SLT  Speech Pathology</td>
</tr>
<tr>
<td>6-5 disciplines</td>
<td>Occup  Occupational Therapy</td>
</tr>
<tr>
<td>6-12 disciplines</td>
<td>Social  Social Work</td>
</tr>
<tr>
<td>13-20 disciplines</td>
<td>Rehab  Rehabilitation Engineer</td>
</tr>
</tbody>
</table>

### 14.5 Therapy Intensity: (State overall intensity of input therapy intervention required from therapist alone)

- **T10** No therapy intervention or 1 hour total/week - Rehab needs met by nursing/other staff or self-exercise programmes

- **T11** Low level - less than daily (e.g. assessment/review/maintenance/supervision) OR Group therapy only

- **T12** Moderate - daily intervention - individual sessions with one person to treat for most sessions OR very intensive group programme of 26 hours/day

- **T13** High level - Daily intervention with therapist plus assistant and/or additional group sessions

- **T14** Very high level - very intensive (e.g. 2 trained therapists to treat or total 11 therapy >30 hrs/week)

Total T score (TD + T1)
### 14. Equipment Required for Discharge / Transfer

<table>
<thead>
<tr>
<th>No needs for special equipment</th>
<th>Basic Special Equipment</th>
<th>Highly Specialist Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requires basic special equipment</td>
<td>□ Wheelchair/pushing</td>
<td>□ Environmental control</td>
</tr>
<tr>
<td>Requires highly specialist equipment (eg electronic assistive technology or highly customized equipment)</td>
<td>□ Pressure care</td>
<td>□ Communication aid</td>
</tr>
<tr>
<td>Requires extremely specialist equipment (ie Really fancy h-tech trauma equipment only available in MTC)</td>
<td>□ Standing frame</td>
<td>□ Customized seating</td>
</tr>
<tr>
<td></td>
<td>□ Off-shelf orthotic</td>
<td>□ Customized standing aid</td>
</tr>
<tr>
<td></td>
<td>□ Waking aid</td>
<td>□ Customised orthotic / brace</td>
</tr>
<tr>
<td></td>
<td>□ Other: ___________________</td>
<td>□ Assisted Ventilation</td>
</tr>
</tbody>
</table>

### TOTAL SCORE SUMMARY

<table>
<thead>
<tr>
<th>Total Needs</th>
<th>Currently gets</th>
<th>Difference</th>
<th>Reason for unmet need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical / Surgical / Trauma / Psychiatric treatment</td>
<td>M-Medical: /6</td>
<td>/6</td>
<td>/6</td>
</tr>
<tr>
<td>Basic care and support (includes risk management)</td>
<td>N-Nursing: /4</td>
<td>/4</td>
<td>/4</td>
</tr>
<tr>
<td>Skilled Nursing care</td>
<td>/4</td>
<td>/4</td>
<td>/4</td>
</tr>
<tr>
<td>Therapy</td>
<td>/8</td>
<td>/8</td>
<td>/8</td>
</tr>
<tr>
<td>Specialist equipment</td>
<td>/3</td>
<td>/3</td>
<td>/3</td>
</tr>
<tr>
<td>Summed RCS</td>
<td>/25</td>
<td>/25</td>
<td>/25</td>
</tr>
</tbody>
</table>

### 15. Ongoing Impairments, Goals and Treatment Plan

<table>
<thead>
<tr>
<th>Ongoing Impairments</th>
<th>Goals</th>
<th>Treatment Plan</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### 16. Level of service needed

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2a</th>
<th>Level 2b</th>
<th>Level 3a</th>
<th>Level 3b</th>
<th>Acute Trusts</th>
</tr>
</thead>
</table>

### 17. Level of service transferring to

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2a</th>
<th>Level 2b</th>
<th>Level 3a</th>
<th>Level 3b</th>
<th>Acute Trusts</th>
</tr>
</thead>
</table>

### 18. If different or transition sub optimal, code reason:

1. Service not available
2. Service available but access delayed
3. Service exists but provision sub-optimal
4. Other: ___________________

### 19. Date of agreement with MDT when the patient is fit for transfer to a non acute setting / 42 Point Date (DD/MM/YY):

<table>
<thead>
<tr>
<th>Date</th>
<th></th>
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</thead>
</table>

### 20. Additional notes and other comments (must be recorded in all cases of mismatch between 13. and 14.):

<table>
<thead>
<tr>
<th>Additional notes</th>
<th>Other comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 21. Referral Plan

<table>
<thead>
<tr>
<th>Services Referred To</th>
<th>Contact Details (incl named person)</th>
<th>Transfer Date / Appointment Time (incl date requested)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WTN – Major Trauma Rehabilitation Prescription

22. Rehabilitation Prescription – Professionals involved in care (mandatory for all specialties/therapists):

<table>
<thead>
<tr>
<th>Name (PRINT):</th>
<th>Name (PRINT):</th>
<th>Name (PRINT):</th>
<th>Name (PRINT):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature:</td>
<td>Signature:</td>
<td>Signature:</td>
<td>Signature:</td>
</tr>
<tr>
<td>Date:</td>
<td>Designation:</td>
<td>Date:</td>
<td>Designation:</td>
</tr>
<tr>
<td>Speciality:</td>
<td>Speciality:</td>
<td>Speciality:</td>
<td>Speciality:</td>
</tr>
</tbody>
</table>

Please Copy to GP, clinical records and the receiving service / return to MTC*

*TARN Team, Regional Centre for Trauma and Specialist Services, University Hospital Southampton NHS Foundation Trust, D Level, North Wing, Mailpoint 46, Southampton General Hospital, Southampton, SO16 6YD

23. Free text: [Note: Please initial and date entry]
# BARTHEL ADL INDEX (Colin et al 1988)

<table>
<thead>
<tr>
<th>Activity / Score</th>
<th>Ability</th>
<th>Score on Admission</th>
<th>Score on Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bowel</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Incontinent (or needs to be given an enema)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Occasional accident (max once per week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Continent</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bladder</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Incontinent or catheterised and unable to manage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Occasional accident (max once per 24 hours)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Continent</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grooming</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Needs help with personal care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Independent face/hair/teeth/brushing</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Toilet Use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Dependent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Needs some help, but can do something alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Independent (on and off, dressing, wiping)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Feeding</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Unable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Needs help cutting, spreading etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Independent</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transfer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Unable - no sitting balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Major help (1 or 2 people, physical), can sit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Minor help (verbal or physical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mobility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Immobile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Wheelchair dependent including corners etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Walks with the help of 1 x person (verbal or physical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Independent (but may use aid e.g. stick, frame)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dressing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Dependent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Needs help, but can do half unaided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Independent (including buttons, zips, laces etc)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stairs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Unable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Needs help (verbal, physical, carrying aid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Independent up and down</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bathing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Dependent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Independent (or in shower)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Barthel scale or Barthel ADL index is an ordinal scale used to measure performance in activities of daily living (ADL). Each performance item is rated on this scale with a given number of points assigned to each level or ranking. It uses ten variables describing ADL and mobility. A higher number is associated with a greater likelihood of being able to live at home with a degree of independence following discharge from hospital. The amount of time and physical assistance required to perform each item are used in determining the assigned value of each item. [http://search.ovid.com/ovidweb.cgi? term=Barthel+ADL+scale&searchid=1&client=ovidfree&context=NEJM&viewport=1&content=fulltext](http://search.ovid.com/ovidweb.cgi?term=Barthel+ADL+scale&searchid=1&client=ovidfree&context=NEJM&viewport=1&content=fulltext)
Rehabilitation Prescription Guidance Notes

1. Introduction
The purpose of the Rehabilitation Prescription (RP) is as follows:

(a) The RP should help patients understand the rehabilitation care that they require in order to make the best possible recovery. This information should help empower patients to ensure that they receive the appropriate care.
(b) The RP should help ensure the robust assessment and identification of patients with major trauma rehabilitation requirements.
(c) The RP should help ensure patients receive the most appropriate rehabilitation in a timely manner.
(d) The RP will provide audit data to establish the gap between what rehabilitation is provided and what is required.

2. General
The RP should be completed within 48 hours of injury, or once the patient is stable. Subsequent revisions should be made at each significant event eg moving from critical care to the ward, or transfer to another hospital.

3. Patient Copy
The RP Patient Copy should be explained and given to the patient at each significant event (as outlined above). The patient should understand the reason for the RP and how it should be used by them.

4. Records Copy
The RP Records Copy should be thoroughly completed at each significant event and kept in the patient record. It should be used to identify the patients rehab requirements and help the relevant specialties respond accordingly. It will also assist the Specialist Nurse Coordinator to coordinate the appropriate rehabilitation resources.

The RP Records Copy will also provide a smooth transfer of the patient from area to area in relation to their rehabilitation care. ‘Levels of Specialisation in Rehabilitation Services’ should be used for reference when completing the RP Records Copy:

The ‘R-Point’ mentioned in the RP is the date at which the patient no longer requires acute care (for example the patient might require an in patient bed and rehab, but not acute medical care.) The R-Point should be agreed by MDT

PLEASE ENSURE THAT ALL REHAB PRESCRIPTIONS ARE FORWARDER AS REQUESTED AT THE END OF EACH DOCUMENT

<table>
<thead>
<tr>
<th>Set</th>
<th>RP Section</th>
<th>Responsible for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 to 11</td>
<td>Major Trauma Clinical Coordinator / Any listed below</td>
</tr>
<tr>
<td>2</td>
<td>12 to 14.5</td>
<td>Ward Nurse / Specialist Area Nurse</td>
</tr>
<tr>
<td>3</td>
<td>14.6 to 14.7</td>
<td>Therapist / Occupational Therapist</td>
</tr>
<tr>
<td>4</td>
<td>15.6</td>
<td>Therapist / Occupational Therapist</td>
</tr>
<tr>
<td>5</td>
<td>15 to 21</td>
<td>Major Trauma Clinical Coordinator / Ward Nurse / Specialist Area Nurse</td>
</tr>
<tr>
<td>6</td>
<td>22</td>
<td>All of the above who had input to the RP</td>
</tr>
<tr>
<td>7</td>
<td>23</td>
<td>As required</td>
</tr>
<tr>
<td>8</td>
<td>Barthel ADL Index</td>
<td>Major Trauma Clinical Coordinator / Ward Nurse / Specialist Area Nurse</td>
</tr>
</tbody>
</table>

Dr Andy Eynon
Dr Simon Hughes
Dr Elizabeth Shewry

Version 1
5. Barthel Index

5.1 Purpose. The Barthel Index (BI) or Barthel ADL index is a scale used to measure performance in basic activities of daily living (ADL). It uses ten variables describing ADL and mobility. A higher number is associated with a greater likelihood of being able to live at home with a degree of independence following discharge from hospital.

5.2 Overview. The Barthel Index (BI) was first introduced by Mahoney and Barthel in 1965, and is now extensively used in rehabilitation. It was initially developed to measure functional ability before and after treatment and to assess the amount of nursing care needed. It is extremely popular, and is one of the oldest and most widely used tests.

5.3 Time. The examination requires 5-10 minutes to complete.

5.4 Scoring. The BI is based on a rating scale that is completed by an observer. It covers 10 activities: personal toileting, feeding, mobility from bed to chair, transfers, bathing, walking, grooming, dressing, incontinence and going upstairs. The values for the 10 activities (ranging from 5 to 15 possible points) are added to give a total score ranging from 0 to 100. According to Sinoff and Ora, scoring on the BI can be interpreted as follows:

- score of 80–100, independent
- score of 60–79, needs minimal help with ADL
- score of 40–59, partially dependent
- score of 20–39, very dependent
- score of < 20, totally dependent.

Although this original version is still widely used, it was modified by Granger et al. in 1979, when it came to include 0-10 points for every variable. Further refinements were introduced in 1989 by Shah, Vanclay, and Cooper using a 5-level ordinal scale for each item to improve sensitivity to detecting change.

5.5 Psychometric Properties. The BI is considered a reliable disability scale for stroke patients. However, the scale suffers from ‘ceiling effects’ and therefore does not differentiate disability well among patients with higher levels of functioning. The BI also has ‘floor effects’ and is not useful in the setting of acute stroke because it typically cannot be used to measure initial stroke severity.

The BI is a useful tool at 30 or 50 days to assess level of assistance required for activities of daily life. There are currently no published instructions on the use of the BI to assess initial stroke disability. Pre-morbid BI is reasonable to assess on presentation, but there is a lack of data to identify how to use it to assess initial stroke presentation. Raters using this at admission or discharge should develop a standard methodology and scoring instructions for use in hospital setting.

5.6 Guidelines for the Barthel Index of Activities of Daily Living (ADL).

5.6.1 General

- The Index should be used as a record of what a patient does, NOT as a record of what a patient could do.
- The main aim is to establish degree of independence from any help, physical or verbal, however minor and for whatever reason.
- The need for supervision renders the patient not independent.
- A patient’s performance should be established using the best available evidence. Asking the patient, friends/relatives, and nurses will be the usual source, but direct observation and common sense are also important. However, direct testing is not needed.
• Usually the performance over the preceding 24 – 48 hours is important, but occasionally longer periods will be relevant.
  • Unconscious patients should score ‘0’ throughout, even if not yet incontinent.
  • Middle categories imply that the patient supplies over 50% of the effort.
  • Use of aids to be independent is allowed.

5.6.2 Bowels (preceding week)
  • If needs incontinence from nurse, then ‘incontinent.’
  • ‘Occasional’ – once a week.

5.6.3 Bladder (preceding week)
  • ‘Occasional’ = less than once a day.
  • A catheterised patient who can completely manage the catheter alone is registered as ‘continent.’

5.6.4 Grooming (preceding 24 – 48 hours)
  • Refers to personal hygiene: doing teeth, fitting false teeth, doing hair, shaving, washing face. Implements can be provided by helper.

5.6.5 Toilet use
  • Should be able to reach toilet/commode, undress sufficiently, clean self, dress, and leave.
  • ‘With help’ = can wipe self and do some other of above.

5.6.6 Feeding
  • Able to eat any normal food (not only soft food). Food cooked and served by others, but not cut up.
  • ‘Help’ = food cut up, patient feeds self.

5.6.7 Transfer
  • From bed to chair and back.
  • ‘Dependent’ = NO sitting balance (unable to sit), two people to lift.
  • ‘Major help’ = one strong/skilled, or two normal people. Can sit up.
  • ‘Minor help’ = one person easily, OR needs any supervision for safety.

5.6.8 Mobility
  • Refers to mobility about house or ward, indoors. May use aid. If in wheelchair, must negotiate corners/doors unaided.
  • ‘Help’ = by one untrained person, including supervision/moral support.

5.6.9 Dressing
  • Should be able to select and put on all clothes, which may be adapted.
  • ‘Full’ = help with buttons, zips, etc. (check!), but can put on some garments alone.

5.6.10 Stairs
  • Must carry any walking aid used to be independent.

5.6.11 Bathing
  • Usually the most difficult activity.
  • Must get in and out unsupervised, and wash self.
  • Independent in shower = ‘Independent’ if unsupervised/unaided.

(Collin et al., 1988)
6. **EQ-5D**

EQ-5D is a standardized measure of health status developed by the EuroQol Group in order to provide a simple, generic measure of health for clinical and economic appraisal. It is applicable to a wide range of health conditions and treatments, providing a simple descriptive profile and a single index value for health status that can be used in the clinical and economic evaluation of health care as well as in population health surveys.

EQ-5D is designed for self-completion by respondents and is ideally suited for use in postal surveys, clinics, and in face-to-face interviews. It is cognitively undemanding, taking only a few minutes to complete.

6.1 **What is a health state?** Each of the 5 dimensions comprising the EQ-5D descriptive system is divided into 5 levels of perceived problems:

- Level 1: indicating no problem
- Level 2: indicating slight problems
- Level 3: indicating moderate problems
- Level 4: indicating severe problems
- Level 5: indicating extreme problems

A unique health state is defined by combining 1 level from each of the 5 dimensions.

A total of 3125 possible health states is defined in this way. Each state is referred to in terms of a 5 digit code. For example, state 11111 indicates no problems on any of the 5 dimensions, while state 12345 indicates no problems with mobility, slight problems with washing or dressing, moderate problems with usual activities, severe pain or discomfort and extreme anxiety or depression.

**NB:** There should be only ONE response for each dimension.

**NB:** Missing values can be coded as ‘9’.

**NB:** Ambiguous values (e.g. 2 boxes are ticked for a single dimension) should be treated as missing values.
6.2 The EQ VAS. The EQ VAS should be scored, for example, as follows:

- We would like to know how good or bad your health is TODAY.
- The scale is numbered from 0 to 100.
- 100 indicates the best health you can imagine.
- 0 indicates the worst health you can imagine.
- Mark an X on the scale to indicate how you feel TODAY.
- Then, please write the number you marked on the scale in the box below.

[Diagram showing a scale from 0 to 100 with an X marked at 77, indicating the health status]

For example this response should be coded as 77.

NB: Missing values should be coded as '999'.

NB: If there is a discrepancy between where the respondent has placed the X and the number he/she has written in the box, administrators should use the number in the box.
6.3 Organising EQ-5D-5L data.

The data collected using EQ-5D is entered into a database in the following way:

<table>
<thead>
<tr>
<th>Variable name</th>
<th>ID</th>
<th>SEX</th>
<th>AGE</th>
<th>EDU</th>
<th>COUNTRY</th>
<th>RISK</th>
<th>MOBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient ID number</td>
<td>1</td>
<td>Male</td>
<td>65</td>
<td>High</td>
<td>UK</td>
<td>2011</td>
<td>1</td>
</tr>
<tr>
<td>Patient ID number</td>
<td>2</td>
<td>Male</td>
<td>75</td>
<td>High</td>
<td>UK</td>
<td>2011</td>
<td>2</td>
</tr>
</tbody>
</table>

6.4 Full User Guide for EQ-5D.

The full user guide for EQ-5D can be found at the link below; it includes a section on how data should be presented.

7. Complexity / Level of Service

**Complexity of need**

<table>
<thead>
<tr>
<th>Needs / Input tools</th>
<th>Outcome measures</th>
<th>Level 1: Specialised rehabilitation services</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPD, NPT*IMA, RCS</td>
<td>FMS, FAM, and/or BI SAS</td>
<td>Predominantly highly complex care - (eg 90-95% patients with RCS score &gt; 10)</td>
</tr>
<tr>
<td>RCS</td>
<td></td>
<td>Catchments: 100-300,000, mixed case load (eg 90-95% patients with RCS score &gt; 10)</td>
</tr>
<tr>
<td>Patients requiring rehabilitation</td>
<td>Minimum data collection and staffing levels</td>
<td></td>
</tr>
</tbody>
</table>

**TERTIARY SPECIALISED REHABILITATION SERVICES - provided at regional / national level**

**Level 1:** Specialised rehabilitation services
- Provided by specialist rehab teams led by consultants trained and accredited in the specialty of rehabilitation medicine (RM) and/or neurorehabilitation
- Serving regional or supra-regional population and taking patients with Category A needs - severe physical, cognitive, communication, disabilities or challenging behaviours, with highly complex rehabilitation needs that are beyond the scope of their local specialist rehabilitation services, and have higher level facilities and skilled staff to support these.
- Collect and report full National Specialist Rehabilitation Dataset

**LEVEL 2:** Local (district) specialist rehabilitation services
- Provided by inter-disciplinary teams led/support by a consultant in RM, and meeting the BSRM standards for specialist rehabilitation services

**Level 2a**
- Led by consultant in RM, serving an extended local population in areas which have poor access to level 1 services.
- Take patients with a range of complexity, including Category B and some Category A with highly complex rehabilitation needs.
- Collect and report full National Specialist Rehabilitation Dataset

**Level 2b**
- Led/support by a consultant in RM, serving a local population, predominantly patients with Category B needs.
- Collect and report full minimum national dataset.

**LEVEL 3:** Local rehabilitation services
- Various specialist services.
- Includes generic rehabilitation for a wide range of conditions, provided in the context acute, intermediate care and community facilities, or other specialist settings (eg stroke units).

**Level 3a**
- Other specialist services led or supported by consultants in specialties other than RM - eg services caring for patient with specific diagnosis (eg stroke) with Category C needs.

**Level 3b**
- General rehabilitation for a wide range of conditions, often led by non-medical staff, provided in the context acute, intermediate care and community facilities, for patients with Category D needs.

*Defined by Rehabilitation Complexity / Northwick Park nursing and Therapy Dependency Scores*
### Appendix 5.4  Wessex Trauma Network booklet

**Wessex Trauma Network**

**Hospital**

**Emergency Department**

**Trauma Booklet**

<table>
<thead>
<tr>
<th>Date / Time of Trauma Call</th>
<th>ED Consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Called</td>
<td>Present on Arrival?</td>
</tr>
</tbody>
</table>

**Team Leader / Grade**

<table>
<thead>
<tr>
<th>Nurse One</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Scribe</th>
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</thead>
</table>

**Attending Specialties**

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Survey Doctor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED Doctor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthetics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITU / PICU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orthopaedics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurosurgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airway assist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paediatrics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Drugs &amp; Fluids</th>
<th>Dose</th>
<th>Route</th>
<th>Sign</th>
<th>Given</th>
<th>Batch</th>
<th>Given By</th>
</tr>
</thead>
</table>

[Image of the form and table structure]
Pre-Hospital Information

<table>
<thead>
<tr>
<th>Ambulance Service</th>
<th>Log number</th>
</tr>
</thead>
</table>

Surname:  
First Name:  
Hospital Number:  
NHS Number:  
DOB:  

Age + Sex (+ name from handover)  
Time of incident (= when it happened)  
Mechanism of injury  
Injuries  

Vital Signs* (first set + significant changes)  
Pulse  
BP  
Resps  
Pupils  
L  
R  
Size  
Reactivity  
SATs  
BMI  
Initial GCS  
E  
V  
M  =  /15  

Treatment:  
Intubated  
Yes  
No  
TxA Given  
Yes  
No  

Triage Tool:  Trauma Unit Bypassed?  Y  N  

Response activated  
ED trauma team  
Hospital trauma team  

Massive Transfusion Policy Activated  
Yes  
No  

Senior Doctor Informed  
Yes  
No  

Name of Senior Doctor Informed:  

ETA..............  
Land  
Helicopter  

Most senior clinician:  Tech / Paramedic / Aircrew / CCP / Nurse / Doctor  

PRE-HOSPITAL DRUGS & FLUIDS  

1.  
2.  
3.  

1.  
2.  

Time at scene:  

PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL  

Version 1  
Dr Andy Eynon  
Dr Simon Hughes  
Dr Elizabeth Shewry
### Primary Survey

<table>
<thead>
<tr>
<th>INITIAL OBSERVATIONS</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂</td>
<td>RR</td>
</tr>
<tr>
<td>HR</td>
<td>BP</td>
</tr>
<tr>
<td>Temp</td>
<td>Weight</td>
</tr>
</tbody>
</table>

Affix NHS Barcode here

| Surname: |
| Firt Name: |
| Hospital Number: |
| NHS Number: |
| DOB: |
| Address: |

### CATASTROPHIC HAEMORRHAGE

<table>
<thead>
<tr>
<th>Y</th>
<th>N</th>
<th>CODE RED</th>
<th>TOURNIQUET</th>
<th>DIRECT PRESSURE</th>
<th>O-VE BLOOD</th>
<th>HAEMOSTATIC</th>
</tr>
</thead>
</table>

### AIRWAY

<table>
<thead>
<tr>
<th>INTUBATION</th>
<th>YES</th>
<th>NO</th>
<th>ET TUBE SIZE</th>
<th>LMA SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILS</td>
<td>CRICOID</td>
<td>GRADE</td>
<td>ADJUNCTS</td>
<td>TIME</td>
</tr>
<tr>
<td>CERVICAL SPINE</td>
<td>APPLICATION OF BLOCKS / COLLAR</td>
<td>YES</td>
<td>NO</td>
<td>TIME</td>
</tr>
<tr>
<td>NECK CLEARED?</td>
<td>YES</td>
<td>NO</td>
<td>CLEARED BY:</td>
<td>TIME</td>
</tr>
</tbody>
</table>

### BREATHING

<table>
<thead>
<tr>
<th>CHEST DRAIN</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDICATION</td>
<td>INSERTED BY:</td>
<td>TIME</td>
</tr>
</tbody>
</table>

### CIRCULATION

| TRANEXAMIC ACID | YES | NO | (dose: 1g IV - check pre-hospital) | TIME |
| PELVIC FRACTURE? | YES | NO | STABLE | UNSTABLE | SPLINT APPLIED | TIME |
| GROUP & SAVE | YES | NO | XmATCH: YES | NO | UNITS | TIME |

Please ensure each page is completed in full.
### Primary Survey cont.d & Initial Interventions

<table>
<thead>
<tr>
<th>DISABILITY</th>
<th>RIGHT PUPIL (SIZE/REACTN)</th>
<th>MM</th>
<th>LEFT PUPIL (SIZE/REACTN)</th>
<th>MM</th>
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<tbody>
<tr>
<td>E</td>
<td></td>
<td>YES</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>LIMB MOVEMENT</td>
<td>RA</td>
<td>LA</td>
<td>PRIAPISM</td>
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<tr>
<td>GCS</td>
<td>BM</td>
<td>RL</td>
<td>LL</td>
<td>SEIZURES</td>
</tr>
</tbody>
</table>

LOG ROLL PERFORMED: YES NO TIME:

FINDINGS:

### Immediate Interventions Required:

- **C-SPINE**: Spinal immobilization initiated? Yes No
- **AIRWAY**: Immediate airway intervention? Yes No Adjunct / RSI
- **BREATHING**: Chest decompression required? Yes No
- **CIRCULATION**: IV fluids stopped or commenced? Yes No Stopped / Started
- **PAIN RELIEF**: Immediate analgesia required? Yes No

### Allergies

<table>
<thead>
<tr>
<th>Medications</th>
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<table>
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<tr>
<th>Tetanus Covered?</th>
<th>YES</th>
<th>NO</th>
<th>UNKNOWN</th>
<th>TIME LAST ATE</th>
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<tr>
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PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL.
# Emergency Department Plan

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<td>NHS Number:</td>
</tr>
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<table>
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**DATE** | **TIME** | **SIGNATURE**
--- | --- | ---
6 |  | 6

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<table>
<thead>
<tr>
<th>PLAIN FILMS</th>
<th>CXR</th>
<th>PXR</th>
<th>C.SPINE</th>
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<td>TIME:</td>
<td>TIME:</td>
<td>TIME:</td>
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<td>TIME:</td>
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<tr>
<td>CLINICIAN NAME:</td>
</tr>
<tr>
<td>CLINICIAN GRADE:</td>
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<tr>
<td>RESULT:</td>
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</table>

<table>
<thead>
<tr>
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<tr>
<td>TIME OF ARRIVAL IN SCANNER ROOM:</td>
</tr>
<tr>
<td>TRAUMA SERIES: YES NO</td>
</tr>
<tr>
<td>HEAD &amp; NECK: YES NO</td>
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<table>
<thead>
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<th>SURGICAL INTERVENTIONS</th>
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<td>TRANSFERED TO THEATRES</td>
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<td>TRANSFER TIME TO THEATRE</td>
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Expected Procedures:

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<tr>
<td>TIME</td>
</tr>
<tr>
<td>FiO₂</td>
</tr>
<tr>
<td>ETCO₂</td>
</tr>
<tr>
<td>PEAK AIRWAY PRESSURE</td>
</tr>
<tr>
<td>SaO₂</td>
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<td>MEAN ARTERIAL PRESSURE</td>
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<td>CENTRAL VENOUS PRESSURE</td>
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<td>CHEST DRAINAGE</td>
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PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL
# UHS Adult Major Trauma Guidelines 2014

## PROVISIONAL CT REPORT

| Affix NHS Barcode here |

| Surname: |
| First Name: |
| Hospital Number: |
| NHS Number: |
| DOB: |
| Affix patient label here |

**RECEIVING DR:**

**GRADE:**

**RECEIPT TIME:**

**RADIOLOGIST:**

---

To guide initial management only. Formal detailed report will follow on PACS

### Airway

<table>
<thead>
<tr>
<th>ET Placement:</th>
<th>N/A</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
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</thead>
<tbody>
<tr>
<td>Airway Obstruction:</td>
<td>Yes</td>
<td>No</td>
<td></td>
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</tbody>
</table>

### Breathing

| Pneumothorax: | Yes | No |
| Heamothorax: | Yes | No |
| Contusion: | Yes | No |
| Laceration: | Yes | No |
| Chest drain placement: | N/A | Satisfactory | Unsatisfactory |

### Massive Haemorrhage

| Thoracic: | Yes | No |
| Abdominal: | Yes | No |
| Pelvic: | Yes | No |

### Disability

| Intracranial Haemorrhage/Oedema: | Yes | No |
| Midline Shift: | Yes | No |

---

**Name (Print):**

**Consultant:**

**Registrar:**

**Signed:**

**Date:**

**Time:**

---

**SIGNATURE OF RECEIVING DOCTOR**

---

**Version 1**

Dr Andy Eynon

Dr Simon Hughes

Dr Elizabeth Shewry
### Emergency Department

<table>
<thead>
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Affix NHS Barcode here

Surname:  
First Name:  
Hospital Number:  
NHS Number:  
DOB:  
Address:  

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PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL

---

UHS Adult Major Trauma Guidelines 2014

Dr Andy Eynon  
Dr Simon Hughes  
Dr Elizabeth Shewry

Version 1
**Secondary Survey**

**BODY REGION FINDINGS**

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<tr>
<td>FACE</td>
<td>NONE</td>
</tr>
<tr>
<td>NECK</td>
<td>NONE</td>
</tr>
<tr>
<td>CHEST</td>
<td>NONE</td>
</tr>
<tr>
<td>ABDOMEN</td>
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<td>PELVIS</td>
<td>NONE</td>
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<tr>
<td>UPPER LIMBS</td>
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<td>LOWER LIMBS</td>
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<td>LOG ROLL/BACK</td>
<td>NONE</td>
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<tr>
<td>PERINEUM/RECTAL</td>
<td>NONE</td>
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<td>ECG</td>
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<tr>
<th>INITIAL BLOODS</th>
<th>AFFIX NHS Barcode here</th>
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<tr>
<td>BLOOD TEST RESULTS</td>
<td></td>
</tr>
<tr>
<td>TIME</td>
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</tr>
<tr>
<td>HB</td>
<td></td>
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<td>WCC</td>
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<td>Hct %</td>
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<td>Plts</td>
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<tr>
<td>ALT</td>
<td></td>
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<tr>
<td>BILI</td>
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| BLOOD GAS RESULTS | | |
| TIME | FiO2 | YestoxygenorArterial | | |
| pH | | |
| pO2 | | |
| pCO2 | | |
| HCO3 | | |
| LACTATE | | |
| BASE EXCESS | | |
| Na | | |
| K | | |
| iCa | | |
| BM | | |
| HbCO | | |
| Hb | | |
| Chloride | | |

**AFFIX ARTERIAL/VENOUS BLOOD GAS HERE**

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<tr>
<th>URINARY CATHETER</th>
<th>YES</th>
<th>NO</th>
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<th>NAME:</th>
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<tbody>
<tr>
<td>URINALYSIS/PREGNANCY TEST</td>
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<td>NAME:</td>
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<td>Result:</td>
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**PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL**
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PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL
### Emergency Department

Affix NHS Barcode here

<table>
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<th>SPECIALITY</th>
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<tbody>
<tr>
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### Discharge

<table>
<thead>
<tr>
<th>Date &amp; Time ready for discharge</th>
<th>Time</th>
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<table>
<thead>
<tr>
<th>Date &amp; Time of actual discharge</th>
<th></th>
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</table>

<table>
<thead>
<tr>
<th>Discharge destination</th>
<th>Home</th>
<th>Ward</th>
<th>ICU</th>
<th>Theatres</th>
<th>Mortuary</th>
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<tbody>
<tr>
<td>(Please circle)</td>
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<table>
<thead>
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<th>Ward Name</th>
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<tbody>
<tr>
<td>Transfer Nurse</td>
<td></td>
</tr>
<tr>
<td>Transfer Doctor</td>
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</tr>
<tr>
<td>Prime Transfer Speciality</td>
<td></td>
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</tbody>
</table>

**PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL**

**Version 1**

Dr Andy Eynon

Dr Simon Hughes

Dr Elizabeth Shewry
### SAFEGUARDING
(please continue on hospital continuation sheets)

Affix NHS Barcode here

<table>
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<tr>
<th>PRINT NAME</th>
<th>SPECIALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSULTANT</td>
<td>Bleep / Ext:</td>
</tr>
</tbody>
</table>

**VULNERABLE ADULT / CHILD MANAGEMENT:**

Whilst an in-patient arrange / offer referral to specialist services. (circle as appropriate)

This should be undertaken early in the patient pathway:

- **MENTAL HEALTH**
- **LEARNING DISABILITY**
- **HOMELESSNESS**
- **SUBSTANCE ABUSE**
- **DOMESTIC ABUSE (inc HTP)**
- **SEXUAL OFFENCES**
- **WORKING WOMENS PROJECT**
- **CHILD SAFEGUARDING CONCERN**

<table>
<thead>
<tr>
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**DATE** 16 **TIME** 16 **SIGNATURE**

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<td>Bleep / Ext:</td>
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PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL
**Nursing Notes**

Affix NHS Barcode here

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<tr>
<th>PRIMARY NURSE</th>
<th>CODE RED NURSE</th>
<th>NURSE 2</th>
<th>NURSE 3</th>
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</thead>
</table>

Police Station and CAD

Next of Kin

Name & Contact tel:

**PRESENT:** YES NO

**SAFEGUARDING CHILDREN / VULNERABLE ADULT ISSUES:**  Y  N

Please go to page 16 to document concerns

DATE:  

TIME:

**PROPERTY REMOVED FROM PATIENT**

<table>
<thead>
<tr>
<th>SHIRT/BLOUSE/JUMPER</th>
<th>UNDERWEAR/NIGHTWEAR</th>
<th>OTHER:</th>
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</thead>
<tbody>
<tr>
<td>TROUSERS/SKIRT:</td>
<td>COAT/JACKET</td>
<td>CLOTHING CUT: YES NO</td>
</tr>
<tr>
<td>SOCKS/TIGHTS/</td>
<td>BAG/CASE</td>
<td>CREDIT/DEBIT/STORE CARDS</td>
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<tr>
<td>SHOES/BOOTS/SLIPPERS</td>
<td>WALLET/PURSE</td>
<td>(Specify credit cards)</td>
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</table>

DENTURES: UPPER LOWER

HEARING AID: UPPER LOWER

STICK/CRUTCHES/FRAMES

CASH — AMOUNT £ ____________

PROPERTY No.

COLECTED BY: RELATIVE / POLICE / FRIEND

DRIVING LICENCE / MOBILE PHONE

**PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL**
### Secondary Transfer

**Affix NHS Barcode here**

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<th>Hospital Number:</th>
<th>NHS Number:</th>
<th>DOB:</th>
<th>Address:</th>
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#### Transfer From:

<table>
<thead>
<tr>
<th>Southampton (UHS)</th>
<th>Salisbury (UHS)</th>
<th>Portsmouth (PICU/LOCAL TEAM)</th>
<th>Swansea (ICU/RETRIEVAL)</th>
<th>Other</th>
</tr>
</thead>
</table>

#### Transfer To:

(please circle)

#### Time of Decision Made to Transfer:

AUTOMATICALLY ACCEPTED TO SOUTHAMPTON ED FOR TIME CRITICAL TRANSFER:

1. GCS Motor 4 or less & Intracranial bleeding
2. Life threatening haemorrhage not amenable to control at trauma unit
3. Successful resuscitative thoracotomy at trauma unit
4. Time Critical Transfer after direct referral to specialist teams (out of ED) at MTC / other TU
5. Urgent (<48 hr) Transfer after direct referral to specialist teams (out of ED) at MTC / other TU

#### Reason for Transfer (Please Circle):

Refer to Wessex Secondary Transfer Tool for phone numbers and specialty contact details

Consider taking cross match blood sample on transfer

#### Time of First Call to Receiving Unit:

#### Time Accepted by Reviewing Unit:

#### Receiving Team Leader:

#### Time of Call to Ambulance Service:

#### Time Ambulance Arrived:

#### Ambulance Service Incident Number:

#### Time of Departure:

#### Time of Arrival:

#### Medical Staff Escorting:

Name, Grade, Specialty

#### Other Staff Escorting:

Name, Grade, Specialty

#### ANY DELAYS OR INCIDENTS DURING TRANSFER? (please specify)

PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL
### Obs/Aneasthetic Chart 2

**Surname:**

**First Name:**

**Hospital Number:**

**NHS Number:**

**DOB:**

**Address:**

<table>
<thead>
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<td>VERBAL (1-5)</td>
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<td>MOTOR (1-6)</td>
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<td>GCS TOTAL (1-15)</td>
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<tr>
<td>LEFT</td>
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<tr>
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</tr>
<tr>
<td>REACTION</td>
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<td>FIO2</td>
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<td>ETCO2</td>
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<td>PEAK AIRWAY PRESSURE</td>
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<td>MOTOR (1-6)</td>
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**PLEASE ENSURE EACH PAGE IS COMPLETED IN FULL**
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