Royal Infirmary of Edinburgh (RIE) Major Trauma Centre (MTC) Clinical Guidelines:

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<th>04/03/2021</th>
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<td>Author/s:</td>
<td>Alex Laird, Andy Tambyraja, Callum Johnston, Christopher Hay, Claire Simpson, Colm McCarthy, Dean Kerslake, Duncan Campbell, Gillian Macdougall, Imran Liaquat, James Powell, Joanne Thomson, Jon Maccormack, Julia Anderson, Laura Fitton, Lindsay Reid, Megan Rowley, Michael Wilson, Mike MacMahon, Murray Blackstock, Nicola Di Rollo, Nicola McCullough, Olivia McBride, Patrick Addison, Robbie Lendrum, Roshan Raghavan, Sadaquate Khan, Sam Molyneaux, Stuart Mckechnie, Tim White, Tom Blankenstein</td>
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<td>Dean Kerslake</td>
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1.0 Hospital Pre-Alert and Handover

1.1. Pre-Hospital Trauma Triage

The ambulance service will use the Pre-hospital Triage Tool to determine the appropriate destination for the trauma patient at the roadside.

The ambulance will provide an ATMIST handover using the form below over the airwaves radio system to the receiving hospital.
1.2. Pre-Alert Information

Record the following information during the pre-alert from the Scottish Ambulance Service (SAS):

- Age and sex of the injured person
- Time of incident
- Mechanism of injury
- Injuries suspected
- Signs, including vital signs, and GCS
- Treatment so far
- Estimated time of arrival (ETA)
- Special requirements
- Ambulance call sign
- Name of person taking the call
- Time of the call

Pass the pre-alert form to the Trauma Team Leader (TTL) or senior nurse who will determine the level of trauma team response according to the trauma team activation protocol.
1.3. Tiered Trauma Team Response (Adults)

The RIE operates a three tiered multidisciplinary trauma team response:

CODE RED TRAUMA TEAM CALL (SEE NOTE BELOW)

*All of the following:*
- Suspected or confirmed active haemorrhage
- SBP ≤ 90mmHg
- Unresponsive to volume resuscitation

ENHANCED TRAUMA TEAM CALL (TANNOY & 2222)

*Any of*
- GCS <14
- RR<10 or >29
- SBP ≤ 90mmHg or sustained loss of radial pulse
- Penetrating injury proximal to shoulders or knees
- Chest wall instability or deformity
- Two or more proximal limb fractures
- Paralysis
- Crushed, de-gloved, mangled or pulseless extremity
- Amputation proximal to wrist or ankle
- Suspected pelvic fracture
- Transfers from other Emergency Departments
- At the request of Pre-hospital team/Team leader/Senior Nurse

TRAUMA TEAM (ED TANNOY ONLY)

*Any of*
- Falls >20 feet
- Ejection from vehicle
- Death in the same vehicle
- Vehicle vs Pedestrian
- Vehicle vs Cyclist
- Motorcyclist >20mph
- Age >55
- Acquired or inherited bleeding disorders
- Morbid obesity
- Pregnancy >20 weeks

1. **Place tannoy call stating which team is activated**
2. **Dial 2222 if activating either enhanced or code red trauma teams**
3. **For CODE RED TRAUMA CALLS – The Nurse in charge or Trauma Team Leader will nominate who dials 2222.** Switchboard will immediately transfer the call to BTS so they must be familiar with ordering blood products according to the code red transfusion protocol and be part of the code red trauma team.
1.4. Tiered Trauma Team Response (Paediatrics)

RHCYP Trauma Team Activation

- **Suspected Major Haemorrhage**
  - DIAL 2222 – State Paediatric Level 1 Trauma Team stand by in Resus Children’s Hospital

- **Obstructed Airway OR Inadequate Breathing/ventilation/oxygenation OR Unresponsive OR responsive only to voice or pain (GCS <14)**
  - DIAL 2222 – State Paediatric Level 2 Trauma Team stand by in Resus Children’s Hospital

- **Level 1 Team:**

- **Level 2 Team:**
  - EM Consultant, Anaesthetic Consultant/Reg, PICU Consultant/fellow, General Surgical ST4+, Orthopedic ST4+, Radiology Consultant, Radiographer, PICU charge nurse, Clinical Co-ordinator, theatre co-ordinator

Level 1 or Level 2 Trauma Team may be activated at any time at the discretion of the EM Consultant.

EM Consultant to consider pre-alert of Neurosurgeon/Plastic Surgeon/Cardiothoracic Surgeon

If no criteria for Trauma Team activation consider pre-alerting the Radiographer and Radiology Reg for isolated head CT or the Radiology Consultant for any other CT.
1.5. Code Red Response

Activate the Code Red Trauma Team if the patient has **ALL** of the following:

- Systolic Blood Pressure (BP) < 90mmHg
- Suspected or confirmed active haemorrhage
- Unresponsive to volume resuscitation

1.5.1. Code Red Protocol for the Royal Infirmary of Edinburgh

**CODE RED – ROYAL INFIRMARY OF EDINBURGH 2020**

Activate **pre-hospital or in ED** for **TRAUMA** patient with:

- Suspected or confirmed bleeding
- Systolic blood pressure < 90 mmHg (in an adult patient) who is
  - Unresponsive to fluid boluses.

**STEP 1. PHONE 2222.** Say **“CODE RED TRAUMA CALL, ROYAL INFIRMARY OF EDINBURGH”** & state your current location and patient ETA

**“STAY ON THE LINE WHILE YOU ARE CONNECTED TO BLOOD BANK”**

**Ensure the patient gets a name band at the earliest opportunity after arrival**

**STEP 2.** Tell Blood Bank:

- i. A contact number (likely Trauma Team Leader phone)
- ii. Gender and if pregnant
- iii. Patient’s exact location and planned moves
- iv. Ask for **TRAUMA PACK A** components to come down to ED (You do not need to state what you specifically require.
  - You will be automatically issued with 4 units of universal red cells (or type specific if BTS sample received) and 4 units of universal FFP (or type specific if BTS sample received).
  - Red cells are likely to come down first followed by other components as they become available.
  - You do not need to make a further phone call, FFP will now come down to the ED as soon as it is ready.

**BLOOD PORTER WILL AUTOMATICALLY BE NOTIFIED OF CODE RED AND WILL ATTEND BLOOD BANK**

**STEP 3. Confirm Activation of Code Red with the Trauma Team Lead (TTL).**

- i. Confirm blood available in ED emergency satellite blood fridge (4xO negative red cells)
- ii. If on arrival of the patient/after resuscitation the TTL wants further blood components then phone **27504** and request **TRAUMA PACK B**.
  - You do not need to state what you specifically require. You will be automatically issued with 6 unit of universal red cells (or type specific if BTS have a tube), 6 units of universal (or type specific) FFP, 1 unit of universal (or type specific) platelets, 2 units of cryoprecipitate

**FOR FURTHER COMMUNICATION WITH BLOOD BANK PHONE ext 27504**

**STEP 4. TTL identifies the team member to act as named point of contact with emergency blood porter.**

- i. Confirm &/or log receipt of expected blood components
- ii. Handover any samples to the blood porter for urgent transfer to the lab
- iii. Perform ROTEM
- iv. Remember 1g TXA within 3 hrs of injury and remember TXA infusion after bolus dose
- v. Remember Calcium replacement. **Stand down Code Red when appropriate**
  - 1 unit of platelets refers to a pool of 6 whole blood derived concentrates (i.e. you would give 1 unit every 6 units of blood if practising 1:1:1 transfusion)
  - Notify blood bank if you have used or wasted the ED blood fridge red cells so that it can be replenished. Do not put platelets in the ED blood fridge

**BLOOD PORTER WILL RETURN TO BLOOD BANK UNLESS ADVISED OTHERWISE**

**STEP 5. At the end of the Code Red the TTL should:**

- i. Inform Blood Bank the Code Red is over
- ii. Ensure all transfusion Labels, Tags & Documentation completed & returned

---

Code Red RIE protocol v 24.08.2020; Authors Matt Reed, Deen Kerelske, Megan Rowley, Catherine Innes, Ross Medine, Julie Taylor
1.5.2. Management of Trauma Induced Coagulopathy

INITIAL PHASE

- Pack A: 4 x PRBC + 4 x FFP followed by Pack B empiric transfusion
- Tranexamic Acid 2 x 1g bolus
  - May have been given in pre-hospital phase.
- Maintain Temp > 35°C
- Maintain Calcium > 1mmol/l
- Expedite definitive haemorrhage control
- Anticipate Transfusion Requirements.

CLOTPro ALGORITHM

ClotPro repeatable 15min after blood products to assess response and guide further therapy.

ClotPro guided therapy is in addition to the empiric transfusion strategy until definitive haemorrhage control has been achieved.

Thrombin Generation/Fibrinogen/Platelets

<table>
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<tr>
<th>EX-test A5</th>
<th>≤ 10mm</th>
<th>11-27mm</th>
<th>≥ 28mm</th>
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<tr>
<td></td>
<td>8 units FFP + 2 pools platelets</td>
<td>8 units FFP + 1 pool platelets</td>
<td>4 units FFP</td>
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<tr>
<td>≤ 3mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIB-test A5</td>
<td>4 units FFP + 2 pools platelets</td>
<td>4 units FFP + 1 pool platelets</td>
<td>No Additional Requirements</td>
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<td>4-6mm</td>
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<tr>
<td>≥ 7mm</td>
<td>2 pools platelets</td>
<td>1 pool platelets</td>
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Fibrinolysis

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<tr>
<th>EXTEM Li30</th>
<th>&lt; 85%</th>
<th>Give 1g Tranexamic Acid Bolus</th>
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</table>
1.5.3. Royal Hospital for Children and Young People Major Haemorrhage Protocol

Activate MAJOR HAEMORRHAGE PROTOCOL

To enable the rapid supply of blood components & rapid transport of blood samples
**BEFORE YOU CALL CHECK THE PATIENT'S ID BAND**

STEP 1.
- PHONE 2222
- Say “MAJOR HAEMORRHAGE, CHILDREN'S HOSPITAL”
- State your current location
- The Paediatric Emergency Team (PET) will be automatically activated by switchboard
- Ask switchboard to urgently contact any additional staff required

STAY ON THE LINE WHilst YOU ARE CONNECTED TO BLOOD BANK

STEP 2.
- Tell Blood Bank
  - Patient’s Name, Sex, DoB, CHI number (or UHPI number if no CHI)
  - Which blood components you require (BE SPECIFIC, there are no standard packs)
  - Typical quantities: Red Cells 20 ml/kg. FFP, if required, 15 ml/kg. Platelets, if required, 15 ml/kg (up to 1 adult pack)
  - Define how soon you want blood components: IMMEDIATE OR WITHIN 30 MINUTES
  - The patient’s exact location and any planned moves
  - Your Name & Contact Details to act as the point of contact for Blood Bank
  - Which blood samples you are sending to the lab. BLOOD BANK WILL INFORM YOU IF A TRANSFUSION SAMPLE IS REQUIRED

STEP 3.
- Confirm activation of the Major Haemorrhage Protocol with the Clinical Team Lead
- Record which blood components have been requested and when they were ordered

For further communication with Blood Bank, phone ext 27501 or 27502
For haematology laboratory bleep (110) 6550

STEP 4.
- Clinical Team Lead identifies the team member to act as named point of contact with Major Haemorrhage Porter
  - Record receipt of ordered blood components
  - Write this information on the MHP feedback sheet provided or somewhere else easily visible
  - Handover any samples to the Major Haemorrhage Porter for urgent transfer to the lab

STEP 5.
- When the rapid supply of blood components & rapid transport of blood samples are no longer required the Clinical Team Lead announces the end of the Major Haemorrhage Protocol
  - Inform Blood Bank the Major Haemorrhage is over
  - Ensure all transfusion labels, tags and documentation including MHP feedback sheet are completed and returned

For further guidance about managing a Major Haemorrhage refer to the RHCYP Major Haemorrhage Guideline or seek advice from on-call Haematologist.

Revised June 2020
Authorised by NHS Lothian Transfusion Committee
Review due June 2023
1.5.4. Royal Hospital for Children and Young People
Traumatic Haemorrhage Guideline

Traumatic Haemorrhage in ED RHCYP

**Before patient arrives**
- Activate Level 1 Trauma Team
- Set up blood warmer/rapid transfusion device (ODP)
- Call BTS on 27501/27502
  - Request 2 units of RCC O Negative for immediate delivery to ED Children’s Hospital

**When patient arrives**
- Activate Major Haemorrhage Protocol by calling 2222 stating clearly ED Children's Hospital, stay on the line to be put through to BTS
- Request blood and components as per Paediatric Major Haemorrhage Protocol

**After patient leaves**
- Phone BTS to stand down Major Haemorrhage
  - return any unused blood components back to BTS as soon as possible
- Debrief trauma team if required

---

1. The emergency porter from BTS will bring the O Negative blood to ED please ensure you state ED Children’s Hospital.
2. No patient details are required for requesting the Emergency O Negative from BTS.
3. Once the MHP is activated, if requesting blood and products for an unknown patient minimum identifiers are ED number and gender of the patient.
4. Do not remove the blood from the red transit box until definitely required for transfusion this may help reduce wastage.
5. Please inform BTS if the patient is moving eg to theatre/PICU and the Major Haemorrhage is ongoing.

11/02/2021 RHCYP PMTC
1.5.5. **Blood Inventory Form**

Use the Blood Inventory Form (Pictured below) to monitor blood ordered and given.

### Blood Products

**BTS – 27504**

#### Blood products that have been ordered:

<table>
<thead>
<tr>
<th>Type of product</th>
<th>Amount</th>
<th>Time ordered</th>
<th>Received?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Blood products that have been given:

- **Red Blood Cells**
  - 1 2 3 4 5 6 7 8
  - ABG/Rotem?
  - 9 10 11 12 13 14 15 16
  - ABG/Rotem?
- **FFP**
  - 1 2 3 4 5 6 7 8
- **Platelets**
  - 1 2 3 4 5 6 7 8
- **Cryoprecipitate**
  - 1 2 3 4 5 6 7 8

**Code Red called?**

[ ] Remember to stand down
1.6. SAS Handover to Hospital

- The TTL should be easily identifiable for receiving handover
- Address immediate life threatening pathology before handover.
- Handover should use ATMIST format
- Handover should take no more than 30 seconds.
- Communicate further relevant information to the TTL or scribe later.
2.0 Trauma Teams

2.1 Trauma Team Leader

An ED consultant will be the TTL and should utilise the leadership and trauma experience of other speciality and ED Consultants if present. They will be present in advance of the patient arriving for all Enhanced and Code Red Trauma Teams. The TTL should:

- Provide expert management of the trauma patient during resuscitative phase
- Prepare the team prior to patients arrival
- Manage the patient in the resuscitation room
- Care for the patient during transport and CT
- Handover care clearly
- Remain Hands Off
- Communicate clearly to the team
- Decide which diagnostic and therapeutic interventions need to performed and in what order
- Ensure accurate documentation in the medical record
- Protect the safety of the trauma team.

2.2 Trauma Team Leader Training

All TTL must have completed and be up to date with TTL competencies. (Please refer to the Trauma Team Document)
2.3 Emergency Department Nurse Training

- All nurses who participate in trauma teams must have completed Level One trauma training.
- There must be a level two trained nurse present for all Enhanced Trauma Teams and Code Red Trauma Teams.
- Please refer to the National Trauma Nursing Group Emergency Department Documents here.

2.4 Trauma Team Standard Operating Procedure

The following document describes the roles and responsibilities of the trauma team, please click here to access the document.

2.5 Thoracotomy Capability

The trauma team leader will ensure there is thoracotomy availability in every enhanced and code red trauma team. This will be documented in the trauma booklet. Please also refer to the Paediatric Trauma Team Document here.
### 2.6. Pre-Arrival Check-list

The Trauma Team Leader will complete the pre-arrival checklist below.

**TRAUMA TEAM LEADER CHECKLIST**

**Pre Arrival**

<table>
<thead>
<tr>
<th>Confirm appropriate tiered response activated</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocate roles</td>
<td></td>
</tr>
<tr>
<td>Ensure PPE worn by team</td>
<td></td>
</tr>
<tr>
<td>Prepare trauma mattress (NOT IF PENETRATING)</td>
<td></td>
</tr>
<tr>
<td>Pre-alert CT</td>
<td></td>
</tr>
<tr>
<td>Brief team members</td>
<td></td>
</tr>
<tr>
<td>• Clarify ability/experience including thoracotomy capability</td>
<td></td>
</tr>
<tr>
<td>• Ensure team booked in with Scribe</td>
<td></td>
</tr>
<tr>
<td>• Confirm role and priorities on arrival of patient</td>
<td></td>
</tr>
<tr>
<td>• Plan for initial resuscitation/investigation</td>
<td></td>
</tr>
<tr>
<td>• Reinforce team behaviours</td>
<td></td>
</tr>
<tr>
<td>Pelvic binder on trolley</td>
<td></td>
</tr>
<tr>
<td>US ready (confirm individual competent to perform)</td>
<td></td>
</tr>
<tr>
<td>Digital Clock ready</td>
<td></td>
</tr>
<tr>
<td>Draw up 10mg Morphine</td>
<td></td>
</tr>
<tr>
<td><strong>Reception ready to book patient in (ALL CODE RED)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Preload CXR Cassette (ALL CODE RED)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Prime Belmont with RCC (ALL CODE RED)</strong></td>
<td></td>
</tr>
</tbody>
</table>

**On Arrival**

<table>
<thead>
<tr>
<th>ATMIST Handover</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer Patient as per SOP</td>
<td></td>
</tr>
<tr>
<td>Aim For CT and/or theatre within 30 minutes</td>
<td></td>
</tr>
<tr>
<td>TXA if not given prehospital</td>
<td></td>
</tr>
<tr>
<td>IV Cefuroxime 1.5g (&amp; metronidazole if significant contamination) for open fractures</td>
<td></td>
</tr>
<tr>
<td>Ensure SAS/EMRS/MEDIC 1 patient record form &amp; Pre alert form completed</td>
<td></td>
</tr>
</tbody>
</table>

**TTL NAME:**

Please place completed checklist in notes.

**STAND DOWN CODE RED** once appropriate. Return & preserve blood products as able.
2.7. Trauma Team Document

The scribe should complete the Trauma Team Document (Appendix 3)
3.0 Primary Survey Key Principles

3.1 Airway

1. Use drug assisted RSI to secure the airway
2. If RSI fails, use basic manoeuvres and adjuncts and / or supraglottic device to oxygenate until:
   either a surgical airway or
   assisted tracheal placement is performed

3.2 Breathing

1. Perform CXR and/or eFAST in all patients with haemodynamic instability or severe respiratory compromise.
2. Decompress the chest using an open thoracostomy followed by intercostals chest drain insertion.
3. Perform immediate CT in other patient with significant chest injury.
3.3 Circulation and Haemorrhage Control

3.3.1. Dressing and Tourniquets

1. Use simple dressings with direct pressure to control external haemorrhage.
2. In patients with major limb trauma use a tourniquet if direct pressure has failed to control haemorrhage.
3. It may be appropriate to use a tourniquet first line in some situations. A second tourniquet is sometimes required. Check the tourniquet after patient movement and consider replacing with a pneumatic tourniquet following resuscitation.

3.3.2. Tranexamic Acid (TXA)

1. Administer TXA in patients with major trauma and active or suspected bleeding (SBP <90 and/or HR>110).
2. Do not administer TXA if >3 hours after injury unless hyperfibrinolysis is demonstrated on ROTEM.

3.3.3. Access

1. Use peripheral intravenous access.
2. If peripheral IV access fails, consider intra-osseous access while central access is being achieved.

3.3.4. Volume Resuscitation

1. Restrict volume resuscitation in patients with active bleeding until haemorrhage control is achieved. Where time to definitive care is prolonged / delayed balance the risks of permissive hypotension against blood loss.
2. Haemorrhage control is the priority. Titrate volume to a central pulse.
3. For patients with haemorrhagic shock and a traumatic brain injury (TBI):
4. Restrict volume resuscitation if haemorrhagic shock predominates.
5. Use a less restrictive approach if TBI predominates.
6. DO NOT use crystalloids for patients with active bleeding.
7. Use a ratio of 1RCC:1FFP to replace volume remembering to include pre-hospital blood.
8. Start with a fixed-ratio protocol for blood components and change to lab/ROTEM/VBG guided once available.

3.4 Imaging

1. Limit imaging to CXR, Pelvis XR and FAST in patients not adequately responding to volume to direct early surgical intervention.
2. A negative FAST does not exclude intraperitoneal or retroperitoneal haemorrhage.
3. Use immediate CT in haemodynamically normal patients/volume responders.

3.5 Definitive Care

Involve specialty consultants (Orthopaedics, Vascular, IR and General Surgery) ensuring joint decision making regarding the following definitive care principles:

1. Consider damage control surgery in patients with instability who do not adequately respond to volume.
2. Use definitive surgery in haemodynamically normal patients.
3. Consider IR in patients with active arterial pelvic haemorrhage unless open surgery required for other injuries.
4. Consider IR in patients with solid organ arterial haemorrhage (spleen, liver or kidney).
5. Consider a joint IR/Surgical strategy for inaccessible regions

3.6 Disability

1. Use intravenous morphine 1st line (5mg aliquots, reduced in elderly)
2. Use intravenous ketamine second line (0.2-0.5 mg/kg)
3. Consider intranasal ketamine if IV access not established (0.7mg/kg)

Paediatrics

Please also refer to the Royal College of Radiologist’s Guidelines for guidance on Paediatric Trauma (click here)
3.7 Environment

Use fluid warming devices, warm blankets and a Bair Hugger in all major trauma patients where haemorrhage is suspected or proven.
4.0 Imaging

4.1 Access to CT

- Inform the Radiographer of all Enhanced and Code Red Trauma Team activations.
- The Radiographer will clear the CT in time for arrival of the patient.
- Whole Body CT (WBCT), CT Head, CT C-spine and CT thoracolumbar spine requests should contain the indication for scan matched against agreed guidelines.
- All other CT requests and requests which do not clearly meet imaging criteria should be discussed with the radiologist.

4.2 Transfer to CT

Transfer to CT should occur in a timely fashion and the patient should usually leave for CT within 20 minutes of arrival.

Arterial line insertion should rarely delay CT.

Please also refer to the Royal College of Radiologist’s Guidelines on imaging (click here)
4.3 CT Reporting Times

- The radiologist should provide a verbal ‘hot’ within 5 minutes of the scan to the nominated TTL for all Enhanced and Code Red Trauma Team CTs whilst the patient is in CT (usually whilst the patient is in CT)
- This also provides an opportunity to update the radiologist with any further clinical information.
- All CT scans for trauma should have a written report within 1 hour of the scan being performed
- The final report should be available within 24 hours for all patients.

4.4 MRI Scanning

There is access to MRI 24/7 at the MTC. The majority should be performed within 24 hours of request.

Indications in trauma

- Spinal injury with neurological deficit (Perform immediately if spinal cord injury)
- Suspicion of ligamentous injury to the cervical spine with normal CT
- CT has demonstrated narrowing of the spinal canal or an unstable bony injury
- Suspected Brachial plexus injuries
4.5 Activation of Interventional Radiology (IR)

Call the interventional Radiologist immediately if the patient has ALL of the following:

- CODE RED
- Pelvic fracture on X-RAY and Pelvic binder in place
- NEGATIVE FAST
- Immediate destination is C

IR for Haemorrhage control should be achieved within 60 minutes of arrival.

The IR Consultant should activate the team who should be ready within 30 minutes of activation.
5.0 CT Imaging

5.1 Principles

1. The Trauma Team Leader is in overall charge in acute care. The acute trauma setting is not the place for disagreements about the patient pathway. Individual cases and pathways should be reviewed regularly at departmental/multidisciplinary meetings.
2. WBCT Imaging for the major trauma patient should be protocol driven and consistent across the network.
3. CT requests must comply with Ionising Radiation (Medical Exposure) Regulations.

5.2 Time to CT

1. Plain films and FAST scans should not delay time to CT.
2. Major Trauma patients should have their CT started within 30 minutes of arrival.
3. When indicated a urinary catheter should be placed and clamped prior to WBCT but should not delay time to CT.
4. There should be an awareness of pregnancy status in females of childbearing age.

5.3 WBCT Protocol

- A split bolus protocol should be utilised for all WBCT scans.
- Vertex to toes scanogram followed by CT from vertex to mid-thigh.
- Clinical findings and the scanogram may direct CT to include the limbs.
- Do not reposition the patient.

5.4 Indications for WBCT

Please also refer to the Guidance on Requesting Whole Body CT in Trauma.

- The mechanism of injury or presentation suggests that there may be occult severe injuries that cannot be excluded by clinical examination or plain films.
  - FAST has demonstrated +ve free fluid.
  - Plain films suggest significant injury e.g. pneumothorax or pelvic fracture.

Please also refer to the Royal College of Radiologist’s Guidelines on CT Imaging (click here).
There is obvious severe injury on clinical assessment

- Post-operatively in severely injured patients who were taken straight to theatre.

### 5.5 Reporting of WBCT

- MTC only – a hot primary survey verbal report should be issues within 5 minutes (this is documented on [this form](#))
- A provisional typed report should be available to the TTL within 1 hour.
- A final report should be issued within 24 hours of the start of the scan.

### 5.6 Consultant Radiologist

All on call radiology consultants should have access to teleradiology from home.
5.7 Guidance on Requesting Whole Body CT In Trauma

Guidance on Requesting Whole Body CT In Trauma

2016 Criteria - Emergency Department, Royal Infirmary of Edinburgh

Whole body CT (WBCT) is indicated (or should be considered) when at least one criteria from 2 of the following categories has been met.

<table>
<thead>
<tr>
<th>Category One - Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
</tr>
<tr>
<td>i) Fatality in same vehicle.</td>
</tr>
<tr>
<td>ii) Ejection from vehicle.</td>
</tr>
<tr>
<td>iii) Entrapment / Prolonged extrication</td>
</tr>
<tr>
<td>iv) Pedestrian / Cyclist / Motorcyclist vs Vehicle.</td>
</tr>
<tr>
<td>FALL</td>
</tr>
<tr>
<td>i) &gt;2m/one flight of stairs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category Two - Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Visible injury to more than one body region.</td>
</tr>
<tr>
<td>ii) Chest injury with altered physiology</td>
</tr>
<tr>
<td>iii) Suspected pelvic fracture with hypotension.</td>
</tr>
<tr>
<td>iv) Spinal trauma with abnormal neurology</td>
</tr>
<tr>
<td>v) Significant abdominal injury e.g. external evidence / guarding / severe pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category Three - Physiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Systolic BP &lt;90mmHg (or &lt;100mmHg if &gt;55 years old.</td>
</tr>
<tr>
<td>ii) RR &lt;8 or &lt;30</td>
</tr>
<tr>
<td>iii) GCS &gt;13</td>
</tr>
<tr>
<td>iv) Age &gt;65</td>
</tr>
<tr>
<td>v) Anticoagulated.</td>
</tr>
</tbody>
</table>

REMEMBER TARGET TIME TO CT <30 MINUTES

*WBCT can be ordered without fulfilling above criteria at consultant discretion or stating clearly on request your indications for WBCT.

** Please order under WBCT request on TRAK with indications for WBCT explicitly documented.
6.0 Interventional Radiology

6.1 Background

The role of IR is to stop haemorrhage as quickly as possible with minimal interference to the patient’s physiology. It is as much a form of damage control as surgical packing or pressing on a bleeding artery.

6.2 Referral and Activation Times

Where active extravasation is seen, the on-call interventional radiologist should be informed immediately along with the TTL.

IR teams should be in place within 60 minutes of the patient’s admission or 30 minutes of referral. Early warning/activation must be considered in select patients.

6.3 Indications for Intervention

<table>
<thead>
<tr>
<th>Organ</th>
<th>Exclusions (surgery indicated)</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney – active arterial bleeding</td>
<td>Multiple other bleeding sites or other indication for surgery</td>
<td>Embolisation or stent graft</td>
</tr>
<tr>
<td>Spleen – active arterial bleeding or pseudoaneurysm</td>
<td>Multiple other bleeding sites or other indication for surgery</td>
<td>Focal or proximal embolisation</td>
</tr>
<tr>
<td>Liver – active arterial bleeding or pseudoaneurysm or failed surgery</td>
<td>Multiple other bleeding sites or other indication for surgery</td>
<td>Focal or non selective embolisation if portal vein patent</td>
</tr>
<tr>
<td>Pelvis - active arterial bleeding, pseudoaneurysm or cut-off</td>
<td>Multiple other bleeding sites or other indication for surgery</td>
<td>Focal embolisation</td>
</tr>
<tr>
<td>Thoracic Aorta distal to left subclavian artery</td>
<td>Ascending or arch involving great vessels</td>
<td>Stent Graft</td>
</tr>
</tbody>
</table>
7.0 Emergency Theatre and Surgery

The Theatre coordinator is paged (2118) following a code red trauma team alert. They are tasked with identifying an available theatre and team to accommodate an expected patient until stood down by anaesthetist or ODP.

All code red patients will ideally, but not always go this theatre. This may include Orthopaedic & Cardiothoracic patients.

- Patients should be taken directly to the operating theatre rather than the anaesthetic room.
- Surgery for haemorrhage control should not be delayed for arterial line insertion and other non-therapeutic monitoring/interventions.
- In un-intubated patients surgery should commence immediately after RSI.
- Patients who require haemorrhage control should not wait in the Emergency Department for Consultants and other staff to come in. They should be immediately transported to the nominated theatre immediately.
- Ensure that blood banks are aware of all movements.
- A pre surgery safety pause must be performed once in theatre.
7.1 **Damage Control Resuscitation (DCR)**

DCR should be employed in all patients with active haemorrhage who have ANY of the following:

- Acidaemia
- Hypothermia
- Coagulopathy

There are five principles of DCR:

- Damage Control Surgery
- Corrective coagulopathy
- Avoid hypothermia
- Limit volume (using only blood)
- Time limited permissive hypotension.

7.1.1. **Anaesthesia for Damage Control Resuscitation**

7.1.1.2. **Key Principles**

- Primary goal is rapid definitive haemorrhage management
- Excessive blood pressure causes bleeding
  - Target MAP 50-60
  - Consider MAP 60 – 70 in elderly or isolated head injury
- Use volume to maintain blood pressure
- Correct coagulopathy early.
- **DO NOT GIVE CRYSTALLOID PRIOR TO DEFINITIVE HAEMORRHAGE CONTROL**
- **DO NOT GIVE VASOPRESSORS PRIOR TO DEFINITIVE HAEMORRHAGE CONTROL**
- Manage hyperkalaemia and hypocalcaemia
- Maintain normothermia
- Minimise patient movement to prevent clot disruption.
- Communicate physiology regularly with surgeons and team.

7.1.1.2. **Prepare**

**Equipment**

- Airway Trolley
- Rapid Infuser
  - May require a dedicated practitioner.
- Cell salvage
- Large Volume Central and Peripheral Access
- Underbody Warmer
- Warm Theatre (Ambient Temperature 25°C)
7.1.1.3. Drugs to Draw Up

<table>
<thead>
<tr>
<th>DRUG</th>
<th>DOSE</th>
<th>CONC.</th>
<th>SYRINGE</th>
<th>INDUCTION DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine</td>
<td>200mg</td>
<td>10mg/ml</td>
<td>20ml</td>
<td>0.5 – 2 mg/kg</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>100mg</td>
<td>10mg/ml</td>
<td>10ml</td>
<td>1.2mg/kg</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>500µg</td>
<td>50µg/ml</td>
<td>10ml</td>
<td>1-3µg/kg</td>
</tr>
<tr>
<td>CaCl 10% (x5)</td>
<td>(13.6mEq)</td>
<td>100mg/ml</td>
<td>10ml (x5)</td>
<td></td>
</tr>
<tr>
<td>Noradrenaline</td>
<td>4mg</td>
<td>0.08mg/ml</td>
<td>50ml</td>
<td></td>
</tr>
<tr>
<td>Co-Amoxiclav</td>
<td>1.2g</td>
<td>60mg/ml</td>
<td>20ml</td>
<td>1.2g</td>
</tr>
<tr>
<td>Tranexamic Acid</td>
<td>2g</td>
<td>100mg/ml</td>
<td>10ml</td>
<td>2g</td>
</tr>
<tr>
<td>Glucose/Insulin</td>
<td>50iu insulin in 50ml 50% glucose</td>
<td></td>
<td>2-5 ml/hr</td>
<td></td>
</tr>
</tbody>
</table>

Monitoring

- Standard AAGBI Monitoring
- Invasive Blood Pressure Monitoring only if it does not delay time to haemorrhage control

Blood Management

- Declare Code Red/Major Haemorrhage as per hospital protocol
- Ensure blood is available and checked prior to induction.

7.1.1.4. Induction and Maintenance of Anaesthesia

- Pre-oxygenate
  - Consider OPA + 2 x NPA to optimise
- Manual In-Line Cervical Spine
- Consider Reverse Trendelenburg position
- Anticipate Hypotension on Induction
  - Ensure Rapid Infuser connected, functional and loaded with blood and products.
- Reduce drug doses and volatile concentration
  - (aim 0.3-0.5 MAC until haemodynamically adequate)
- Antibiotics
- Aim to deliver 300-500µg fentanyl slowly over first half an hour.
7.1.1.5. Blood Pressure and Coagulopathy Management

Blood Pressure

- Cycle BP at one minute intervals
- Target: MAP 50-60 mmHg (60-70 in Elderly/Isolated Head Injury)
- Use volume and Calcium Chloride (centrally) to maintain MAP

Coagulation

- Target an empiric Red Blood Cell:Plasma:Platelet ratio of 1:1:1
- Tranexamic Acid 1g (may have been given by pre-hospital team)

Maintain Ionised Calcium > 1.0mmol/l

7.1.1.5. Post Definitive Haemorrhage Control

- Aim to restore normal physiology
- Use base deficit and lactate to guide volume resuscitation
- ROTEM may be used to deliver targeted coagulopathy management
- Consider Noradrenaline, if required, only once circulating volume is restored and definitive haemorrhage control achieved.

7.2 Access to Specialists

Consultants from all specialties should be available to attend a Major Trauma patient or give an opinion within 30 minutes of a referral when deemed appropriate. Examples are given below:

- Anaesthesia – All emergency major trauma cases
- General Surgery – all emergency laparotomies
- Orthopaedics – Pelvic Packing, compromised limb.
- Vascular – compromised limb.
- Cardiothoracics – All emergency cardiothoracic surgery
- IR – Haemodynamically unstable pelvic fractures
- Neurosurgery – All emergency craniotomies
- Urology – Haemodynamically unstable high grade renal injuries
- Plastics – open fractures/compromised limb & burns
- ENT – Penetrating Neck injuries
- Maxillofacial – torrential maxillofacial haemorrhage
- Paediatrics – Patients <16 years old.
7.3 Fixation of Pelvic Ring Injuries

Pelvic ring fractures should be fixed within 24 hours of injury in physiologically stable patients.
8.0 Tranexamic Acid

8.1 Indications

- Significant haemorrhage and SBP <90mmHg or HR >110bpm
- At risk of significant haemorrhage

8.2 Relative Contraindication

- History of thromboembolic disease
- >3 hours from injury unless hyperfibrinolysis is demonstrated on ROTEM.

Administer 1g bolus over 10 minutes followed by 1g infusion over 8 hours.

The infusion can be omitted/stopped in the following patients:

- No evidence of haemorrhage or
- Haemorrhage controlled with a normal ROTEM.

Tranexamic Acid (TXA) can be administered to Paediatrics within 3 hours of injury if the child requires RCC transfusion or is considered to be at major risk or bleeding especially if managed conservatively.

Dose for Paediatrics is 15mg/kg up to a maximum of 1g.

Please also refer to TXA Guidelines for Paediatrics here.

8.3 Managing patients who refuse blood (including Jehovah’s Witnesses)

Resources for managing patients who refuse blood (including Jehovah’s Witnesses) is available from NHS Lothian Policy Online.
9.0 Silver Trauma

9.1 Principles

- Elderly patients should receive the same trauma care following admission to that given to younger patients.
- Advanced age is not an absolute predictor of poor outcomes following trauma and should not be used as the sole criterion for denying or limiting care.
- An initial aggressive approach should be pursued for management of the elderly patient unless in the judgement of an experienced consultant it seems the injury burden is severe and the patient appears moribund.

9.2 Trauma Team Activations

- Elderly patients can experience significant injury in spite of a trivial mechanism of injury.
- The physiologic response is different to younger patients.
- Under triage by ambulance staff and ED staff double the risk of death.
- Consider a trauma team activation for all patients aged 65 or more with pre-existing medical conditions.

9.3 Initial Evaluation

- Determine medications early in particular Anticoagulants and Antiplatelets and antihypertensives.
- Consider medical conditions which may have contributed:
  - ACS
  - Hypovolemia / dehydration
  - UTI
  - Pneumonia
  - Acute Kidney Injury
  - Cerebrovascular event
  - Syncope
- Hypo perfusion is under-appreciated in the elderly. Utilise lactate and BE early.

9.4 Imaging
CT should be used liberally in elderly trauma as occult injuries are common and radiation exposure has minimal risk.
10.0 Anticoagulant / Antiplatelet Reversal

- An INR and an APTT of ≤1 excludes the presence of significant levels of novel anticoagulants in most patients.
- Patients on warfarin should be reversed unless the bleed is extremely small and the procoagulation risk is high.
- Reversal should occur within one hour of decision to reverse.

Advanced age is not an absolute predictor of poor outcomes following trauma and should not be used as the sole criterion for denying or limiting care.
11.0 The Surgical Airway

11.1 Equipment Checklist (Mandatory)

- Scalpel
- Tracheal hook
- Bougie (155mm for Adult)
- Size 6.0 Tracheostomy tube (Portex; obturator removed)
- Tracheostomy ties
- Size 6.0 Endotracheal tube
- 10ml Syringe

11.2 Procedures

1. Ensure Anaesthetics have been alerted and are attending.
2. If there is time [predicted difficult airway], prepare skin with chlorhexidine, don sterile gloves, mark cricothyroid membrane and skin marker & consider 2% Lignocaine / Adrenaline 5ml sc local infiltration.
3. Identify cricothyroid membrane; stabilize with non-dominant hand.
5. With non-dominant hand, insert tracheal hook into incision following line of the scalpel blade; rotate through 90 degrees. Apply caudal (inferior) traction to cricoid cartilage.
6. Remove scalpel and insert bougie into trachea.
   Insert 6.0mm tracheostomy tube over bougie (lubricated if necessary) & into trachea.
7. Remove tracheal hook whilst ensuring tracheostomy tube remains fully inserted.
8. Remove bougie whilst maintaining tracheostomy tube position.
9. Inflate cuff & verify ventilation and tube position as per standard anaesthesia post-intubation checks.
   Secure tracheostomy tube with ties.

Paediatrics
Refer to Paediatric ENT if Surgical Airway is a potential
11.3 Modifications

- If the cricothyroid membrane cannot be identified easily using surface landmarks, first use a midline longitudinal incision to identify the underlying structures then proceed with the horizontal incision.
- If there are significant face and neck burns or oedema (e.g. risk of further swelling), a size 6.0 ETT may be used instead of a tracheostomy tube.
- If the surgical cricothyroidotomy fails, consider reinserting iGel / LMA for transfer/until further expert assistance arrives.
12.0 Emergency Anaesthesia for Suspected Major Trauma Patients in ED

12.1 Background

Emergency anaesthesia usually occurs as part of the ongoing resuscitation of major trauma patients. The overriding priority in all trauma patients is to provide anaesthetic that minimises haemodynamic instability.

12.2. Considerations for the Major Trauma Patient

12.2.1. Prior to Anaesthesia the anaesthetist should:

1. Arrive before the patient and clarify role
2. Prevent hypothermia – forced air patient warming device e.g. Bair Hugger and Warmed IV line.
3. Utilise damage control resuscitation and code red protocols when indicated (see separate guideline)
4. Check that vascular access is working.
5. Perform the pre intubation checklist (please click here)

12.2.2. Induction of Anaesthesia

- RSI is the safest and most effective method to secure the airway.
- Induction in the exsanguinating patient can be fatal. Provide ongoing volume resuscitation during RSI in these patients
- Do not delay induction for arterial or central access in patients in extremis.
- Standard induction doses should be reduced and titrated to balance the induction of anaesthesia with haemodynamic changes
- Ketamine is the first line agent for RSI in Major trauma patients
- The use of vasopressors in major trauma may be harmful
- Minimise manipulation of the cervical spine during laryngoscopy using manual in line stabilisation. Direct laryngoscopy rarely causes or worsens cervical spine injury.
- Place an orogastric/nasogastric tube as soon as possible

Please refer to Induction Protocol in section 12.3.
### 12.2.3. Maintenance of Anaesthesia in the ED

- Provide continuous intravenous anaesthesia with propofol
- Provide opioid analgesia in boluses.
- Tolerate a MAP >55mmHg in the anaesthetised bleeding patient to facilitate end organ perfusion without exacerbating bleeding.
- Patients with a significant brain injury should maintain a SBP >90mmHg unless haemorrhage is the primary pathology
- Administer antibiotics early if indicated.
- Employ lung protective ventilation using Vt = 6ml/kg IBW
- Ensure all patient movements are communicated to blood bank

### 12.2.4. Standards

- Patients who require an RSI should have this performed within 45 minutes of injury.
- Trauma patients in the OR should maintain a temp >36 degrees Celsius.
- Induction of anaesthesia should not cause >20% drop in initial blood pressure
- Antibiotics, when indicated, should be administered within 30 minutes of incision.

Patients who require RSI should have this performed within 45 minutes of injury

<table>
<thead>
<tr>
<th>Airway Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Anticipate a difficult airway</td>
</tr>
<tr>
<td>- Assign roles</td>
</tr>
<tr>
<td>- Pre-Oxygenate</td>
</tr>
<tr>
<td>- Ketamine (0.5mg/kg IV) if combative/uncooperative to facilitate pre-oxygenation</td>
</tr>
<tr>
<td>- Manual in line stabilisation (MILS)</td>
</tr>
</tbody>
</table>
12.3. Trauma RSI Induction Protocol

**Trauma RSI**

**Aim**
- Provide strategy for RSI in major trauma patients
- Improve safety for hypovolaemic trauma patients

**Pre-RSI Phase**
- Standard pre induction preparation/checks
- Prepare ketamine 200mg/20mls, Rocuronium 100mg/10mls, Fentanyl 500mcg/10mls.
- Determine degree/cause of shock + treat

**Euvolaemia (3,2,1)**
- Fentanyl - 3 mcg/kg
- Ketamine - 2 mg/kg
- Rocuronium - 1 mg/kg

**Hypovolaemia (1,1,1)**
- Fentanyl - 1 mcg/kg
- Ketamine - 1 mg/kg
- Rocuronium - 1 mg/kg

**Severe hypovolaemia (1,1)**
- Ketamine - 1 mg/kg
- Rocuronium - 1 mg/kg

**Peri-arrest (1)**
- Rocuronium - 1 mg/kg

---

**Notes**
This document provides a guide to assist with managing induction of anaesthesia in patients with major injury and does not attempt to cover all aspects of trauma patient Mx.

3,2,1
- This strategy is aimed at the trauma patient requiring anaesthesia without coexisting hypovolaemia e.g. combative patient with or without head injury, burns patient etc.
- Tachycardia/hypertension are not usually an issue post induction if appropriate dose of opiate is used.

**Post Induction**
- Hypotension post induction should be managed primarily with volume resuscitation plus exclusion of obstructive cause of shock e.g. tension PTX, tamponade.
- Ensure adequate anaesthesia post induction and resuscitation/restoration of systemic blood pressure.
12.4. RIE Emergency Department RSI Checklist

Please also refer to RIE Advanced Airway Management Guidelines

Emergency Department RSI Checklist - PART 1 equipment check and planning for difficulty

<table>
<thead>
<tr>
<th>Intubator and assistant check and response</th>
<th>Prepare for difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check and response</strong></td>
<td><strong>Assess airway</strong></td>
</tr>
<tr>
<td>- Suction</td>
<td>Difficulty predicted?</td>
</tr>
<tr>
<td>- Oxygen</td>
<td>If yes are any of the following required?</td>
</tr>
<tr>
<td>- BV Mask / Mapleson C</td>
<td>- More help</td>
</tr>
<tr>
<td>- NPA / OPA</td>
<td>- Difficult airway trolley</td>
</tr>
<tr>
<td>- ETT x 2</td>
<td>- Double prep (in anticipation of FONA)</td>
</tr>
<tr>
<td>- 10 ml Syringe</td>
<td>- Awake intubation</td>
</tr>
<tr>
<td>- Laryngoscopes (McIntosh and McGrath)</td>
<td></td>
</tr>
<tr>
<td>- Bougie / lubricant</td>
<td></td>
</tr>
<tr>
<td>- Tape / Tie</td>
<td></td>
</tr>
<tr>
<td>- Catheter mount / CO2</td>
<td></td>
</tr>
<tr>
<td>- iGEL</td>
<td></td>
</tr>
<tr>
<td>- FONA kit</td>
<td></td>
</tr>
<tr>
<td>- Stethoscope</td>
<td></td>
</tr>
<tr>
<td>- Ventilator and circuit</td>
<td></td>
</tr>
<tr>
<td>- Infusion drugs and pumps</td>
<td></td>
</tr>
<tr>
<td>- O2 cylinder</td>
<td></td>
</tr>
<tr>
<td>- Additional equipment required?</td>
<td></td>
</tr>
</tbody>
</table>

**Dentures**
- Does the patient have dentures?
  - If so please place these in a labelled denture pot and document their location in the notes.
## Emergency Department RSI Checklist - PART 2 whole team pre-RSI checklist

### Whole team pre-RSI checklist (to be conducted once equipment check and planning for difficulty are complete)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Equipment and drugs</th>
<th>Define roles</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position optimised / ramped</td>
<td>Equipment ready</td>
<td>Team lead</td>
<td>Not anticipated – as per DAS</td>
</tr>
<tr>
<td>Airway optimised</td>
<td>PPE correctly donned</td>
<td>Monitoring</td>
<td>Plan A (max 3+1 attempt)</td>
</tr>
<tr>
<td>Pre-oxygenation optimised / nasal O2</td>
<td>Any known drug allergies?</td>
<td>Intubator 1 (audit form)</td>
<td>- Oral intubation</td>
</tr>
<tr>
<td>Bleeding controlled</td>
<td>Drugs and doses planned</td>
<td>Intubator 2</td>
<td>Plan B (max 3 attempt)</td>
</tr>
<tr>
<td>Reliable IV/IO + Belmont if indicated</td>
<td>- Opioid</td>
<td>Assistant</td>
<td>- iGEL</td>
</tr>
<tr>
<td>CVS optimised</td>
<td>- Induction</td>
<td></td>
<td>Plan C (2 person)</td>
</tr>
<tr>
<td>Monitoring</td>
<td>- Paralysis</td>
<td>Drugs</td>
<td>- Face mask</td>
</tr>
<tr>
<td>- ETCO₂</td>
<td>- Inotropes / vasopressors</td>
<td>Cricoid (if indicated)</td>
<td>Plan D</td>
</tr>
<tr>
<td>- ECG</td>
<td>- On-going sedation</td>
<td>MILS (if indicated)</td>
<td>- FONA</td>
</tr>
<tr>
<td>- SpO2</td>
<td></td>
<td>FONA</td>
<td>Anticipated - Outline:</td>
</tr>
<tr>
<td>- BP cycling (&lt;2 min)</td>
<td></td>
<td></td>
<td>Plan A</td>
</tr>
<tr>
<td>Anticipated difficulties</td>
<td></td>
<td></td>
<td>Plan B</td>
</tr>
<tr>
<td>- Mitigation / plan</td>
<td></td>
<td></td>
<td>Plan C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Plan D</td>
</tr>
</tbody>
</table>
12.5. Tracheal Intubation in Critically Ill Adults Algorithm

Tracheal intubation of critically ill adults

Pre-oxygenate and Checklist
Position: head up if possible
Assess airway and identify cricothyroid membrane
Waveform capnograph
Pre-oxygenate: facemask / CPAP / NIV / nasal O₂
Optimise cardiovascular system
Share plan for failure

Plan A: Tracheal Intubation
Laryngoscopy
Maximum 3 attempts
Maintain oxygenation
  • Continuous nasal oxygenation
  • Facemask ventilation between attempts
Neuromuscular block
Video or direct laryngoscopy +/- bougie or stylet
External laryngeal manipulation
Remove cricoid

Succeed
Confirm with capnography

First failure
Call HELP
  • Video laryngoscopy
  • Get Front Of Neck Airway (FONA) set

Fail
Declare “failed intubation”

Plan B/C: Rescue Oxygenation
2nd generation supraglottic airway
Facemask
  • 2 person
  • adjuncts

Maximum 3 attempts each
Change device / size / operator
Open Front Of Neck Airway set

Succeed

Stop, think, communicate
Options
  • Wake patient if planned
  • Wait for expert
  • Intubate via supraglottic airway x1
  • Front Of Neck Airway

Fail
Declare “can’t intubate, can’t oxygenate”

Plan D: Front Of Neck Airway: FONA
Use FONA set
Scalpel cricothyroidotomy
Extend neck
Neuromuscular blockade
Continue rescue oxygenation

Trained expert only
Other FONA techniques
  • Non-scalpel cricothyroidotomy
  • Percutaneous tracheostomy
  • Surgical tracheostomy
12.6. Can’t Intubate, Can’t Oxygenate (CICO) In Critically Ill Adults

Can't Intubate, Can't Oxygenate (CICO) in critically ill adults

CALL FOR HELP

Declare "Can’t Intubate, Can’t Oxygenate"

Plan D: Front Of Neck Airway: FONA

- Extend neck
- Ensure neuromuscular blockade
- Continue rescue oxygenation
- Exclude oxygen failure and blocked circuit

Scalpel cricothyroidotomy

Equipment:
1. Scalpel (wide blade e.g. number 10 or 20)
2. Bougie (≤ 14 French gauge)
3. Tube (cuffed 5.0-6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane
- Transverse stab incision through cricothyroid membrane
- Turn blade through 90° (sharp edge towards the feet)
- Slide Coudé tip of bougie along blade into trachea
- Railroad lubricated cuffed tube into trachea
- Inflate cuff, ventilate and confirm position with capnography
- Secure tube

Impalpable cricothyroid membrane
- Make a large midline vertical incision
- Blunt dissection with fingers to separate tissues
- Identify and stabilise the larynx
- Proceed with technique for palpable cricothyroid membrane as above

Post-FONA care and follow up
- Tracheal suction
- Recruitment manoeuvre (if haemodynamically stable)
- Chest X-ray
- Monitor for complications
- Surgical review of FONA site
- Agree airway plan with senior clinicians
- Document and complete airway alert

Trained expert only
- Other FONA techniques
  - Non-scalpel cricothyroidotomy
  - Percutaneous tracheostomy
  - Surgical tracheostomy
12.7. DAS / APA Algorithm for failed intubation in Paediatrics

**Unanticipated difficult tracheal intubation – during routine induction of anaesthesia in a child aged 1 to 8 years**

**Difficult direct laryngoscopy** → **Give 100% oxygen and maintain anaesthesia** → **Call for help**

**Step A Initial tracheal intubation plan when mask ventilation is satisfactory**
- Direct laryngoscopy – not > 4 attempts
  - Check
    - Neck flexion and head extension
    - Laryngoscopy technique
    - External laryngeal manipulation – remove or adjust
    - Vocal cords open and immobile (adequate paralysis)
  - If poor view – consider bougie, straight blade laryngoscope* and/or smaller ETT

**Failed intubation with good oxygenation**

**Step B Secondary tracheal intubation plan**
- Insert SAD (e.g. LMA™) – not > 3 attempts
  - Oxygenate and ventilate
  - Consider increasing size of SAD (e.g. LMA™) once if ventilation inadequate

**Failed oxygenation e.g. SpO₂ < 90% with FiO₂ 1.0**
- Convert to face mask
- Oxygenate and ventilate
- Ventilate using two person bag mask technique, CPAP and orotracheal/upper airway
- Manage gastric distension with ONG tube
- Reverse non-depolarising relaxant

**Following intubation attempts, consider**
- Trauma to the airway
- Extubation in a controlled setting

*SAD = supraglottic airway device*
13. Blunt Chest Injuries (Blunt Aortic, Blunt Cardiac, Chest Wall)

- Perform an ECG in all patients with chest trauma
- Perform a troponin in all patients with sternal fracture/potential myocardial contusion.

13.1. Blunt Aortic Injury

<table>
<thead>
<tr>
<th>Types</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I</td>
<td>Intimal tear</td>
<td>Conservative management</td>
</tr>
<tr>
<td>Grade II</td>
<td>Intramural haematoma</td>
<td>Repair / conservative</td>
</tr>
<tr>
<td>Grade III</td>
<td>Pseudoaneurysm</td>
<td>Repair</td>
</tr>
<tr>
<td>Grade IV</td>
<td>Rupture</td>
<td>Repair</td>
</tr>
</tbody>
</table>

13.1.1. Initial Management

- RSI is the safest and most effective method to secure the airway.
- Induction in the exsanguinating patient can be fatal. Provide ongoing volume resuscitation during RSI in these patients
- Do not delay induction for arterial or central access in patients in extremis.

CT is diagnostic modality of choice

- Resuscitate and treat immediately life threatening injuries before Aortic repair
- Control Blood Pressure (SBP <120mmHg) with intravenous anti-hypertensive (whilst awaiting repair or under observation
- CT is diagnostic modality of choice
- Resuscitate & treat immediately life threatening injuries before Aortic repair
- Control Blood Pressure (SBP<120mmHg) with intravenous anti-hypertensives (whilst awaiting repair or under observation)
13.1.2. Timing

- Repair early (<24hrs) in the following situations
- absence of other serious non aortic injuries requiring intervention
  - Grade III/IV injuries
  - Pseudocoarctation
  - High risk of rupture (based upon imaging and clinical findings)
- Delay repair until life and limb threatening injuries have been treated
  though aim to repair immediately thereafter
- TEVAR is treatment of choice unless contra-indicated or poor anatomy

13.1.3. Special Considerations in TEVAR for Trauma

- Use systemic heparin at a lower dose than elective TEVAR in patients with
  brain injury or solid organ injury at risk of bleeding
- Heparin has and can be safely omitted dependent on risk/benefit
- Prophylactic spinal drainage is not indicated
- Consider a spinal drain only if symptoms of spinal cord ischemia develop

13.2. Blunt Cardiac Injury

- Admit all patients with chest wall trauma new ECG abnormalities.
- Admit all patients with a raised troponin and perform serial troponins.
- Perform Echocardiography if haemodynamic instability or persistent new arrhythmia.
- Cardiac CT/MRI may differentiate between acute MI and Blunt cardiac injury.

13.3. Chest Wall

13.3.1. Sternal Fractures

Indications for admission:

- Evidence of blunt cardiac injury (as above)
- inadequate pain control
- Severely displaced (which rarely may be considered for fixation)

13.3.2. Rib Fractures

Clear pathways which encompass early identification, imaging, multimodal
analgesia including paravertebral or epidural analgesia combined with
surgical fixation in appropriate groups have been shown to reduce morbidity
and length of stay. The following guideline should be used when the patient
arrives in the ED:
13.3.3. Co-existent Pulmonary Contusions

Once adequately resuscitated, unnecessary fluid administration should be meticulously avoided.

13.4. Chest Trauma Analgesia Pathway

Please refer to 13.5 Algorithm for Chest Trauma Analgesia Pathway.

Paediatric Analgesia Doses

- Paracetamol - oral - 15mg/kg up to max 1g
- Ibuprofen - oral - 5-10mg/kg to a max of 400mg
- Morphine - IV - 0.05 - 0.1mg/kg
- Ketamine - IV - 0.2 - 0.5mg/kg (with full monitoring)
13.5. Chest Trauma Analgesia Pathway

**Chest Trauma Analgesia Pathway**

**Rib Fractures +/- other injuries**

**Step 1**
- Regular Paracetamol (PO/IV)
- +/- NSAID (if no contraindications)
- Oral Morphine or Oxycodone IR as required
- Antiemetic PRN

**Elderly or Frail**
- Early referral to Anaesthesia (bleep 2200) for consideration of urgent regional analgesia (target < 6 hrs)
- Avoid polypharmacy and Opioids where possible

**Step 2**
- Consider titrating IV morphine to gain analgesia
- Analgesia as per step 1 plus:
  - Oral Morphine MR and IR PRN or
  - Oral Oxycodone MR and IR PRN
- If no oral route available - PCA
- Consider Gabapentin, clonidine, other adjuvant agents
- Prescribe antiemetic and laxatives
- Refer pain team (bleep 5247 day 2140 night)

**Flail segment, 2-3 rib fractures**
- Uncontrolled pain not responding to conventional analgesia
- Early referral to Anaesthesia (bleep 2200) for consideration of urgent regional analgesia (target < 6 hrs)
- Consider referral for rib fracture fixation

**Step 3**
- IV PCA opioid +/- (antiemetic and laxatives)
- Urgent Regional Analgesia
- Refer CEPPOD Anaesthetist (bleep 2200)
- See Chest Wall Regional Flow Chart
- Refer pain team (bleep 5247 day 2140 night)
- Patient requires admission to HDU/Major Trauma Ward
- Consider:
  - S/C Ketamine infusion (NHS Lothian protocol)
PIC Score

1 2 3 4 5 6 7 8 9 10

<table>
<thead>
<tr>
<th>Pain</th>
<th>Inspiration</th>
<th>Cough</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - Controlled</td>
<td>3 - Strong</td>
<td>1 - Absent</td>
</tr>
<tr>
<td>(Pain intensity scale 0-4)</td>
<td>3 - Goal to alert volume</td>
<td>1 - Unable to perform incentive spirometry</td>
</tr>
<tr>
<td>2 - Moderate</td>
<td>2 - Weak</td>
<td></td>
</tr>
<tr>
<td>(Pain intensity scale 5-7)</td>
<td>2 - Below alert volume</td>
<td></td>
</tr>
<tr>
<td>1 - Severe</td>
<td>1 - Absent</td>
<td></td>
</tr>
<tr>
<td>(Pain intensity scale 8-10)</td>
<td>1 - Unable to perform incentive spirometry</td>
<td></td>
</tr>
</tbody>
</table>

Inspiratory Spirometry -

Goal - 80% of expected inspiratory capacity
Alert - 15 mL/kg or a maximum of 1500 mL

- Score 3 - 10. Goal is 10
- Calculate goal inspiratory capacity
- Calculate inspiratory alert volume
- Explain aims of PIC score to patient
- Display PIC score in a visible location
- Record PIC score in EPR
- Check PIC Score hourly - Level 3 area
- Score 7 or less – Intervene
Chest Wall Regional Analgesia
Regional Technique Decision-Making Flowchart

START HERE

Rib fractures requiring regional analgesia

Bilateral fractures

Unilateral fractures

Consider bilateral SAP as interim measure**

Access to patient's back?

Yes

Thoracic epidural or Bilateral ESP/PV if contraindicated

SAP or ESP or PV

Consider rib fixation if appropriate.

<4 anterior/lateral fractures, above T9, no flail

Access to patient's back?

Yes

ESP or PV

Consider thoracic epidural in severe unilateral injuries*

Notes
Usually multiple regional analgesia options exist. The choice of technique will depend on:

- Anaesthetist's skillset
- Ability to position patient
- Ability to obtain ultrasound images (e.g. presence of surgical emphysema)
- Presence of vertebral fractures
- Presence of contraindications including disordered coagulation (see below)

Patients with disordered coagulation (coagulopathy, anticoagulants, antiplatelet agents)

- Thoracic epidural: Consult local & national guidelines.
- PV: Risk vs benefit decision. Bleeding into the PV space or chest is a serious complication.
- ESP/PV: Limited evidence. Likely to be safer than epidural & paravertebral given location.

* The following features, particularly in combination, indicate a severe chest wall injury. With increasing severity of injury, consider inserting a thoracic epidural if no contraindications:

- Flail segment
- Displaced rib fractures
- >5 rib fractures
- Underlying lung injury
- Poor baseline lung function

** Access to the patient's back can be prevented by spinal precautions or difficulty positioning due to severe pain despite IV analgesia. In this situation consider performing a single-shot unilateral/bilateral SAP block. SAP block may be of limited benefit with posterior/lower/more severe injuries, but may still provide some analgesia. Once access to the patient's back is possible (i.e. spine cleared or pain improved) aim to insert a more appropriate catheter (i.e. ESP, PV or epidural). Ensure safe local anaesthetic dosing if inserting epidural / PV / ESP catheter within 4 hours of single shot SAP block.

SAP = Serratus Anterior Plane
ESP = Erector Spinae Plane
PV = Paravertebral

Ensure pain team referral made.

See NHS Lothian Adult Chest Wall Trauma protocol.

Consider referral for rib fixation if appropriate.
13.6. Adult (16 yrs+) Chest Wall Trauma Management Guideline

Assess and identify all potential injuries to assist in decision to admit - a CXR has poor sensitivity in >65yrs/frail and CT is the modality of choice. Patients requiring admission should have a CT Chest with contrast (3D surface rendered images within 24hours if rib fractures identified). Calculate the Battles Chest Trauma Score\(^1\) - consider d/c for patients with a score of ≤10, a strong cough, able to deep breathe with pain controlled.

<table>
<thead>
<tr>
<th>Age</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 – 50</td>
<td>4</td>
</tr>
<tr>
<td>51 – 60</td>
<td>5</td>
</tr>
<tr>
<td>61 – 70</td>
<td>6</td>
</tr>
<tr>
<td>71 – 80</td>
<td>7</td>
</tr>
<tr>
<td>81 – 90</td>
<td>8</td>
</tr>
<tr>
<td>91 – 100</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SpO(_2) on Air</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 – 94</td>
<td>2</td>
</tr>
<tr>
<td>85 – 89</td>
<td>4</td>
</tr>
<tr>
<td>80 – 84</td>
<td>6</td>
</tr>
<tr>
<td>75 – 79</td>
<td>8</td>
</tr>
<tr>
<td>70 – 74</td>
<td>10</td>
</tr>
<tr>
<td>65 – 69</td>
<td>12</td>
</tr>
</tbody>
</table>

**A:** Consider critical care referral in patients with the following features (Thoracics if isolated, General if polytrauma)

1. Clinical failure
2. Radiological failure
3. Requiring regional anaesthesia or step 3 of the analgesic ladder
4. CT evidence of lung injury
5. Battles Chest score ≥ 20

**B:** Patients in group A who have been reviewed by Cardithoracs & Critical Care can be admitted to the MTW level 1 area under cardiac thoracs. For all other patients follow the chest wall trauma admission pathway.

Management principles for all patients

1. Follow chest injury analgesia pathway
2. Refer to physiotherapy on admission - including early Incentive spirometry
3. Mobilise / sit out of bed early (on day of admission if possible)
4. Refer to pain team on admission via TRAK shortcode, patientef
5. Avoid unnecessary fluid administration after resuscitation
6. A trial of High Flow Nasal Oxygen (HFNO) or mask CPAP may be considered

MT - Refer rib fixation - contact ortho and thoracic on-call

1. Clinical or radiological flail chest
2. Multiple displaced rib fractures
3. Uncontrolled pain or respiratory compromise + 1and/or 2.
4. Significant displacement/lung impalement
5. VATS/Thoracotomy for other indication

Rib fixation should occur within 48 hours of the decision to operate. Transfers should occur within 48 hours of the decision to transfer or the patient becoming fit to transfer. Patients with trauma should not be admitted under medicine. They may however be discharged/referred to a relevant medical specialty once appropriate.
1. **Battle et al.** Predicting outcomes after blunt chest wall trauma: development and external validation of a new prognostic model. *Critical Care* 2014;18:R98

# Surgical rib fixation pathway

## Pre-operative

- Half Day theatre session in Trauma Theatres
- Give LMWH (where possible) >12 hours before surgery
- Fixation kit available + VATS equipment if reqn Trauma Theatres
- 3D reconstruction available
- FBC/U&Es/Coag, 2 units crossmatched
- Planning, equipment, expertise as required for lung isolation

## Intra-operative

### Anaesthetist

1. Extra-thoracic rib fixation does not require lung isolation, therefore a single lumen ETT is sufficient.
2. If thoracoscopic assessment is planned, lung isolation is required. A DLT or bronchial blocker should be available.
3. Insert arterial line
4. Insert erector spine (ESP) block + catheter (or paravertebral, PV) post procedure in the lateral position prior to extubation.
5. If undergoing VATS, a paravertebral catheter can be inserted by the surgeon under direct vision.
6. Please contact the CEPOD Anaesthetist on-call (Bleep 2200) to seek assistance with any of the above.

### Surgeons

1. Plan muscle sparing surgical incision(s), orthopaedic and/or thoracic surgical team as required
2. Identify fractures clinically or with ultrasound
3. Replace any pre-existing chest drains prior to operative fixation
4. If patient undergoing VATS, paravertebral catheter can be surgically placed at the end of the procedure
5. Perform CXR in theatre at end of case

## Post-operative

1. Aim to extubate at end of the procedure, unless intubated pre-op or significant respiratory compromise. Consider CPAP/HFNO.
2. Administer ESP/PV loading dose L-Bupivacaine as per protocol and commence infusion.
3. Remove ESP/PV catheter at approximately 5 days after insertion (discretion of team if longer/shorter)
4. Incentive spirometry 4 hourly
5. Sit up and ambulate ASAP

## Discharge

1. Continue incentive spirometry at home 4 hourly
2. Wound review at 2 weeks
3. Clinic review at 6 weeks
14. Chest Drain Insertion in Adult Trauma Patients

14.1. Aim, Background and Safety

14.1.1. Aim

To describe the indications and procedures for chest drain insertion in adult trauma patients as well as post procedure monitoring and removal.

14.1.2. Background and Safety

Chest trauma is common in major trauma, both penetrating and blunt. In particular motor vehicle collisions are associated with significant amounts of chest trauma, and the commonest cause in our setting. 25% of all trauma deaths are due to chest trauma. Thus the chest must be quickly and accurately assessed allowing treatment to occur in a timely fashion. Serious chest injuries account for approximately 4000 deaths in the UK each year. Many of these patients will require chest drain insertion.

Incorrect placement of a chest drain can lead to significant morbidity and even mortality

They are 4 key British Thoracic Society recommendations.

1. All personnel undertaking the procedure should have been suitably trained in theory, simulated practice and should be supervised until considered competent.
2. Pleural procedures should not take place out of hours unless it is an emergency.
3. Pleural procedures should take place in a clean environment with full aseptic technique.
4. Chest drain insertion should be delayed where possible in anticoagulated patients until the INR is < 1.5.

14.1.3. Indications for Chest Drain In Trauma

- Pneumothorax: Following decompression of tension
- Haemo-pneumothorax
- Post Surgery
14.2. Consent

Written consent should be obtained in all cases except in an emergency in which verbal consent should be sought where possible.

Complications that should be covered are

- Pain
- Intrapleural infection
  - Visceral injury
- Blockage

14.3. Sedation / Analgesia

The insertion of chest drains is a painful procedure despite the use of local anaesthesia. Analgesia should be used in the non-anaesthetised patient and sedation considered where appropriate.

1\textsuperscript{st} Line – intravenous Morphine
2\textsuperscript{nd} Line – intravenous Ketamine

14.4. Procedure

14.4.1. Positioning

The semi erect position is optimal for insertion of chest drains. In blunt trauma and unwell patients this may not be possible. In this situation the patient should remain supine and the arm lifted superiorly by an assistant.

14.4.2. Anatomy

Insertion should be in the triangle of safety, bordered anteriorly by the lateral edge of latissimus dorsi, the lateral border of pectoralis major and superior to the horizontal level of the fifth intercostal space.

\textbf{Figure 1}
14.4.3. **Insertion**

1. Confirm patient’s identity and review imaging/clinical signs.
2. Use Aseptic technique
3. Lidocaine 1% should be instilled paying particular attention to skin, periosteum and pleura.
4. Make an incision (larger than drain and able to accommodate a finger) parallel to and above the rib
5. Blunt dissection without undue force parting the intercostal muscles down to the pleural space.
6. Finger the tract ensuring it is connected to the hemithorax.
7. Insert the drain through the tract and suture in place using a 0 or 1-0 silk suture.
8. Tape in place using the omental method as in figure 2.
9. The drain should be attached to a valved passive closed drainage device and confirmed with swinging and bubbling.

---

**Key point:**

*Not all pneumothoraces require drainage. ‘Occult’ pneumothoraces (seen on CT and not CXR) may be safely observed in ventilated patients.*

---

**Chest Drain Securing Method**

- Connect tubing using strips of zinc oxide tape leaving the connection visible
- Attach the tubing to abdomen or thigh using Mefix
14.5. **Antibiotic Prophylaxis**

- Administer 1.2g Co-Amoxiclav ideally before insertion and continue for 24 hours for all patients requiring a chest drain.
- Consider tetanus status for all patients.

14.6. **Documentation**

- Record all plural procedures on TRAK system (Please refer to Appendix 4: Pleural Procedures Documentation)
- Use the chest drain chart to record chest drain observations. (Please refer to Appendix 5: Chest Drain Chart)
15. Penetrating Chest Injury

15.1. Background

Up to 20% of patients with penetrating chest injury managed by intercostal drainage alone get complications consisting of:

- Retained haemothorax
- Empyema
- Persistent air leak
- Occult diaphragmatic injury
- Drain malposition / misplacement

15.2. Anatomy

- Trauma doesn’t always respect anatomical boundaries and wounds can often involve both thoracic and abdominal compartments – especially bullets.
- Supraclavicular injuries should be managed as a penetrating neck injury and may require a cardiothoracic surgeon, vascular surgeon and ENT.

15.3. Presentation

Stable vs. Unstable  (SBP <90mmHg +/- HR >120bpm, not explained by pain, anxiety or hypoxia)

15.4. Imaging

- A FAST scan can assess for pericardial fluid, although cannot rule out a cardiac injury in the presence of a left haemothorax
- Perform an immediate CXR in unstable patients.

15.5. Needle Chest Decompression

This is rarely, if ever indicated in the hospital where thoracostomy and chest drain insertion are usually more appropriate.
15.6. The Stable Patient

15.6.1. Principles

- Perform a CXR +/- eFAST
- Patients with no evidence of intrathoracic penetration and no significant chest wall injury can be discharged

15.6.2. Pneumothorax

- Small pneumothoraces (not visible on initial CXR) can be observed for 24 hours and repeat CXR
- Most small pneumothoraces do not require evacuation, even if intubated
- Pneumothoraces which are visible on the first CXR generally require drainage:
  - 16Fr catheters are acceptable (including seldinger)
  - Patients with any of the following may require image directed drainage:
    - Previous thoracotomy
    - Chronic lung disease
    - Pleural inflammation

15.6.3. Open Chest Wounds

- Occlude and place a chest drain
- Theatre for debridement

15.6.4. Thoracoabdominal Injuries

- Up to 20% have diaphragm injuries
- Consider wound location, tract and clinical findings
- Thoracoscopy or laparoscopy for left sided injuries
- Suspected right sided diaphragmatic may not need repair

15.6.5. Haemothoraces

- Small haemothoraces can be observed for 24 hours and repeat CXR
- Use 28-32 Fr chest drain (though 11-16Fr Seldinger may be as effective)
- The primary reason for empyema is residual haemothorax after chest drain insertion
• Residual haemothorax seen in the ED on CXR or CT showing >300ml residual are at risk of empyema
• Often a second chest drain may be recommended.
• Consider a VATS procedure for washout and evacuation, ideally within 72 hours when indicated.
• Do not use thrombolytics

15.6.6. **Indications for Thoracotomy / VATs**

• Relying on chest tube output may underestimate injury severity
• >1.0L on initial drainage should mandate immediate operative exploration
• >200ml/hr for 4 hours or >1.5L/24 hours should consider operative intervention
• Consideration in the following situations even if <1.5L/24hrs:
  o Large retained haemothorax
  o Transient instability
  o Clinical features (unexplained acidosis, air leak, diaphragm injury
  o Massive air leak

15.6.7. **Principles**

Determine which cavity is the priority to enter first using clinical findings, chest tube output, CXR and FAST. If in any doubt the chest should be entered first to gain proximal control.

• Time to theatre is paramount. Use dedicated code red theatre rather than cardiothoracic theatres.
• Crucifix position draped to include proximal thighs and supraclavicular/neck
• Use a single lumen tube (unless skills immediately exist for emergent double lumen placement)
• Perform and ED resuscitative thoracotomy if indicated as per guideline
<table>
<thead>
<tr>
<th>Tamponade</th>
<th>Relieve and repair wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilar injury</td>
<td>Clamp Hilar superior to inferior</td>
</tr>
<tr>
<td>Air embolus (following positive pressure ventilation or during lung decompression at thoracotomy)</td>
<td>Clamp the affected airway/Hilar Clamp the Aorta Vent the LV</td>
</tr>
</tbody>
</table>

15.6.8. **Antibiotics**

- Administer 1.2g co-amoxicalay for 24 hours in patients requiring intercostal chest drainage for penetrating trauma or surgery, ideally before tube thoracostomy.

15.6.9. **Damage Control**

- Consists of packing where possible.
- Ligation is generally limited to the left subclavian injury in patients with devastating injuries and coagulopathy
- Tractotomy
- Pneumonectomy and parenchymal resections have a high mortality

15.6.10. **Post-repair/Surgery**

- IABP/Bypass/ECMO has rarely been used to support the patient with myocardial compromise from coronary artery injury after repair only if haemorrhage controlled
- Delayed closure of the chest may be appropriate in patients who have thoracic compartment syndrome/instability/ongoing diffuse bleeding. Manifestations include:
  - Drop in BP and rise in airway pressures when closing the chest
16. Resuscitative Thoracotomy

16.1. Background

Resuscitative Thoracotomy (RT) is a rarely performed procedure that has an extremely high mortality: benefit ratio. It can be associated with 100% individual mortality if the procedure is not performed. It is a time critical procedure that in all likelihood will be being performed for the first time in a high-pressure situation. With limited opportunities for training, simplifying both the indications as well as the procedural technicalities is important.

RT is a controversial procedure, and with the evidence base unlikely to ever be the most robust (limited scope for prospective data), the indications are constantly altering especially in blunt trauma. Current evidence indicates most benefit will be for cohorts with short transfer times and cardiac tamponade, which is often diagnosed post thoracotomy. RT is a high risk procedure, and the risk of transmission of BBVs to Health Care Professionals must not be underestimated. While this is a time critical procedure, standard PPE must still be adhered to.

16.2. Defining Signs of Life

Signs of life are considered present if there are any of the following:

- Pupillary response
- Spontaneous ventilation
- Presence of a carotid pulse
- Measurable/palpable blood pressure
- Cardiac electrical activity compatible with an output
- Extremity Movement

16.3. Personnel

There should be a consultant within the trauma team (usually TTL, General Surgeon or Cardiothoracic) 24/7 who is trained and nominated to perform the resuscitative thoracotomy in the MTC before the patient arrives.

16.4. Indications for Resuscitative Thoracotomy

Patients presenting pulseless to the ED

16.4.1. Absolute

- With signs of life after penetrating thoracic trauma
16.4.2. Relative

- With signs of life after blunt trauma
- Without signs of life after penetrating thoracic trauma
- With or without signs of life after extra-thoracic penetrating trauma.

16.4.3. Contra-indications

- Without signs of life after blunt trauma
- Confirmed CPR >15 mins

16.5. Aims of the Procedure

- Release of cardiac tamponade
- Release of tension pneumothorax
- Control of haemorrhage
- Internal cardiac massage

16.6. Equipment

The figure below shows the equipment required for a resuscitative thoracotomy.
16.7. Procedure

1. Ensure adequate PPE is worn at all times as this is a high risk exposure prone procedure.
2. Intubation, IV access, volume resuscitation should be simultaneously achieved whilst undertaking RT. Position the patient supine
3. Rapid skin preparation only is appropriate over full asepsis. PPE is mandatory.
4. Bilateral thoracostomies in 3rd or 4th intercostal space mid-axillary line (STOP AT THIS POINT IF ROSC).
5. Connect the thoracostomies with a deep swallow shape skin incision following the infra-mammary crease (see diagram below)
6. Insert two fingers into a thoracostomy to hold the lung out the way while cutting through all layers of muscle and pleura toward the sternum with Tuff Cutts.
7. Perform this on both sides
8. Cut through the sternum. If unable to cut with scissors use the Gigli Saw.
9. Open the clam shell using rib spreaders
10. Extend the incisions posteriorly if exposure is inadequate.
11. Lift the pericardium with forceps and make a large longitudinal incision using scissors
12. Evacuate all blood and clot present and inspect the heart for the site of bleeding

There can be a tendency to place the incision too low which can go through the sternum rather than the xiphoid.

Please also refer to “Emergency Thoracotomy: How To Do IT” by David Wise, published by the EMJ (Click Here)
### 16.8. Possible Outcome and Actions

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSC with good output</td>
<td>Manage cardiac wound</td>
</tr>
<tr>
<td>ROSC with inadequate output or No ROSC</td>
<td>Manage cardiac wound Compress the Aorta Volume resuscitation if heart empty Internal cardiac massage Adrenaline</td>
</tr>
<tr>
<td>VF and continue as per No ROSC</td>
<td>Flick the heart Internal paddles 10 Joules Close the chest and use external paddles if internal paddles unavailable</td>
</tr>
</tbody>
</table>

### 16.9. Internal Cardiac Massage

- Use a two handed technique
- One flat hand applied to posterior surface of heart and one on anterior surface
- Blood is milked from the apex upwards at a rate of 80bpm.
- Keep the heart horizontal during massage

### 16.10. Aortic Compression

- An assistant can compress the aorta against the spinal column using a gloved hand, entering the hemithorax from the left of the patient.
- Only an experienced Surgeon should clamp the aorta.
- An NG tube may aid in identification the aorta from the esophagus.
16.11. Managing Cardiac Wounds

1. Apply direct compression initially—temporarily occlude wounds with your fingers +/- gauze swab
2. Suturing following compression—Ideally only utilized by experienced surgeons as challenging and can occlude coronary arteries.

If significant haemorrhage encountered despite above measures consider:

1. Foley Catheter (only in LV wounds >1cm where pressure does not work) – pass a Foley catheter, inflate no more than 10ml and gently pull back being careful not to cause further injury, ensuring the catheter is clamped.
2. Staples (on LV wounds only)
3. Caval occlusion

16.12. Post-procedure

- The patient may wake up so be prepared to provide immediate anaesthesia
- Control bleeders from intercostal and mammary arteries with direct pressure or artery forceps
- Move directly to theatre in the MTC for definitive repair

*Image: Clamshell Thoracotomy with manual aortic compression*
16.13. **Algorithm for Emergency Department Thoracotomy After Traumatic Cardiac Arrest**

**Emergency Department Thoracotomy after traumatic cardiac arrest**

- CPR in progress
  - Any Signs of life on arrival? Yes → STOP RESUSCITATION
  - CPR>5mins (blunt) CPR>15mins (penetrating) No → CPR
  - or Never any signs of life? Yes → STOP RESUSCITATION

**Signs of Life**
1. Pupillary response
2. Spontaneous ventilation
3. Carotid pulse
4. Measurable BP
5. Extremity movement
6. Electrical activity compatible with output (not VF, idioventricular rhythm or HR<50)

- Perform ED Thoracotomy
  - Organised Cardiac Contractility? No → Tamponade?
    - Yes → Decompress & Repair
    - No → Sustained SBP>70mmHg?
      - Yes → Operating Theatre
      - No → Pack thoracic cavity
      - Aortic cross-clamp
      - Hilar cross-clamp
17. Penetrating Neck Injury

17.1. Anatomical Zones of The Neck

Zone 1: Clavicle and sternal notch to cricoid cartilage
Zone II: Cricoid cartilage to the angle of the mandible
Zone III: Angle of mandible to base of skull.

17.2. Management Principles

- If the platysma is not breached, a serious injury is effectively excluded.
- If this distinction cannot be made then further investigation is required.
- Ensure early airway assessment and consider a definitive airway early where appropriate.

17.3. Access for Hard and Soft Signs

<table>
<thead>
<tr>
<th>Hard Signs</th>
<th>Soft Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active haemorrhage</strong></td>
<td>Non pulsatile / non expanding haematoma</td>
</tr>
<tr>
<td>Pulsatile / expanding haematoma</td>
<td>Venous oozing</td>
</tr>
<tr>
<td>Bruit/thrill</td>
<td>Dysphagia</td>
</tr>
<tr>
<td>Haemodynamic instability</td>
<td>Dysphonia</td>
</tr>
<tr>
<td>Unilateral upper limb pulse deficit</td>
<td>Subcutaneous emphysema</td>
</tr>
<tr>
<td>Massive haemoptysis / haematemesis</td>
<td></td>
</tr>
<tr>
<td>Air bubbling in the wound</td>
<td></td>
</tr>
<tr>
<td>Airway compromise</td>
<td></td>
</tr>
<tr>
<td>Cerebral Ischemia</td>
<td></td>
</tr>
<tr>
<td><strong>Major Haemorrhage</strong></td>
<td></td>
</tr>
<tr>
<td>1) Apply direct pressure</td>
<td></td>
</tr>
<tr>
<td>2) Consider haemostatic dressings</td>
<td></td>
</tr>
<tr>
<td>3) Foley catheter</td>
<td></td>
</tr>
</tbody>
</table>
17.4. Imaging vs. Theatre

- Unstable patients with hard signs require emergency surgery.
- Perform immediate CTA Neck in patients with hard signs not requiring emergency surgery.
- Perform immediate CTA Neck in patients with soft signs.

17.5. Other injuries to consider

If there is concern for aerodigestive injury despite normal / equivocal CTA:

- Consider Barium Swallow in conjunction with laryngoscopy / esophagoscopy.
- Consider ENT and cardiothoracic involvement as required.

Some Zone 1 injuries will require a thoracotomy for proximal control.
18. Spinal Column and Spinal Cord Injury

18.1. Diagnosis and Imaging

- Refer to Cervical Spine assessment and imaging protocol (Available here)
- Refer to thoracolumbar spine assessment & imaging protocol. (Available here)
- MRI aids prognosis, identifies prolapsed discs, haematomas and ligamentous injuries.
- Perform MRI urgently in SCI patients. (Emergent MRI may be required as per Neurosurgical guidance)

18.2. ED Documentation and Referral

- ED Trauma team leader ensures an ASIA Chart (Appendix 9) is completed
- ED Trauma team leader confirms SCI and refers to Neurosurgical Registrar on call

**Emergency surgical decompression (<4 hrs)**

- Low velocity (falls, sport, recreation, swimming, diving, rugby, gymnastics, trampolining) cervical SCI with bifacetal dislocation = emergency reduction within 4 hours of injury (MRI not needed for diagnosis)
- Perform post reduction CT MRI

**Consider Urgent Surgical Decompression**

- The evacuation of a compressive haematoma or large central disc prolapsed requires urgent management.

**May benefit from urgent surgical decompression (<24 hours)**

- Patients with an incomplete spinal cord injury especially central cord
- Some motor or sensory function is retained below the level of the lesion with sacral sparing e.g. Traumatic cord syndromes – Central, Anterior, Posterior, Brown Sequard, Conus medullaris or cauda equine.
18.3. Admission Pathways

All patients with a traumatic spinal cord injury should be admitted to a critical care environment. Isolated SCI patients should be admitted under the care of Neurosurgery, or transferred to the local MTC or ICU following advice from SIU and Neurosurgeon. Polytrauma patients with spinal cord injury should remain at the RIE with neurological input.

18.4. Referral and Transfer to Spinal Injuries Unit (SIU)

Neurosurgical registrar refers to Spinal injuries unit within 4 hours of diagnosis (Please refer to the Referral Form in Appendix 10). An early joint management plan must be formulated and recorded in the notes within 12 hours Transfers to SIU do not usually occur direct from the ED (only at SIU discretion)

Patients accepted for transfer to SIU should be transferred with 24 hours of being stable and accepted for transfer Spinal stabilisation for patients with a spinal cord injury may be chosen to be undertaken at the SIU in Glasgow. See Spinal Injury Unit Transfer Checklist.

18.5. Management Principles in ED/Early ICU

18.5.1. Spinal Shock

Total flaccid paralysis of all skeletal muscle and loss of all spinal reflexes below the level of the lesion. It may last several hours to weeks. The return of the bulbospongiosus reflex denotes its end.

18.5.2. Neurogenic Shock

Body’s response to sudden loss of sympathetic control in cervical and high thoracic lesions (above T6). Hypotension is from a lack of vasomotor control. Bradycardia from of an unopposed vagus nerve

18.5.3. Airway

Intubation can precipitate severe bradycardia and cardiac arrest in cervical/high thoracic spinal cord injuries. Atropine 0.3mg / 0.6mg may be required.

18.5.4. Breathing

Patients with high cord lesions (C3/4/5) have a high risk of respiratory deterioration.

- Monitor SaO2, blood gases and vital capacity
• Use humidified oxygen
• Early, regular and frequent physiotherapy including assisted cough and incentive spirometry
• hourly turns to optimise V/Q mismatch
• Elective ventilation may be needed
• Secure airway if vital capacity <1L
• Consider primary tracheostomy
• Pre-oxygenate with 100% oxygen before and after suctioning as bradycardia and hypoxia can occur

18.5.5. Circulation

• Patients with acute spinal cord injury must be nursed flat
• Monitor BP usually via arterial line
• Maintain SBP >100mmHg. Initial MAP target 85mmHg. Consider maintaining these targets for 7 days.
• Maintain urine output of 30mls or above per hour
• Administer IV fluids - DO NOT over-infuse. This may precipitate cardiac failure and pulmonary oedema.
• Vasoconstrictors via a central line may be required to maintain a stable BP
• Use atropine 0.5-1.0mg or glycopyrrolate 200-600mcg i.v. for bradycardia <40bpm or instability.
• Bradycardia usually resolves over a few days. Avoid pacemakers where possible.

18.5.6. Disability

• Ensure ASIA Chart (Appendix 9) is completed in full
• Perform neurological examinations 2 hourly to identify and prevent any avoidable deterioration.

18.5.7. Other considerations

1. Do not give IV steroids
2. LMWH VTE prophylaxis should be started by day 3 and TEDs/Flowtrons on admission.
3. Give regular ranitidine/PPI
4. prescribe nebulised saline, salbutamol 2.5mg and ipratropium 250mcg 4 hourly in all high cord injuries
5. Monitor for signs of alcohol withdrawal
18.5.8. **Skin**

1. Heels should be supported clear of the bed with pillows
2. Pressure relief and minimum 30 degrees side to side turning should occur every 2 hours from admission

18.5.9. **Bladder**

1. All patients should be catheterised
2. If Priapism is present, initially manage with urethral catheterisation where possible. May require a suprapubic catheter.

18.5.10. **Paralytic ileus**

1. Nil-by-mouth
2. NG tube in all patients (may precipitate bradycardia)
3. if abdomen is distending due to build up of gas, undertake PR and decompression
4. Commence nutrition once bowel sounds have returned

18.5.11. **Bowel**

1. Daily insertion of a glycerin or bisacodyl suppository 15-30 minutes before rectal examination and evacuation if rectum full

2. If BS present, passing flatus or moving bowels then start in ALL patients:
   a) Senna 15mg alternate evenings
   b) Lactulose 15ml b.d.
   c) OR if unsuccessful consider
   d) Macrogol i sachet b.d.
   e) Bisacodyl 10mg alternate evenings

**AND if T12 & above (reflex UMN bowel)**

 a) Daily PR
 b) Daily anal digital stimulation to trigger reflex. CHECK digitally that emptying is complete
OR if L1 or below (flaccid LMN Bowel)

a) daily PR
b) daily manual evacuation of faeces (essential in these patients).

DO NOT USE A FLEXISEAL unless diarrhoea caused by confirmed *C.Diff.* infection

18.5.12. Analgesia

1. Prescribe simple analgesia e.g. paracetamol
2. Opiates for fractures but caution in high cord injuries
3. Neuropathic analgesics e.g. gabapentin

18.5.13. Joint mobility

Daily passive limb movement, stretching and positioning with input from PT, OT and nurses from admission

18.5.14. Other guidance

Further guidance on mobilisation, autonomic dysreflexia, weaning and other issues is available at [www.spinalunit.scot.nhs.uk](http://www.spinalunit.scot.nhs.uk) and [www.spinalcordinjury.nhs.uk](http://www.spinalcordinjury.nhs.uk). Contact Edenhall for nursing advice on 0141 201 2533/

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NICE Guidelines for Spinal Injury Assessment and Initial Management are available. (Click [Here](http://www.nice.org.uk)).

Paediatrics

C-Spine Guidelines for Paediatrics have been published by the RCEM (Click [Here](http://www.rcem.org.uk)).
18.6. Cervical Spine Assessment and Imaging Protocol

Adult (>16 YO) Blunt Trauma Patients with Mechanism That May Have Injured the Neck

**1. Assessments**

- **High Risk?**
  - Any of the following?
    1. GCS of <15/15
    2. Paralysis, Neurological deficit or extremity paraesthesia.
    3. On RED FLAG List Below * AND either neck pain, visible injury above the clavicles or severely painful (>7/10) thoracic injury.

- **Low Risk?**
  - Any of the following?
    1. Simple rear-end collision (unless pushed into another large vehicle/hit by high speed vehicle)
    2. Sitting position in the ED
    3. Ambulatory at any time
    4. Delayed onset neck pain (not immediately present)
    5. Absence of midline tenderness

  IF NOT ON THE ABOVE LIST: REQUEST PLAIN FILMS

**Radiography**

- CT C-Spine if ANY OF THE FOLLOWING
  1. GCS <13/15 or intubated
  2. CT for any other body region required
  3. Severe neck pain (>7/10 or C-spine neurology
  4. Chronic disability precluding accurate clinical exam
  5. X-ray is inadequate or abnormal. Patient may not need CT unless there are high risk features.

IF NOT ON THE ABOVE LIST: REQUEST PLAIN FILMS

**2. Features**

- **Red Flag List * **
  1. Fall from >1m or down 25 stairs
  2. Axial load to the head (e.g. driving) or bicycle collision
  3. RTC with combined speed >60mph or rollover, ejection from vehicle; motorised recreational vehicle accident.
  4. >65 or vertebral disease
  5. Injury >48 hours ago or re-attending with the same injury

**3. Outcomes**

- **CT Abnormal**
  - Discuss with Neurosurgeons

- **Imaging Normal**
  - Consultant radiologist final CT report is normal (if out of hours, see list below***)
  - CT not indicated and plain films assessed as adequate and normal by ST4+

- **Radiologically***
  - C-Spine cleared radiologically***

**Veretebral Disease**

1. Ankylosing spondylitis
2. Rheumatoid Arthritis
3. Spinal Stenosis
4. Previous Spinal Injury

**YES**

- Is there severe pain (>7/10) or reduced range (<45) of movement when rotating laterally in both directions?

**YES**

- **CT C-Spine Cleared Clinically**
  - C-Spine cleared clinically by ST3+ (This must be documented)

**NO**

- **CT C-Spine Cleared Radiologically***
  - Patients fit for general ward/discharge with provisional, typed, ‘normal’ CT report, may have C-Spine cleared clinically by ST3+ (This must be documented)

- **YES**
  - Normal CT and severe neck pain (>7/10), C-Spine Neurology or restrictions of neck movement (<45) should remain immobilised and be considered for MRI after discussion with radiologist/neurosurgeon

- **NO**
  - Obtunded patients should be assessed clinically when alert, but should not delay C-Spine clearance
18.7. Principles of Spinal Immobilisation and Clearing the Spine

1. **Spinal Immobilisation**

   The aim of spinal immobilisation in the trauma patient is to reduce the potential for secondary spinal cord injury patients deemed at risk of cervical spine injury should have spinal immobilisation until spinal clearance has occurred.

   There are some rare exceptions

   1. The only time immobilisation should occur in penetrating trauma is for a gunshot wound that traverses the neck. The cervical collar should be removed if it interferes in any way with haemorrhage or airway control.
   2. Patients with vertebral abnormalities (e.g. Ankylosing Spondylitis, Spinal stenosis, Rheumatoid arthritis, previous spinal surgery) should be immobilised in a position of comfort which may not necessarily be achieved with a cervical collar.
   3. There are a small number of patients who do not comply with immobilisation or where immobilisation may cause immediate harm (e.g. airway compromise) – efforts should be made to protect the spine as safely as possible and the risk/benefits of interventions considered. The patient should never be restrained or be seen to forcefully resist immobilisation. The reasons to alter standard immobilisation techniques should be clearly documented by senior clinical judgement.

   Immobilisation consists of all four of the following:

   1. Cervical collar or Manual in Line Stabilisation (MILS) (Head blocks are an alternative in patients who are deeply sedated or paralysed with a significant brain injury.)
   2. Nursing in the supine position or anatomically aligned lateral position with wedge supports.
   4. The Absence of pillows under the head.

2. **Care of Patients in a Collar**

   1. Stiff-neck collars from the ambulance service/Emergency Department are temporary collars originally designed for extrication. Ideally these should be worn for no more than 4 hours. Replace with a Miami J or Aspen Collar if cervical collar is still required after 4 hours as follow.
   
   i) The collar should be removed every 4 hours and the neck inspected for areas of pressure
   ii) Movement restrictions should be clearly documented
   iii) Movement restrictions should be clearly documented.
   2. Patients who have their cervical spine cleared, no longer require collar/MILS/head-blocks. Log-rolling is still required if thoracolumbar spine is not cleared.
   3. Patients who have had their thoracolumbar spine cleared and still require cervical spine immobilisation, need an early decision by the neurosurgeon on movement restrictions. Mobilisation in a collar should be specifically considered and documented if appropriate (e.g. semi-recumbent position)
   4. Patients with pelvic fractures may have other movement restrictions in place.

3. **Clearing the Cervical Spine**

   1. To reduce potential complications, spinal clearance should occur within 12 hours in most patients, and in nearly all patients within 72 hours.
   2. The cervical spine can be cleared RADIOLOGICALLY or CLINICALLY (See flowchart).
   3. The time and date and name of the person who has cleared cervical spine should be clearly documented.
   4. Only re-apply a collar if there has been a breach in protocol or there is a new clinical concern. Any concerns should feedback through the trauma governance process.
   5. The following, possibly clinically insignificant injuries, warrant a senior neurosurgical opinion about potential spinal clearance:
      i) Isolated spinous process fractures not involving lamina
      ii) Wedge compressed fractures <25%
      iii) Type 1 odontoid peg fracture
      iv) Isolated avulsion without associated ligamentous injury
      v) End plate fracture
      vi) Isolated transverse process fracture not involving the facet
      vii) Trabecular bone injury
      viii) Osteophyte fracture, excluding teardrop and corner fractures

4. **Complications**

   Delays in spinal clearance can lead to a number of potential complications including:

   1. Cervical collar-related decubitus ulceration and sepsis (risk increases by 66% daily).
   2. Procedural difficulties – intubation, tracheostomy and central lines
   3. Increased risk of pulmonary aspiration and pneumonia
   4. Increased need for sedation without delaying weaning
   5. Increased intracranial pressure
   6. Delays in mobilisation and associated complications.
18.8. Assessing and Imaging the Thoracolumbar Spine

2. Assessment

Complaining of a thoracolumbar pain AND
   i) Age ≥ 65
   ii) Dangerous mechanism
      - Fall >3m
      - Axial load to head or spine
      - RTC - >60mph, rollover, ejection
      - Lap belt restraint only
      - Horse riding
      - Campervan/mobile home collision
      - Bicycle collision
   iii) Vertebral disease* 
      - Ankylosing spondylitis
      - Rheumatoid arthritis
      - Spinal stenosis
      - Previous spinal injury
   iv) Known or at risk of osteoporosis

OR a history of any of the following
   i) Spinal fracture in another region of the spine
   ii) Paresthesia weakness or numbness
   iii) Midline/spinal pain when coughing

OR any of the following on examination
   i) Motor deficit
   ii) Sensory deficit
   iii) Deformity
   iv) Midline bony tenderness (percussion or palpation)

1. Outcomes

Radiography
CT IF ANY OF THE FOLLOWING
   i) GCS <13/15 or intubated
   ii) Vertebral disease*
   iii) Paresthesia, weakness or numbness
   iv) Motor deficit
   v) Sensory deficit
   vi) X-ray is abnormal or inadequate ***

(*low energy (e.g. fall from standing) osteoporotic vertebral compression if body collapse or greater than 50% loss of height. Discuss with radiology)

IF NOT ON ABOVE LIST REQUEST PLAIN FILMS

3. Features

CT Abnormal
Discuss with Neurosurgeons

Imaging Normal
Consultant radiologist final CT report is normal (if out of hours, see list below***)

Or
CT not indicated and plain films assessed as adequate and normal by ST3+

Radiologically***

Thoracolumbar spine cleared radiologically***

1. Patients fit for general ward/discharge with a provisional, typed ‘normal’ CT report, may have TL spine cleared clinically by ST3 or equivalent. (This must be documented)
2. Normal CT with motor or sensory deficit, paresthesia, weakness or numbness at rest or when mobilising should remain immobilised and be considered for MRI after discussion with radiologist/neurosurgeon.
3. Obtunded patients should be assessed clinically when alert, but this should not delay thoracolumbar spine clearance.
19. Abdominal Trauma

19.1. Background to Abdominal Trauma

Blunt abdominal trauma is more challenging than penetrating trauma, where the decision to operate is usually straightforward. All abdominal trauma is managed one of three ways:

1. Operative
2. Non-operative management (NOM) with IR
3. NOM without IR

19.1.1. Pitfalls!

- Suspect rather than rely on numbers - Abdominal haemorrhage is often concealed, is always non compressible and recognition is challenging.
- The surgical hand will only detect 50% of abdominal injuries, even in conscious patients
- Beware – Elderly, Obese, obtunded and spinal cord injuries
- This starts at the nipples anteriorly and scapular angle posteriorly, though trauma rarely respects these boundaries.
- Do not remove the pelvic binder to perform a laparotomy
- Patients with a sustained SBP <70mmHg and abdominal trauma should probably be in theatre.
- Ureteral injuries are rare but commonly missed

19.1.2. Surgery

- A midline laparotomy should be used over other approaches
• Haemorrhage control should occur as quickly as possible within 1 hr of presentation.
• A surgical consultant should be present for all laparotomies in trauma.
• The following are the commonest indications for an immediate laparotomy.
  o Unstable patient with positive FAST
  o Peritonitis
  o Unstable patient with free fluid on CT
  o Hollow viscus injury
  o Retained weapon
  o Gunshot wound
  o Evisceration
• A laparotomy should be strongly considered when free fluid is present in the absence of solid visceral injury

19.1.3. Damage Control

• Utilise damage control principles (Proximal Control, Haemostasis and Faecal/Urinary diversion) over definitive procedures in selected patients with physiological compromise.
• Consider temporary abdominal closure in the presence of physiological compromise.
• The second look should follow between 24-72 hours after the first operation.

19.1.4. CT

CT is the gold standard imaging modality of choice in blunt abdominal trauma

19.1.5. FAST

• A FAST should can be useful in the following situations
  o Unstable patients
  o Multiple casualties where triage can be challenging.
• FAST can rule in intra-abdominal haemorrhage
• A negative FAST does not rule out injury
19.1.6. Ultrasound

Ultrasound should not be used acutely to assess intra-abdominal injury in adults. CT is modality of choice.

19.2. Penetrating Abdominal Trauma Specifics:

19.2.1. Imaging

- Perform CT in all penetrating trauma where Non-operative Management (NOM) is being considered.
- NOM should be considered if there is all three of:
  - Haemodynamic stability
  - Absence of peritonitis
  - Absence of diffuse abdominal tenderness (away from wound)

19.2.2. Laparoscopy

- Consider in left sided thoracoabdominal injuries to rule out diaphragmatic injury
- Can be used to determine peritoneal penetration

19.2.3. Antibiotics

- Administer A single pre op dose of antibiotics as per local guidelines for all patients undergoing a laparotomy for penetrating trauma.
- If there is no hollow viscus injury then no further antibiotics are required
- If there is hollow viscus injury then continue antibiotics for 24 hours
- Consider repeat dosing of antibiotics during massive transfusion.

19.2.4. Penetrating Colon injuries

- Resect penetrating colonic injuries and strongly consider leaving definitive repair or stoma formation until relook laparotomy in damage control setting.

19.2.5. Penetrating Rectal Injuries
• Perform proximal diversion in patients with suspected non-destructive penetrating extra-peritoneal rectal injuries
• Do not use presacral drains or perform distal rectal washout.

19.2.6. Discharge of penetrating injuries

Discharge after 24 hours in the presence of reliable clinical examination and minimal to no abdominal tenderness

19.2.7. Penetrating Colon injuries

Resect penetrating colon injuries and consider colostomy during damage control.

19.2.8. Penetrating Rectal Injuries

• Perform proximal diversion in patients with non-destructive penetrating extra-peritoneal rectal injuries
• Do not use presacral drains or perform distal rectal washout.

19.2.9. Discharge of penetrating injuries

Discharge after 24 hours in the presence of reliable clinical examination and minimal to no abdominal tenderness
19.3. Algorithm for Abdominal Trauma

Haemodynamic Instability

i) Admission SBP <90mmHg with evidence of vasoconstriction, altered level of consciousness and or shortness of breath.
ii) Admission SBP >90mmHg requiring ongoing volume resuscitation.
iii) Admission BE > -5
iv) Shock Index (HR/SBP) >1
v) 4-6 units RCC in 24 hours
vi) Unable to maintain sufficient stability to undergo CT or IR
19.4. Splenic Trauma

19.4.1. Operative Management – Splenectomy

Indications:

1. Separate indication for laparotomy
2. Unresponsive haemodynamic instability
3. Ongoing signs of haemorrhage after IR

19.4.2. Non-operative Management (NOM)

Indications:

Any grade of injury even with free fluid and pseudoaneurysm.

Only consider in patients with severe Traumatic Brain Injury when there is immediate access to IR and surgery.

Risk Factors of NOM failure:

1. Age >55yrs
2. Grade III, IV & V injuries
3. High Injury Severity Score
4. Large Hemoperitoneum
5. Hypotension before resuscitation
6. GCS<12
7. Low haematocrit on admission
8. Blush on CT
9. Anticoagulated
10. HIV
11. Drug addiction
12. Cirrhosis
13. Blood Transfusion required

19.4.3. Interventional Radiology

Absolute Indications

- IR is the 1st Line intervention where there is active arterial extravasation, regardless of injury grade and stability and no other indication of laparotomy.
Strong consideration in:

- Stable/Stabilising Grade III-V injuries with active arterial extravasation, pseudo-aneurysm or AV fistula.
- All Grade IV/V injuries
- Persistent signs of haemorrhage and isolated splenic injury on CT, regardless of the presence of active arterial extravasation.
- Grade III injuries in the presence of Risk Factors for NOM failure
- Blush seen on CT but not present during angiography

19.4.4. Admission and Ongoing Management

- Transfer patients with a grade III/IV/V to the MTC for a minimum of 48-72 hours observation and bed rest.

- Start LMWH 24 hours after injury in most cases, even in patients undergoing NOM
- Reversal of anticoagulant should be individualised on risk-benefit
- Consider repeat CT scanning during admission in:
  - Grade III-V injuries
  - Decreasing haematocrit
  - Presence of blush, pseudoaneurysm or AV fistula on initial scan
  - Underlying splenic pathology*
  - Coagulopathy*
  - Neurologically impaired patients*

19.4.5. Vaccinations and Antibiotics

In splenectomised patients commence prophylactic antibiotics immediately and give Pneumococcal, Hib, MenC and influenza vaccines after 14 days or on discharge.

Immune function is thought to be preserved in patients who have undergone embolisation.
19.5. Liver Trauma

19.5.1. Surgical Principles

Absolute Indications

- Haemodynamic instability
- Peritonitis
- Penetrating injury with any of:
  - significant free air
  - localised thickened bowel wall,
  - evisceration
  - impalement
  - free fluid without solid visceral injury
  - Other organ injury requiring laparotomy

Relative Indications
Severe Head or spinal cord injury which impairs clinical assessment

19.5.2. Non-operative Management (NOM)

- Should be attempted in all grades of liver injury not requiring laparotomy.
- All Grade III/IV/V injuries and all penetrating liver trauma should be monitored in the MTC:
  - 4-6hrly bloods and clinical examination for 48hrs in a monitored environment

19.5.3. IR

Indications (In the absence of another indication for laparotomy)

- Stable patients with active arterial extravasation on CT
- Unstable patients with active arterial extravasation responding to resuscitation
- Hepatic artery pseudo aneurysms
- Post operative repair for liver injury

IR can be safely repeated if required.
19.5.4. **Complications of Liver Trauma**

12-14% complication rate, most commonly in Grade IV/V consisting of:

- Bleeding
- Abdominal compartment syndrome
- Abscesses
- Necrosis
- Biliary complications:
  - Leak
  - Haemobilia (raised bilirubin +/- upper GI bleed)
  - Biloma
  - Peritonitis
  - Fistula

19.5.5. **Further Imaging / Interventions**

Perform a repeat CT in the presence of:

- Abnormal inflammatory response
- Abdominal pain
- Fever
- jaundice
- Drop in Hb
  - Biliary complications may require ERCP, stenting, drainage or surgery
19.6. Kidney Trauma

19.6.1. History & Examination

- Pre-existing renal pathology/surgery makes injury more likely
- The following examination findings may suggest renal injury:
  - Flank pain
  - Plank abrasions
  - Fractured lower ribs
  - Abdominal tenderness/distension/mass

19.6.2. Investigations

Perform a Urinalysis and Creatinine in all patients.

19.6.3. Imaging:

19.6.3.1. USS

USS is not useful in the acute setting

19.6.3.2. IVP

- IVP should only be used if CT is unavailable
- Perform a one shot IVP in the OR for patients who were taken directly to theatre without imaging (2ml/kg of contrast followed by plain film after 10 mins.)

19.6.3.3. CT

- CT is the imaging modality of choice and indicated in the presence of:
  - Frank haematuria
  - Microscopic haematuria with a single episode of haematuria
  - All penetrating Trauma
- Consider in the following, even in the absence of haematuria; Rapid deceleration injury
  - Direct flank trauma
  - Flank contusions
  - Lower rib/Thoracolumbar fractures

Concerns regarding contrast worsening outcomes are

A delayed phase scan should be performed in all renal injuries to identify urine leak
unwarranted as low rates of contrast induced nephropathy are seen in renal trauma patients

19.6.4. **Non-Operative Management (NOM)**

- All injuries can be attempted to undergo NOM.
- Pedical and vascular avulsion injuries often require surgery +/- IR

Transfer all patients with Grade III/IV/V injuries to the MTC for serial 6 hourly clinical and laboratory observation for 24 hrs in a monitored environment.

19.6.5. **Interventional Radiology**

- All injuries can be attempted to undergo NOM.
- Pedical and vascular avulsion injuries often require surgery +/- IR

Transfer all patients with Grade III/IV/V injuries to the MTC for serial 6 hourly clinical and laboratory observation for 24 hrs in a monitored environment.

**Indications**

- Active extravasation of contrast at WBCT / CT angiography.
- AV fistula
- Pseudonaeurysm
- Some blunt grade III
- Grade IV/V injuries
- Penetrating injuries

19.6.6. **Surgery**

**Absolute Indications**

- Haemodynamic instability
- Expanding or pulsatile haematoma seen at laparotomy
- Patients who have an abnormal one shot IVP during laparotomy

**Relative indications**

- Grade V blunt vascular injuries involving renal pedicle or avulsion*
- Grade IV or V penetrating injury*

*Senior Consultant input with Urology/IR if NOM is to be considered
Nephrectomy is the procedure of choice in damage control / major haemorrhage.

Only attempt renal reconstruction if haemorrhage controlled and there is sufficient viable renal parenchyma.

19.6.7. Antibiotics

Indicated in the following:

- Devitalised tissue
- Significant soft tissue loss
- Immunosupression
- Grade IV/V injuries
- Fever with no other obvious cause

48-72 hours of IV followed by 5 days oral.

19.6.8. Repeat Imaging

- All grade V injuries after 72 hours
- At 48-72hrs if urinary extravasation seen on initial scan to determine need for diversion procedure
- Fever with no other explanation
- Decreasing haematocrit
- Significant flank pain

19.6.9. Ongoing Management / Follow-up

- Bed rest until haematuria is light and bladder irrigation not required
- Follow up after 3 months, monitoring blood pressure, creatinine and urinalysis.
19.7. Pancreatic Injuries

19.7.1. Investigations / Imaging

- CT scan is the diagnostic modality of choice
- Raised amylase is suggestive of but not diagnostic of pancreatic injury

19.7.2. Principles

- Transfer all pancreatic injuries to the RIE
- Strategies include:
  - Operative
  - NOM
  - Drainage
  - Suture repair
  - Resection for major injuries.
  - Endoscopic stenting
- In damage control situations perform drainage only.

19.7.3. Management

Grade I/II injuries (no ductal involvement seen on CT)

- 1st Line is NOM
- Evaluate further with MRCP/ERCP as this may change the grade/management
- If diagnosed at laparotomy use non-resectional management:
  - pancreatography, drainage or no drainage

Grade III/IV (any ductal involvement)

- Operative management has fewer complications than NOM and is recommended.
- If diagnosed at laparotomy undertake resection (drainage if damage control)

Octreotide is not recommended as postoperative prophylaxis to prevent fistula.
19.7.4. Pancreatic Trauma Algorithm

**Presentation**
- Trauma event
- ATLS protocol
- Trauma CT
- Isolated, "low-energy" mechanism
- Suspected/delayed presentation of occult abdominal injury
- ±US/CT

**Compromised physiology**

**Diagnosis**
- Suspected pancreatic injury ± ductal injury
- MRCP ± ERCP

**Severity**
- Ductal injury present
- NO ductal injury

**High Grade**
- Damage control
- Drainage only
- Surgical resection (failure)
- Late reconstruction
- Symptomatic care: Pain management, Early enteral feeding, Mobilisation

**Low Grade**
- ERCP
- Stent
- ±drain

**Treatment**
- Operative
- Minimally invasive
- Non-operative
19.8. Ureteral Injuries

19.8.1. Background

Gun shot wounds and RTCs are the commonest mechanism of injuries

19.8.2. Diagnosis

- The diagnosis is often delayed
- Haematuria is an unreliable finding
- Suspect if extravasation of contrast on CT
- Should be considered and looked for during laparotomy for other injuries

19.8.3. Further Imaging

The following features on CT warrant discussion with a urologist and consideration of retrograde/antegrade urography:

- Hydronephrosis
- Ascites
- Urinoma
- Mild ureteral dilation

19.8.4. Management

Acutely

- Perform immediate repair in stable patients with acute injuries
- In damage control ligate the ureter and divert urine (usually by nephrostomy)

Delayed Diagnosis

- Nephrostomy +/- Stent (Retrograde stenting is usually unsuccessful)
20. Severe Pelvic Fracture

20.1. Key Questions

1. Is the patient haemodynamically stable?
2. Is the pelvic fracture mechanically stable?
3. Are there other sites of bleeding including chest and abdomen?
4. Is the fracture open? (perineum, rectum, vagina)

20.2. Principles

Mortality of up to 35% is reported with pelvic bleeding. Haemorrhage control should be achieved within 60 minutes of the patient’s arrival.

The majority of haemorrhage (>70%) is venous and can be controlled by:

1. Minimising patient movement
2. A pelvic binder applied over the greater trochanters
3. Binding the knees and ankles together
4. The principles of damage control resuscitation.

Arterial bleeding is controlled by four methods:

1. Embolisation
2. Extra-peritoneal Pelvic Packing
3. Thoracotomy with Aortic Cross Clamping
4. Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) – Currently unavailable in SE Scotland

20.3. Log-Rolling

- DO NOT log roll before imaging unless:
  - An occult penetrating injury is suspected in an unstable patient
  - It is required to clear the airway
- Log rolling can disrupt clot and cause haemodynamic instability.
20.4. Transfer

Transfer to the MTC patients with:

1. haemodynamic instability from a pelvic or acetabular fracture - immediately
2. A failed closed reduction of a native hip joint, where local expertise is unavailable - immediately
3. Pelvic and acetabular fractures who require specialist pelvic reconstruction - <24 hrs from injury

20.5. Imaging

20.5.1. X-Ray

X-ray is Indicated In the Following:

1. Code Red patients
2. Low Energy (Suspected pelvic fractures)

20.5.2. eFAST

eFAST is used in pelvic fracture patients deemed too unstable for CT.

- A positive FAST mandates a laparotomy followed by EPP.
- A negative or equivocal FAST suggests EPP first followed by laparotomy.

20.5.3. CT

Use CT for suspected high-energy pelvic fractures
20.6. Embolisation

The absence of extravasation does not exclude pelvic haemorrhage. Consider repeat three phase CT if clinical signs of ongoing bleeding.

**Indications:**

- Active extravasation and hemodynamic instability and no indication for laparotomy
- Active extravasation in patients aged>60 with open book, butterfly or pelvic shear fractures, regardless of haemodynamic stability
- Active extravasation regardless of haemodynamically stability, especially in the elderly.

**Relative Indications:**

1. Active extravasation regardless of haemodynamic stability, especially in the elderly
2. Pelvic haematoma >500ml

20.7. Surgery and Extra-peritoneal Pelvic Packing (EPP)

The pelvic binder should remain on during laparotomy and EPP if a laparotomy is required perform this first a pelvic retroperitoneal zone III injury from blunt trauma should not be explored from within the abdomen.

Extra-Peritoneal Packing from a supra-pubic incision is indicated in the following patients:

1. Patients who require a laparotomy for abdominal injuries
2. Patients in extremis (sustained SBP<70mmHg)
3. Patients in whom IR is not available within 30 minutes
4. Persisting bleeding after embolisation

20.8. Pelvic Binders

Pelvic Binders are a resuscitation aid and should be removed once resuscitation is complete in patients who are normothermic with no further bleeding and normal coagulation. This is usually within 24 hours of admission.
20.9. Mechanically Unstable Pelvic Fractures Requiring Fixation

20.9.1. External Fixation

Consider external fixation in patients undergoing laparotomy and/or EPP with deranged physiology and those receiving damage control surgery only after discussion with a specialist pelvic surgeon.

20.9.2. Internal fixation

Should be performed within 24 hours in patients in stable patients without deranged physiology Patients with deranged physiology should have and definitive fixation delayed.

20.10. Open Pelvic Fractures

The lower abdomen, groin, buttocks, perineum, anus, rectum and vagina must be examined in all cases for wounds. This can be performed intra-operatively or after imaging as appropriate.

A positive PR exam for blood mandates a proctoscopy.
A positive PV exam for blood mandates a colposcopy.

Debridement should occur:

- Immediately if contaminated with agriculture, aquatic or sewage material
- Within 12 hours if high energy
- Within 24 hours if low energy

Wounds to the anus and rectum, and some buttock and perineum wounds often require a defunctioning stoma and general surgery input. The principle of which are

- Consider each case carefully on own merits with regard to need and timing
- Do not perform during damage control
- Obtain consent where possible
- May be created laparoscopically for a defunctioning colostomy after distal injury
- It should be sited in the upper abdomen remote form the site of pelvic fixation
- Rectum/colon injuries from pelvic fractures should be treated with resection or repair, defunctioning stoma and irrigation of the distal bowel segment and pelvic drainage.
20.11. Algorithm for Suspected Pelvic Fractures

Suspected Pelvic fractures

- Manage as appropriate
  - Pelvic or acetabular fracture requiring pelvic surgery
    - Transfer to MTC within 24hrs.
  - Any of the following?
    - Active arterial extravasation AND either
      - Haemodynamic instability OR
      - Age >60
    - Pelvic haematoma >500ml

- XR if low energy CT if high energy

- Indication for laparotomy?
  - CT

- Hemodynamically stable
  - No
    - No
      - Consider Embolisation
    - Yes
      - Signs of ongoing bleeding post AE
      - Yes
        - Extraperitoneal Pelvic Packing +/- Laparotomy
      - No
        - Yes
          - FAST
          - Negative or equivocal

PELVIC BINDERS SHOULD IDEALLY BE REMOVED WITHIN 24 HOURS IN ALL PATIENTS.
THE BINDER IS REMOVED IN STABLE PATIENTS WITH NORMAL COAGULATION.
A CORRECTLY PLACED PELVIC BINDER DOES NOT OBSTRUCT LAPAROTOMY/PACKING
REPEAT PELVIC X-RAY AFTER BINDER REMOVAL IN HIGH ENERGY POLYTRAUMA PATIENTS EVEN IF CT NORMAL

Suspect & manage Bladder & Urethral injuries as per local Urology trauma guidelines.
Examine genitalia, anus and perineum in all patients. Blood on PR mandates proctoscopy. Open pelvic fractures should be managed as per local open fracture guidelines and consider defunctioning colostomy as per BOAST 3 guidelines

Do not log roll before imaging unless vomiting or occult penetrating injury.
Control haemorrhage within 60 minutes of arrival.
Repeat CT if signs of ongoing bleeding.
21. Bladder, Urethra and Genital Injuries

21.1. Bladder Trauma

21.1.1. Classification

1. Intra-peritoneal (50%) – direct blow or sudden increase in abdominal pressure
2. Extraperitoneal (40%) – usually form a pelvic fracture
3. Combined

21.1.2. Background

- RTCs, and falls from height cause most bladder injuries.
- 75% of patients with bladder injuries have a pelvic fracture
- 55% of patients with a bladder injury have abdominal injuries.
- 13% of patients with a bladder injury will have a urethral injury
- 4% of patients with pelvic fractures will have a bladder injury

21.1.3. Imaging

Perform a CT cystogram in the following scenarios:

- Frank Haematuria and any Pelvic fracture
- Microscopic haematuria with
  - >1cm displacement disruption of the pelvic ring or
  - >1cm pubic symphysis diastasis
- Inability to void or inadequate urine output
- Abdominal tenderness or distension due to urinary ascites or signs of urinary ascites on imaging
- Uraemia and elevated creatinine due to intraperitoneal reabsorption
- Suspected penetrating trauma

Cystography must be performed using 300-350ml of dilute contrast to fill the bladder
21.1.4. Management

**Conservative:**

Extraperitoneal injuries are often managed conservatively with a urinary catheter and antibiotic prophylaxis

**Surgery:**

*Surgery* should be performed in the following patients:

1.1 Extraperitoneal Injuries AND:
   - Bladder neck involvement
   - Bone fragment in bladder wall
   - Rectal or vaginal injury
   - Entrapment of the bladder wall
   - Patients undergoing ORIF for a pelvic fracture
   - Patients undergoing a laparotomy for other injuries
2.1 All intraperitoneal injuries
3.1 All penetrating injuries (unless minor and isolated extraperitoneal)

21.1.5. Follow-up

Perform cystography in patients managed conservatively 10 days after injury

Patients who underwent surgery can have the catheter removed after 5-10 days without the need for cystography unless complex injury or risk of impaired healing
21.2. Urethral Injuries

21.2.1. Types

- Posterior male urethral injuries are usually caused as a result of pelvic fracture.
- Anterior male urethral injuries are usually as a result of straddle injury, RTC perineal injury or penile fracture
- Female urethral injuries are usually from pelvic fractures associated with vaginal lacerations.

21.2.2. Signs

- Blood at urethral meatus
- Urinary retention
- Haematuria
- Dysuria
- Scrotal/penile/perineal/labial swelling & bruising
- Inability/difficulty to catheterise

21.2.3. Surgery

Surgery is indicated immediately in penetrating urethral injuries and in injuries involving the bladder neck, the rectum or bony fragment impingement on the urethra.

The European Association of Urology has published guidelines on bladder, urethra and genital injuries. (Click here)
21.3. Genital Injuries

Usually occur as a result of blunt, penetrating and sporting injuries

21.3.1. Assessment

- Male + haematuria: Perform retrograde urethrogram
- Female + haematuria: Perform cystoscopy
- Female + blood in vagina: Speculum examination

21.3.2. Penile Injuries

- A fractured penis requires surgical repair
- Penetrating injuries required debridement/soft tissue cover
- Amputations should be saline washed and saline gauze wrapped in a plastic bag on ice for surgery within 24 hours

21.3.3. Scrotal Injuries

- Look for testicular dislocation which requires replacement & orchidopexy
- A Haematocoele 3x size of other testicle requires surgery
- Pain, nausea, vomiting, tender, bruised & swollen may suggest rupture which often requires surgery due to poor sensitivity of USS Doppler
- Explore all penetrating scrotal injuries and administer antibiotics

21.3.4. Vaginal Injuries

- Suture lacerations under local anaesthetic
- Vulvar injuries require exploration under GA and cystoscopy to exclude urethral injury
22. Traumatic Brain Injury

22.1. Background

Head injury is the commonest cause of death & disability in people aged 1-40 years in the UK. Twenty percent of admitted patients have evidence of a fracture or brain injury. 1 in 500 Emergency Department (ED) attendances for head injury result in death. The majority of deaths occur in the 5% of patients who present to the ED with a GCS <13.

The South East Scotland Trauma Network utilises the NICE guidelines for Head injury. A Summary of which follows in this document:

22.1.1. Definitions

**Head Injury**: trauma to the head other than superficial injuries to the face.

**Focal Neurological deficit** – any of the following:

- Difficulties with understanding, speaking, reading or writing
- Decreased sensation
- Loss of balance
- General weakness
- Visual changes

*Head Injury is the commonest cause of death and disability in people aged 1-40 years in the UK*
• Abnormal reflexes
• Problems walking

**High Energy head injury** – any of the following:

• Pedestrian vs. car
• Occupant ejected from motor vehicle
• Fall >1m or >5 stairs
• Diving accident
• High-speed Motor vehicle collision (MVC)
• Rollover motor accident
• Accident involving motorised recreational vehicles
• Bicycle collision
• Any other potentially high-energy mechanism

**Base of skull fracture signs** – any of the following:

• Clear fluid running from the ears or nose
• Black eye with no associated damage around the eyes
• Bleeding from one or both ears
• Bruising behind one or both ears

**Open or depressed skull fracture or penetrating head injury signs:**

• Penetrating injury signs,
• Visible trauma to the scalp or skull of concern to the professional.

### 22.1.2. Assessments in the ED

**Prioritise <C>ABC**

Clarify potential coagulopathy/thrombocytopenia early.

**Assess GCS:**

• Do not ascribe depressed consciousness to intoxication until a head injury has been excluded.
• Assess all patients GCS<15 immediately for CT
• Assess all GCS 15 patients within 15 minutes of arrival for CT
• Patients with a GCS<9 should have early anaesthetic involvement
Re-assessment:

- Patients who do not initially require a CT scan should be reassessed within an hour of the first assessment

Re-attenders:

- Patients who have previously attended the ED for a head injury and return within 48 hours should be seen / discussed with a senior clinician and strong consideration should be given to performing a CT scan.

22.1.3. Further Management

Pain management – pain can rise intracranial pressure. Treat with:

1. Reassurance
2. Splintage of limb fractures
3. Urinary catheterisation of a full bladder
4. Titrate intravenous opioids

Safeguarding issues – Documents any concerns and follow age appropriate safeguarding procedures.

Head injury proforma – A standardised head injury proforma and observation chart should be used when assessing and observing patients with a head injury (Please refer to the Head Injury Proforma)

22.1.4. Imaging

When CT is unavailable - transfer all patients with a GCS<15 immediately to a centre with CT capability. Patients with a GCS 15 can be admitted overnight for observation with clear arrangements for urgent transfer if there is deterioration.

Perform a CT within 1 hour of any of the following risk factors being identified:

- GCS<13 on initial assessment in the ED
- GCS<15 at 2 hours after the injury on assessment in the ED
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture

CT Reporting – A Written report should be available within 1 hour of the scan being performed for all patients.
• Post-traumatic seizure (CT immediately if delayed)
• Focal Neurological deficit
• >1 episode of vomiting

*Perform a CT within 8 hours of the head injury if there has been some loss of consciousness or amnesia and:*

1. Age ≥ 65 years old
2. Any history of bleeding or clotting disorders
3. Dangerous mechanism of injury:
   a. Pedestrian or cyclist struck by a motor vehicle
   b. Occupant ejected from a motor vehicle
   c. Fall from a height >1m or >5stairs
4. >30 minutes retrograde amnesia of events immediately before the head injury

*Perform a CT scan within 8 hours of injury for all patients on warfarin, even in the absence of any other symptoms.*

**22.2. Cervical Spine Injury**

Assess all patients with a head injury for the possibility of cervical spine injury. See separate Spinal Injury guideline for further details

**22.3. Involving Neurosurgery**

Discuss all of the following with a neurosurgeon:

1. New, surgically significant abnormalities on CT
2. Persisting GCS 8 or less after initial resuscitation
3. Unexplained confusion which persists for >4 hours
4. Deterioration in GCS after admission (especially motor response)
5. Progressive focal neurological signs
6. A seizure without full recovery
7. Definite or suspected penetrating injury
8. CSF leak

**22.4. Information and Support for Families and Carers**

• Introductions: Staff should introduce themselves to family and carers and explain what they are doing.
• ED information sheets: All EDs should have information available about head injury management.
• Ensure there is a board/area displaying leaflets or contact details for patient support organisations either locally or nationally.
22.5. Transfer to the MTC

22.5.1. Indications for transfer

Transfer all patients with a GCS 8 or less irrespective of the need for neurosurgery.

22.5.2. Indications for intubation prior to transfer:

- GCS <9
- Loss of protective laryngeal reflexes
- Hypoxaemia (PaO2 <13kPa on oxygen)
- Hypercarbia (PaCO2 >6kPa)
- Spontaneous hyperventilation (PaCO2 <4kPa)
- Irregular respirations
- A deterioration of 1 point or more on the motor score
- Unstable facial fractures
- Copious bleeding into mouth (e.g. from BOS fracture)
- Seizures
- Brain injury with likely progression and deterioration.

22.5.3. Preventing Secondary Brain injury:

- PaO2 >13 kPa.
- PaCO2 4.5 -5.0 KPa
- Only temporarily hyperventilate to treat signs of raised intracranial pressure. Increase Fio2 during hyperventilation.
- MAP ≥ 80mmHg with volume or vasopressor as indicated.
22.6. Admission

22.6.1. Indication for admission:

- New clinically significant abnormality on CT
- GCS<15
- Indication for CT scanning but CT scan unavailable or patient not cooperative
- Continuing worrying signs (e.g. persistent vomiting, Severe headache)
- Other concerns (drug/alcohol intoxication, meningism, CSF leak)

22.6.2. Admitting team

Admit under a team led by a consultant who has been trained in head injury management (defined by local agreement) (Link to the regional TBI admission policy)

22.7. Observation of Admitted Patients

22.7.1. Observations

The minimum observations are:

- GCS
- Pupil size and reactivity
- Limb movements
- Respiratory Rate
- Heart Rate
- Blood Pressure
- Temperature
- SpO2

22.7.2. Frequency of observations if GCS<15 at any time

- Every 30 minutes

22.7.3. Frequency of observations if GCS 15 on presentation in ED

- Every 30 minutes for 2 hours
- Then hourly for 4 hours
• Then every 2 hours

22.8. Escalation Procedure (Ideally agreed between two members of nursing staff)

22.8.1. Escalation Criteria

• Call the supervising Dr if there is any of the following:
  • New agitation or abnormal behaviour
  • Sustained (30 minutes) drop of 1 point in GCS (especially if motor)
  • Any drop of 3 points in E or V score
  • Any drop of 2 points in M score
  • New severe or increasing headache
  • New persisting vomiting
  • New neurological symptoms or signs e.g. pupil inequality, asymmetry of facial or limb movement

22.8.2. Repeat CT

The Dr should arrange an immediate CT scan if the escalation criteria are confirmed on assessment.

22.8.3. Further Head imaging after 24 hours

Patients who remain GCS <15 after 24 hours observation should be considered for a repeat CT or MRI even if the first CT was normal.

22.9. Discharge

22.9.1. Discharge from the ED

The patient must meet all of the following criteria:

• Normal CT or CT not indicated
• GCS 15
• Somebody at home to supervise or nobody at home but suitable supervision arranged or risk of late complication deemed negligible
• No other indication for admission:
  o Drug or alcohol intoxication
  o Other injuries
  o Shock
  o Meningism
22.9.2. Discharge following admission

Patients can be discharged once all significant symptoms have resolved and they have suitable supervision arrangements.

22.9.3. Discharge advice

Give verbal and printed discharge advice for all patients who are discharged.

22.9.4. Drug and Alcohol liaison

Offer information on alcohol and drug misuse to patients in whom this was an issue.

22.9.5. Follow up

Patients with persisting problems following a head injury should be referred from their GP to XXXXXX

22.10. Ongoing Management of Severe TBI

22.10.1. Early Care and Prevention of Secondary Brain Injury

- Head elevation 30 degrees.
- Tape ETT.
- Hb > 90
- Correct coagulopathy (APTT/PT < 1.5, Platelets > 100)
- Use 0.9% Saline or Plasmalyte 148 if crystalloid is required
- Normoventilation with PaCO2 4.5-5 KPa and PaO2 > 13.
- Only use prophylactic hyperventilation as a temporising measure in the setting of suspected herniation
- Administer antibiotics if penetrating injury, open skull fracture or pre-operative.
- Maintain glycaemic control, avoiding hypoglycaemia
- Avoid Steroids
• Maintain MAP > 80mmHg
• Avoid SBP ≤ 90mmHg at all times.
• Maintain normothermia.

22.10.2. Maintenance of Anaesthesia During Transfer

• Propofol is preferred for sedation
• Atracurium is preferred for paralysis
• Intermittent or continuous narcotics can be utilised
• Monitor pupil size and reactivity every 30 minutes.

22.10.3. Indications for ICP Monitor

All patients deemed salvageable with a GCS<9 and either:

• Abnormal CT and:
  o Haematoma
  o Contusion
  o Swelling
  o Herniation
  o Compressed basal cisterns or
• Normal CT with any 2 of the following:
  o Age>40
  o Unilateral or bilateral posturing
  o SBP<90mmHg

22.10.4. ICP Options

• Parenchymal ICP monitor
• External Ventricular drain
• Licox ICP / PbO2 monitor

22.10.5. ICP Targets

• ICP ≤20mmHg
• A combination of ICP values and CT findings may be used to make management decisions on ICP treatment thresholds

22.10.6. CPP Targets
• CPP 60-70mmHg
• Avoid aggressive attempts to maintain CPP >70mmHg with fluids and pressors unless directed by Pbo2 targets.

22.10.7. **Treatment of Intracranial Hypertension**

Treatment of known or suspected intracranial hypertension qremains a cornerstone in patients with severe brain injury. Patients with intracranial hypertension should receive the following treatments.

22.10.8. **Whilst Awaiting ICP Monitor Placement**

**1st Line:** 250ml bolus of 3% Hypertonic Saline over 10-15mins (ideally via a central line)

**2nd Line:** 1g/kg Mannitol (5ml/kg of 20% Mannitol) bolus

Replace Urine output with crystalloid. Avoid Mannitol in hypotensive or under-resuscitated patients.

22.10.9. **Once ICP Monitor Placed**

Please refer to the [Treatment of Intracranial Pressure in Adults Document](#)

**Other Measures:**

- Avoid and treat hyperthermia
- Elevate head of bed to 30-45 degrees. Use reverse trendelenburg if spinal injury.
- Gastric Ulcer prevention
- Enteral nutrition should be achieved by at least day 5 and at most day 7.
- Commence VTE prophylaxis early (48-72hrs) if the brain injury is stable and the benefit outweighs the risk
- Licox monitoring should ideally be placed aiming for a Pb)2 >20mmHg
- Early Tracheostomy is recommended when overall benefit is felt to outweigh complications.
- Commence antibiotics and vaccinations where appropriate if: penetrating injury, open fracture or pre-surgery
- CSF leaks do not require antibiotics but will require pneumococcal, Meningitis and HiB vaccines.
22.11. Neurosurgical Intervention

Quality Standards

- The registrar should discuss all neurosurgical referrals with the consultant and clearly document this
- All decisions to perform neurosurgery are discussed with a consultant
- Surgery is performed within one hour of arrival

Consideration should be given to emergency evacuation of intracranial haemorrhages if there is significant local or generalised mass effect and patient is at risk of clinical deterioration and/or death. Small or moderate Haematomas can be scheduled urgently on CEPOD if they have normal conscious level but severe headache. They would need to be observed in a critical care environment with 30 minute observations.

Paediatrics

The Paediatric dose for hypertonic saline is 3ml/kg

Strength - 2.7% - Commonly referred to as 3% Sodium Chloride.
22.12. Imaging for Children <16 with a Head Injury

22.12.1. Purpose

To provide guidance on appropriate radiological imaging in children & young people with a head injury.

22.12.2. Scope

All clinicians caring for children & young people aged < 16yrs who present within 72 hours of a head injury.

22.12.3. Definitions

Head injury is any injury to the head.

22.12.4. Roles and Responsibilities

The assessing clinician and radiology staff should determine the need for imaging as indicated in this guideline and should ensure any request complies with IRMER regulations.

22.12.5. Main Content

Most children who present with a head injury will not require any imaging. This guideline provides indications for imaging the small number of children who are at risk of associated brain injury / complications.

Plain x-rays (i.e SXR) is not routinely indicated in children with head injury

CT scanning should be performed if, after discussion with a senior ED clinician (ideally consultant) there is:

- Suspicion of non-accidental injury
- Clinical evidence of base of skull fracture
- Any new focal neurological deficit
- A reduced conscious level (aged over 1yr: GCS <14 at presentation, or < 15 after 2 hrs; aged under 1yr GCS <15 at presentation)
- A suspected open fracture, penetrating brain injury or tense fontanelle
- A bruise, swelling or laceration of more than 5 cm on the head and the child is aged under 1 year
- A bleeding disorder or anticoagulation with any neurological symptoms / signs

Children with the following should be discussed with senior ED clinician (ideally consultant), observed for 2-4 hrs and a CT performed if any deterioration / failure to improve / ongoing concern:
Loss of consciousness lasting more than 5 minutes (witnessed).
Abnormal drowsiness
Persistent vomiting
Significant mechanism of injury (e.g. high energy RTA, fall >3m)
Amnesia (anterograde or retrograde) lasting more than 5 minutes
Bleeding disorder or anticoagulation with no neurological concerns (must be discussed with haematology team – may need longer period of observation)

Any child with an abnormal CT scan, or persisting decreased conscious level or persisting focal neurology should be discussed with the on-call neurosurgical team (via switchboard)
23. Blunt Cerebrovascular Injury (BCVI)

BCVI will not be seen on initial CT scans unless specifically requested. Up to 20% will be missed with stroke being the most devastating consequence.

23.1. Extended Denver Criteria

Extended Denver criteria for blunt cervical vascular injury

<table>
<thead>
<tr>
<th>Signs/Symptoms</th>
<th>Risk Factors (High energy mechanism AND)</th>
</tr>
</thead>
</table>
| - Arterial haemorrhage from neck, nose or mouth | - Le Fort II or III facial fracture  
- Mandible fracture  
- Complex skull/BOS/occipital condyle fracture |
| - Cervical Bruit (<50yr old)             |                                                                                                          |
| - Expanding cervical haematoma           |                                                                                                          |
| - Focal Neurology (TIA, hemiparesis, posterior symptoms, Horners) | - Severe TBI with GCS <6  
- Unstable C-Spine fracture |
| - Neurological deficit inconsistent with CT head | - Near hanging with anoxic brain injury |
| - Stroke on CT/MRI                       | - Clothesline/seat belt injury with significant swelling/pain or reduced GCS  
- TBI with thoracic injuries  
- Thoracic vascular injuries  
- Scalp degloving  
- Upper rib fractures  
- Blunt cardiac rupture |

23.2. Grades of Injury

- Grade I (intimal injury <25% narrowing)  
- Grade II (dissection or intramural haematoma >25%)  
- Grade III (pseudoaneurysm)  
- Grade IV (occlusion)  
- Grade V (transection with extravasation)
23.3. Management

- Surgery is indicated for Grade II, III, IV & V injuries that are surgically accessible
- Endovascular treatment for Grade V injuries that are not surgically accessible
- Treat Grade I injuries and Grade II, III, IV and V injuries not undergoing surgical intervention with Aspirin (or heparin) and repeat CTA in 7-10 days
- If Repeat CTA shows a healed injury stop treatment otherwise continue treatment for 3-6 months and re-image.
24. Craniofacial Trauma

24.1. General Considerations:

The facial skeleton acts as a crash bag to protect the brain and may be associated with less obvious spinal injury. Bleeding is usually self limiting except posterior nasal bleeding. ATLS priorities apply to which the prevention of avoidable blindness is the other most specific concern. All other aspects can be immediately transferred to OMFS.

24.2. Craniofacial Trauma is Common and Airway is At Risk

- ATLS principles apply
- Comminuted fractures to the anterior mandible will reduce the ability of a conscious patient to maintain an airway if supine.
- Bleeding obstructing the airway is usually nasopharyngeal or midfacial and may be associated with a base of skull fracture or comminuted midface. In a conscious patient nasal packs are required, commonly the patient is unconscious and manual occlusion can be achieved by compressing the soft palate and nose.
- If the maxilla is unstable packing will be less effective there for it must be stabilised, manually, with bite blocks or by temporary plate fixation (by OMFS). The patient will require a GA and prompt OMFS treatment
- Tranexamic Acid 1g bolus is helpful.

24.3. Severe Haemorrhage (uncommon)

Compression packs. Adjuncts, urinary catheters via the nose can be used to retain nasal packs with balloon compression posteriorly. There are various products – e.g. rapid rhino. Note these require a stable maxilla.

24.4. Prevention of Avoidable Blindness

- Retrobulbar Haemorrhage in a conscious patient is excruciating and obvious, it requires immediate lateral canthotomy. In an unconscious patient must be considered in craniofacial trauma and is evident by a tense proptosed eye, compared with the other side.
- Lateral canthotomy is a simple intervention and you are unlikely to cause harm if you follow these principles.
- ED immediate lateral canthotomy (request assistance of OMFS or Ophthalmology if time permits) LA via skin 2mls of your usual LA, skip if the patient is unconscious.
- Incise the lateral canthus skin from canthus 45 degrees infero laterally boldly for 1cm to bone, compress the bleeding edges with a gauze square.
Compress the globe medially, staying on the orbital wall. Dissect with surgical scissors to cut all the structures that attach the globe to the lateral orbital wall, they are just above the height of the skin canthus and within 1cm of the orbital rim. (There is no significant nerves or vessels on the wall)

- You can confirm completion by feeling the globe move medially without tethering to the lateral wall.
- Bipolar any bleeding at the skin edge.
- If cornea unprotected due to skin loss cover with eye shields then eye pads.
25. Open Fractures

25.1. Background

Open fractures require timely multidisciplinary management and significant morbidity can occur as a result of infection. This guideline applies to all long bone, hind foot and mid-foot open fractures. This guideline does not apply to open fractures of the hand, wrist, forefoot or digit.

25.2. Management in the ED

- Do not irrigate
- Photograph open fracture wounds when they are first exposed, before debridement (Keep in patient record, in line with information governance policy)
- Assess nerve and nerve function. Document the following using MRC grading system where applicable:
  - Time of assessment
  - Sensation
  - Motor function (using MRC grades 0-5)
  - Pulses (if not accessible document how circulation has been assessed)
  - Reassessment of the above (especially after reduction/splintage)
- Re-align and splint the limb
- Cover with a saline-soaked dressing covered with an occlusive layer
- Give 1.5g Cefuroxime within 60 minutes (& metronidazole 500mg if contused/dirty/acquatic)
- Give 500IU tetanus immunoglobulin if wound contaminated with soil/manure or has extensive devitalised tissue. Check tetanus status for all other patients.
- Involve Orthopaedics and plastics/transfer to MTC.
- Extend the WBCT to include the limbs and provide angiography where clinically indicated
- Manage compartment syndrome in line with separate guidelines.

25.3. Emergency Amputation

Paediatrics

The dose of cefuroxime (IV) for children is 50mg/kg up to a maximum of 1.5g.
Perform an emergency amputation in the following three scenarios:

1. The limb is the source of uncontrollable life threatening haemorrhage
2. The limb is salvageable but attempted preservation would pose an unacceptable risk to life.
3. The limb is deemed unsalvageable after review by a consultant Orthopaedic and Plastic surgeon.

25.4. Debridement, Fixation and Definitive Cover

- All the above should be performed concurrently by an orthopaedic and plastics consultant
- Debridement should occur in the following timescales:
  - IMMEDIATELY if highly contaminated (agricultural, aquatic, sewage) or vascular compromise
  - WITHIN 12 HOURS OF INJURY if high energy
  - WITHIN 24 HOURS OF INJURY if low energy
- Perform fixation and definitive soft tissue cover at the same time as debridement. If this is not possible then consider negative pressure wound therapy and perform internal fixation and soft tissue cover WITHIN 72 HOURS of injury.
- Internal fixation and definitive soft tissue cover should usually occur at the same time.

25.5. Limb Salvage or Delayed Primary Amputation

Do not base this decision on an injury severity tool score. If indicated a delayed primary amputation should occur within 72 hours of the injury and after assessments and discussions involving the patient, family, carers, an orthopaedic surgeon, plastic surgeon and rehabilitation specialist.
26. Other Fractures

26.1. Femur Fractures

All femur fractures should undergo definitive fixation early once the patient has been fully resuscitated.

26.2. Complex Single Limb Trauma

Transfer complex single limb fractures e.g. Pilon, Plateau to the MTC where local expertise is not available.
27. Compartment Syndrome

27.1. Background

Acute compartment syndrome (CS) of a limb is due to raised pressure within a closed fascia compartment causing local tissue ischaemia and hypoxia.

27.2. Commonest Causes

CS can occur in any muscle compartment, most commonly the lower leg and forearm.

- Tibia fractures – up to 48 hours after injury
- Tibia fractures – up to 48 hours after fixation
- Forearm fractures
- High energy wrist fractures
- Crush injuries
- Reperfusion to ischaemic limbs
- Prolonged immobilisation or a ‘long lie’
- Restrictive dressings/casts

27.3. Pitfalls

**Pulses** - Pulses are normally present in CS. Absent pulses are usually due to:

- Systemic hypotension
- Arterial occlusion
- Vascular injury

**Palpably tense compartments** may suggest CS but its absence does not rule out CS; this clinical finding is also highly subjective.

**Open fractures** even with traumatic fasciotomy open tibia fractures have higher rates of CS than closed fractures.

**Regional anaesthesia and analgesia** – Avoid where possible in patients at high risk for compartment syndrome.

**Foot CS** – There is no consensus on management.

Please also refer to the British Orthopaedic Association’s guidelines on management of open fractures in Trauma Patients (Click [here](#)).

Early diagnosis and treatment is vital to avoid severe disability as a result of compartment syndrome. The commonest error is failure to diagnose early.
27.4. Clinical Symptoms / Signs

The cardinal features of compartment syndrome are:

- Pain out of proportion to the associated injury
- Pain on passive movement of the muscles within the affected compartment.

Pain may be difficult to assess in patients with fractures. Clinicians should be alerted to any paraesthesia / reduced sensation in the distribution of nerves within the affected compartment.

27.5. Pain Assessment

- Assess pain scores hourly for all patients. Considering the amount of opiates used and the response to opiates.
- Seek immediate senior orthopaedic opinion (ST4+) if any of the following:
  - Pain scores not improving
  - Increasing opiate use
  - Poor response to opiates

27.6. Documentation

Please see the Acute Limb Compartment Observation Chart (Appendix 8).

As well as pain also document the following hourly:

- Neurology
- Capillary Refill Time
- Peripheral pulses
- Compartment pressures (when a compartment monitor has been placed)

None of these findings contribute to early diagnosis
27.7. Management of Suspected Compartment Syndrome

27.7.1. Initial Management

1. Remove all circumferential dressings to skin
2. Elevate limb to heart level
3. Maintain a normal blood pressure
4. Re-assess after 30 minutes

27.7.2. Re-assessment at 30 minutes

If clinical signs/symptoms persist there are two options:

1. Immediate surgical decompression or
2. Placement of a compartment monitor if not already in place or if the clinician is not convinced by clinical signs/symptoms.

27.8. Compartment Monitors

Indications - Place a compartment monitor into the compartment of concern in patients with high-risk features and the following:

- Reduced level of consciousness / clinical assessment unreliable
- Regional anaesthesia has been performed
- ST4+ not convinced by clinical signs/symptoms.

In the MTC we place a compartment monitor routinely in all Tibial fractures and any other injury where there is clinical suspicion of a compartment syndrome.

27.9. Surgical Decompression

Indications:

- A clear clinical diagnosis.
  A Compartment Perfusion Pressure <30mmHg (Diastolic blood pressure-compartment pressure) is highly suggestive of the need for surgery and only a Consultant may decide to continue monitoring in this situation.
- A compartment pressure >40mmHg with symptoms also requires senior review.
Contra-indications:

- CS > 12 hours of warm ischaemia with nonviable muscle should not routinely undergo fasciotomy. The role of amputation is unclear in this situation and aggressive medical management should be instituted.

27.10. Surgery

Timing - Compartment syndrome is a surgical emergency and surgery should occur within 1 hour of the decision to operate.

Early Plastics involvement – Consider involving a plastic surgeon as soon as the decision to operate is made. Open fascial decompression of all involved compartments, taking into account possible reconstructive options.

Procedure - Excise all necrotic muscle. Document the compartments decompressed.

Lower leg fasciotomies – Perform a two-incision four-compartment decompression

Incomplete lower leg fasciotomies cause significant morbidity. The common reasons are:

- Identification of the septum dividing the anterior and lateral compartments. This can be avoided by making an initial transverse incision in the fascia overlying the septum, then deliberately opening the anterior and lateral compartments separately, creating a so-called “H” incision.
- Incomplete development of the deep posterior compartment release by not deliberately taking the soleus muscle fibres off the posterior tibia. If performed correctly, the neurovascular bundle should be exposed in a fully decompressed deep posterior compartment.
- Fascial incisions are too short and do not cover the entire extent of the fascial compartment, either at the knee or ankle levels.

Re-look – Re-explore at 48 hours (or earlier if indicated)
28. Vascular Trauma Associated with Fractures / Dislocations

28.1. Background

Fast and accurate diagnosis is paramount if limb salvage is to be successful. Early Orthopaedic and Vascular consultant referral and intervention is usually indicated.

28.2. Management in the ED

- Treat life threatening injuries ideally in conjunction with limb threatening injuries
- Consider Code Red.
- Apply direct pressure or a tourniquet (as distal as possible) to control active haemorrhage
- Do not blindly clamp
- Document neurovascular examination
- Immediately re-align and reduce the pulseless deformed limb. Splint, reassess & image if appropriate
- Identify direct/indirect signs of injury

<table>
<thead>
<tr>
<th>Direct Signs</th>
<th>Indirect signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Pulsatile</td>
<td>i. Reduced or unequal pulse(s)</td>
</tr>
<tr>
<td>ii. Expanding</td>
<td>ii. Non-pulsatile haematoma</td>
</tr>
<tr>
<td>iii. Absent</td>
<td>iii. History of significant haemorrhage</td>
</tr>
<tr>
<td>iv. Palpable</td>
<td>iv. Injury in close proximity to neurovascular structures</td>
</tr>
<tr>
<td>thrill/bruit</td>
<td>v. Mechanism e.g.: Knee dislocation/displaced tibial plateau, groin contusion from handlebar or mangled extremity</td>
</tr>
<tr>
<td></td>
<td>vi. Paraesthesia</td>
</tr>
</tbody>
</table>

Do not use ‘pinkness’, capillary return or Doppler signal to exclude injury
28.3. Direct Signs

- Urgent surgical exploration is indicated
- Angiography should not delay revascularisation but may be considered if:
  - Multilevel injury
  - Peripheral vascular disease
  - Absent proximal pulse
  - Patient undergoing a WBCT for other indications and scan extended to include limb angiography.

28.4. Indirect Signs

- CT Angiography should be performed as soon as possible.

28.5. Surgery

- Orthopaedic and Vascular consultant should attend. Plastic Surgery should attend if open fracture
- Patients should be aware of the high risk of amputation for some injuries
- Two consultants should be involved in the decision to perform early amputation
- Beyond 3-4 hours, warm ischaemia results in irreversible tissue damage and an increasing risk of amputation. Risks of delayed revascularisation include myoglobinuria and may be associated with increased mortality. Access incisions should be planned to facilitate soft tissue coverage
- Vascular surgery ideally performed first
- Prioritise haemorrhage control and revascularisation. This may involve external fixation and temporary shunts.
- Repair of identified nerve injuries is subsequently performed (delay if damage control).
- Low threshold for post reperfusion fasciotomy.

Admit all patients to a critical care environment post operatively.
29. Penetrating Extremity Vascular Trauma

The Femoral and popliteal artery are the most commonly affected arteries

29.1. Management

1st Line Direct compression and elevation
2nd Line Tourniquet (document time)

Direct Signs

CTA is required if shotgun or skeletal injury. Take direct to theatre. If there is no significant delay and physiology permits consider CT angiography on route to theatre.

Indirect Signs

Perform CTA

29.2. Non-operative Management (NOM)

Asymptomatic nonocclusive arterial injuries may undergo NOM with subsequent repair if indicated

29.3. Surgery

- Temporary vascular shunts may be used in damage control scenarios
- Tibial vessels may be ligated if there is documented flow distally

29.4. IR

Embolisation of profunda branches or tibial vessels is acceptable

29.5. Compartment Syndrome

Apply fasciotomy liberally when there is an associated injury or there has been prolonged ischaemia. If not performed place a compartment monitor
30. Complex Peripheral Nerve Injury

30.1. Examination

- Examine the peripheral nervous system for all injuries and document findings.
- Repeat examination after any manipulation or surgery.

30.2. Management

- Reduce fractures/dislocations urgently if there is an associated nerve injury
- Refer the following for plastics opinion:
  - Laceration near a nerve
  - Laceration associated with a neurological deficit

30.3. Investigations

- Neurophysiology is rarely needed acutely and must not delay referral or treatment
- MRI can assist in surgical planning but is not essential and surgery should not be delayed to wait for the scan

30.4. Surgery

- Explore the nerve during internal fixation of fractures associated with nerve injury except axillary nerve (with low energy shoulder trauma) and Lumbosacral plexus injury (during sacroiliac screw fixation)
- Document exploration of the nerve in the notes and the proximity of the nerve to any internal fixation device
- Nerves damaged during surgery should undergo urgent repair
- If a divided nerve is found during surgery:
  - If skilled and able repair nerve
  - If not oppose nerve with fine coloured sutures & Refer

30.5. Post-surgery Complications

- If a new vascular or nerve deficit post surgery develops:
  - Loosen bandages
  - Split plaster of paris to the skin
  - Gentle repositioning of limb
  - Refer consultant if no improvement to consider re-exploration
- Explore painful post-operative paralysis urgently, it could be:
  - compartment syndrome
  - nerve compression from:
    - Bone fragments
    - Suture
    - Haematoma
    - Hardware
• Explore pain and progressive loss of sensation urgently as critical ischaemia is likely
31. Brachial Plexus Injuries

31.1. Background

Please also refer to the Brachial Plexus website.

There is a national brachial plexus injury service at the Victoria Infirmary, Glasgow that should be contacted within 48 hours of identification of injury or immediately if there is vascular injury or an open wound.

Risk Factors:

1. High speed RTC, especially motorcycle
2. Fracture or dislocation of shoulder, scapular or elbow
3. Open injury to neck, arm or upper quadrant of trunk
4. Arterial injury in upper limb
5. Traction injury to upper limb

Signs:

1. Swelling above and/or below the clavicle
2. Horner’s sign
3. Severe pain in upper limb
4. Paralysis
5. Sensory loss

Paediatrics

Paediatric Brachial Plexus Injuries should be referred to Plastics at RHCYP.

The Consultant Paediatric Hand Plastic Surgeon is Mr Wee Lam
32. Hand Trauma

32.1. Background

Hand injuries are common and may be missed in the assessment of the multiply injured patient. A thorough secondary and tertiary survey must be undertaken once life threatening injuries have been corrected.

32.2. History & Examination

- Mechanism of injury
- Time since injury
- Digits or parts of the hand and wrist injured
  - Open vs. closed injuries
  - Amputations
- Assessment of the following must be undertaken and documented
  - Vascularity of the hand and digits
  - Neurological status of the hand
  - Tendon function of flexors (FDS & FDP) and extensors
  - Bone injury – fractures, dislocations and ligament injuries

32.3. Investigations

- Radiographs of the affected areas
  - If a single digit – a PA and true lateral of the digit required
  - If a hand, request PA, oblique and lateral images
  - Wrist injuries should have a PA and lateral view available
  - Amputated digits – image the amputated part and the hand as well
- CT scans will rarely be indicated
  - Discuss with hand surgeon

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The hand trauma service is based at St John’s Hospital. There is a separate hand consultant on-call rota in addition to the plastics consultant on call.
32.4. Management in ED

- Manage life threatening injuries first
- Thorough secondary & tertiary surveys to identify subtle injuries
- Analgesia to manage pain
- X-Ray of hand/digit AND amputated part
- Realign fractured digits & reduce dislocated joints
  - If grossly contaminated open injuries, avoid reduction; patient will need emergency debridement of the tissues
  - Open fractures require treatment with IV antibiotics as documented in the hospital antibiotic guidelines
- Splint to stabilise injury and contribute to pain relief
  - Volar hand splint in position of safe immobilisation (Edinburgh position)
- If patient stable, referral to plastics hand team at St John’s Hospital to arrange transfer for definitive treatment
- If patient unstable or multiply injured, arrangements for surgery at MTC can be accommodated.

32.5. Amputations

Refer to plastics team for consideration of replantation.

Major limb replantation (wrist and proximal) will require the collaboration of the orthopaedic, plastic/hand and vascular teams.

32.5.1. Indication for replantation

- Thumb
- Multiple digits
- Hand
- Any amputation in a child
- Wrist and proximal upper limb (forearm/elbow/arm)
  - NB not avulsion injuries
- Single digit distal to FDS insertion

32.5.2. Contraindications to replantation

- Severe soft tissue damage – crushed or mangled tissues
- Multi-level amputation
- Associated life threatening injuries/illnesses
• Prolonged warm ischaemia time
• Non-compliant patient or unable to manage rehabilitation constraints
The decision to replant or not rests with the hand/plastics consultant on call.

32.5.3. Warm ischaemia time

The presence of muscle and nerve in the proximal amputations reduces the time available to undertake replantation. Blood supply must be reinstated with vascular shunts within 6 hours to maintain viability.

• 6 hours for amputation proximal carpus
• 12 hours for digit.
Digits have no muscle and can be appropriately stored for up to 24 hours before starting replantation if required.

32.5.4. Management of the amputated part

• Wrap the part in a saline soaked gauze swab.
• Place it into a sealed plastic bag.
• Place the plastic bag into a container of slush (ice and water)
• Ensure patients name is on the container and transfer with the patient to St John’s Hospital if stable enough.
• Never place the part directly onto ice – ice crystals formed will damage the tissue.

Please send all amputated parts with the patient, even if considered not replantable. Skin and other tissues can be used as grafts.
33. Burns Management

33.1. Analgesia in the ED

- Intravenous Morphine 1st Line and Intravenous Ketamine 2nd line
- Cover burns with non circumferential cling film

33.2. Airway Burns

1. Suspect in patients with facial, perioral or nasal burns
2. Voice changes, hoarseness and stridor require further examination and intervention
3. Refer immediately to anaesthesia
4. All airway burns should be managed by rapidly securing the airway with an uncut endotracheal tube.

33.3. Smoke Inhalation

1. Consider early anaesthetic review for consideration of a definitive airway.
2. Suspect in fire victims who have
   a. History of altered level of consciousness
   b. Respiratory problems
   c. Rescued from an enclosed place
3. Perform an arterial or venous blood gas for carboxyhaemoglobin.
4. A Carboxyhaemoglobin >10% is diagnostic
5. Administer high flow oxygen until the carboxyhaemoglobin level is <10%
6. Prescribe VTE prophylaxis.
7. Treat cyanide poisoning if unconscious and lactate >10 in the absence of major burns after resuscitation.
8. Utilise lung protective strategies for patients that require ventilation.

33.4. Fluid Management

- Do not use 0.9% saline, albumin or hypertonic saline for resuscitation.
- Use a balanced salt solution e.g. plasmalyte, ringers lactate
- Baseline fluids will also be required (incorporating early enteral nutrition)
- Circulate Urine output with ideal body weight
- If urine output low for >2 hours senior review
### Parkland Formula

<table>
<thead>
<tr>
<th>Parkland Formula</th>
<th>Urine Output</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation fluid in first 24 hours =</td>
<td>&lt;0.25 ml/kg/hr</td>
<td>Give 500 ml bolus</td>
</tr>
<tr>
<td>Actual body weight x BSA burned (%) x 4</td>
<td>0-25 – 05 ml/kg/hr</td>
<td>Give 250 ml bolus</td>
</tr>
<tr>
<td></td>
<td>1-2 ml/kg/hr</td>
<td>Reduce resuscitation fluid by 50 ml/hr</td>
</tr>
<tr>
<td>Half in first 8 hours and half in second 16 hours</td>
<td>&gt;2 ml/kg/hr</td>
<td>Reduce resuscitation fluid by 100 ml/hr</td>
</tr>
</tbody>
</table>

### 33.5. Referral to Burns Units

1. TBSA > 10%
2. TBSA > 5% with significant co-morbidities / pregnant / immunocompromised.
3. Facial Burns > 3% with or without inhalation
4. Hand
5. Genitals / perineum
6. Circumferential
7. Requiring Critical Care
8. Chemical Burns
9. High Voltage Electrical Burns

1. COBIS have published Paediatric Guidelines on the following:
   - Airway Burns Inhalation
   - COBIS Fluid Guidelines
2. The Care of Burns In Scotland National MCN Website can be referred to for access to further clinical guidelines (Click here)
33.6. Guideline for the Management of Adult Burns

**Guideline for the Management of ADULT BURNS (v1.0)**

**Commence with ATLS Approach**

Are there signs of airway injury? If so, contact anaesthetist

If appropriate, COOL THE BURN with cool running tap water. However, keep the person warm

- **Burn TBSA > 15%**
  - **YES**
    - Heat room
    - Insert PVC
    - Obtain FBC, U&Es, CRP
    - Blood Glucose, G&S
    - Commence maintenance fluids
    - Commence resusc fluid following COBIS Protocol (see below)
    - Apply a loose layer of cling film
    - Administer analgesia by IV route
    - Contact Burns/Plastics Registrar on call as per local arrangement/burns unit to arrange transfer
  - **NO**
    - Is transfer going to be delayed?
      - **YES**
        - Keep person warm
        - Clean wound and dress
        - Site NG tube and commence slow feed
        - If circumferential burn, discuss need for escharotomy with receiving team
      - **NO**
        - Continue care as above
  - **Burn TBSA > 10%**
    - **YES**
      - Heat room
      - Apply a loose layer of cling film
      - Administer analgesia
      - Contact Burns/Plastics Registrar on call as per local arrangement/burns unit to arrange transfer
    - **NO**
      - Is burn full thickness?
        - Does it involve hands, face, feet, perineum or joints?
        - Is burn circumferential?
        - Is burn > 3% → for discussion with receiving team
        - Are there any Vulnerable adult issues?

**Check Tetanus Status**

**FLUIDS.** The initial resuscitation period is 24 hours, split into 2 periods;

Modified Parkland formula - given as Ringers Lactate (Hartmann’s) solution

\[
4 \text{ (ml)} \times \text{Weight (in Kg)} \times \%\text{Burn}
\]

This is a guide to the total volume of resuscitation fluid required by 24 hours post-injury

Half is given in first 8 hours and calculated from Time of Injury

Half in next 16 hours

If fluid boluses have been given it should be a clinical decision whether bolus volumes are included in the total amount

Adequacy of resuscitation should be based on target urine output of 0.5-1.0 ml/kg/hr

Over-resuscitation as well as under-resuscitation can lead to poor outcomes

Detailed guidance available from Care of Burns in Scotland (COBIS) website

**WEBSITE** www.cobis.scot.nhs.uk
# 33.7. Antithrombotic Reversal in TBI or Traumatic Haemorrhage

(Please also refer to Antithrombotic Guidelines)

## General Principles
- Stop the offending drug
- Consult a haematologist

### Vitamin K Antagonists (Warfarin & Acenocoumarol)
- Immediate Point of Care & lab INR.
- If INR>1.3 give 10mg Vitamin K
- Beriplex according to weight/INR
- Repeat INR 15-60mins after Beriplex
- Repeat INR every 6-8hrs for the next 24-48 hours
- if INR >1.3 give one further dose 10mg Vitamin K
- if INR >1.3 consider FFP rather than further Beriplex

### Unfractionated Heparin - reverse prophylactic dose only if aPTT significantly prolonged)
- 1mg Protamine for every 100 units of heparin given in the last 3 hours. Max dose 50mg
- if aPTT remains elevated - give further protamine (half the above the dose)

### LMWH (do not reverse prophylactic doses)
- **Enoxaparin***
  - 1mg Protamine per 1mg of Enoxaparin if last dose <8hrs (max dose 50mg)
  - 0.5mg per 1mg of Enoxaparin if last dose 8-22.5 hrs.
  - 1g Protamine per 100units if last dose given <12.5 hrs. (<36hrs in renal failure)
- **Dalteparin***
  - 1g Protamine per 100units if last dose given <12.5 hrs. (<36hrs in renal failure)
- **Tinzaparin***
  - 1g Protamine per 100units if last dose given <17hrs
  - *If ongoing bleeding or renal insufficiency repeat above doses at HALF

### Direct Factor Xa Inhibitors (Rivaroxaban, Apixaban & Edoxaban)
- Give 50g Activated charcoal if last dose within 2 hours
- Give 50 Units/kg Beriplex

### Pentasaccharides - Fondaparinux (not prophylactic)
- D/W haematology for consideration FEIBA/FVIIa

### Direct Thrombin inhibitors
- **Dabigatran**
  - Give 50g Activated charcoal if last dose within 2 hours
  - Give idarucizumab (5g IV in 2 divided doses)
  - Give 50 Units/kg Beriplex if idarucizumab not available
  - Consider re-dosing idarucizumab or haemodialysis if ongoing bleeding

### Thrombolitics
- 10 units Cryoprecipitate (10-15mg/kg of TXA if cryoprecipitate not available)
- Check Fibrinogen after cryoprecipitate and give more if Fibrinogen <1.5

### Antiplatelets - (TBI patients not undergoing surgery do not require reversal)
- **Aspirin, Dipyridamole, clopidogrel, prasugrel & Ticagrelor**
  - One unit of platelets. Can repeat if ongoing bleeding
  - 0.4mcg/kg IV Desmopressin
  - Glycoprotein IIb/IIIa and NSAIDs
  - No reversal
34. VTE Prophylaxis

VTE disease is responsible for 1/3 of all major trauma deaths who have survived >24 hours

34.1. Bleeding Risk

1. Active Bleeding
2. Acquired or inherited bleeding disorders
3. Formally anti-coagulated (e.g. INR>2)
4. Acute Stroke
5. Platelets <75
6. BP > 230/120
7. LP/Epidural/Spinal anaesthesia within previous 4 or next 12 hours
8. Other high risk procedures anticipated in next 12 hours

34.2. Principles

- Commence mechanical prophylaxis in all patients unless contraindicated
- Commence chemical VTE prophylaxis without any significant bleeding risk as soon as possible in most patients.
- Patients should rarely, if ever go >72 hours without chemical prophylaxis

34.3. Special Considerations for Chemical VTE Prophylaxis

**Traumatic Brain injuries**

- Administer within 24-48 hours of injury if clinically or radiologically stable
- Administer 24 hours after craniotomy

**Spinal/Spinal Cord injury**

- As soon as possible and <72 hours after injury

**Solid Organ Injury**

- As soon as possible, ideally <24 hours after injury
35. Formal Tertiary Survey

Trauma Tertiary Survey
Survey (TTS)

Why?

- Around 1 in 17 major trauma patients have 'missed injuries' during their hospital stay which can cause significant morbidity.
- Trauma Tertiary surveys may reduce this figure to as low as 1 in 40.
- The intensive Care society and Trauma quality improvement programs have therefore made it a quality standard.

Who?

All trauma patients admitted to critical care

What?

A comprehensive general physical re-examination and review of all investigations, including imaging and blood results.

When?

1. Within 24 hours of admission 'after the dust has settled'
2. Repeated once awake, if reduced level of consciousness

What is the difference from the Primary and Secondary survey?

- Primary survey = performed by an ED registrar to identify life threatening injuries.
- Secondary survey = completed by an appropriate ATLS trained provider to complete a head to toe examination.

The secondary survey may still need to be completed when patients arrive in Critical Care

The tertiary survey should be performed at a later stage (within 24 hours) when more information may be available and initial procedures/operations are complete. This should be undertaken by ICU staff.

How?

- On admission fill in all trauma patients on whiteboard as we do for APACHE forms.
- Complete TTS form (available in Drs room 118)
- Document in TRAX once completed (as per short-code on form)
- Wipe off whiteboard once TTS completed.
# Major Trauma Tertiary Survey

## History (Salient Points Only)

<table>
<thead>
<tr>
<th>Addressograph</th>
</tr>
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<tbody>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>DOB:</td>
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<tr>
<td>CHI:</td>
</tr>
</tbody>
</table>

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**Pre-Hospital notes present & read? [ ]**

<table>
<thead>
<tr>
<th>Known Injuries:</th>
<th>Interventions to date: (Surgery/Interventional Radiology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>4</td>
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<td>5</td>
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</tbody>
</table>

## Laboratory results (complete and repeat if required)

<table>
<thead>
<tr>
<th>Bloods</th>
<th>CK</th>
<th>Amylase</th>
<th>Troponin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Cultures</td>
<td>Toxicology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group and Save</td>
<td>Electronic Release</td>
<td>Valid Until:</td>
<td></td>
</tr>
<tr>
<td>Other (List Below)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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## Specialities Involved / Required

<table>
<thead>
<tr>
<th>Speciality</th>
<th>Referred</th>
<th>Seen by</th>
<th>Consultant</th>
<th>Notes on Talk</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Head:</td>
<td>Addressograph</td>
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<tr>
<td>------</td>
<td>--------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scalp</td>
<td>□ Left Ear □ Right Ear □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCS:</td>
<td>E: _________ V: _________ M: __________</td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Face:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left eye</td>
<td>□ Left pupil □ Right eye □ Right pupil □</td>
</tr>
<tr>
<td>Cranial nerves</td>
<td>□ Lips □ Teeth - Loose □ Cracked □</td>
</tr>
<tr>
<td>Secondary brain injury prevention measures in place:</td>
<td></td>
</tr>
<tr>
<td>Neck / Spine:</td>
<td></td>
</tr>
<tr>
<td>N.B. remove collar with in-line immobilisation. Do not move neck without senior presence. See also perineum/limb sections for when log-rolling patient.</td>
<td></td>
</tr>
<tr>
<td>Miami J/Aspen Collar in situ</td>
<td>□</td>
</tr>
<tr>
<td>Gross Injuries</td>
<td>□</td>
</tr>
<tr>
<td>Tracheal Deviation</td>
<td>□</td>
</tr>
<tr>
<td>Correct fit</td>
<td>□</td>
</tr>
<tr>
<td>Pressure Points</td>
<td>□</td>
</tr>
<tr>
<td>Pressure checks frequency prescribed</td>
<td>□</td>
</tr>
</tbody>
</table>

**All spinal cord injuries should have an ASIA Chart**

| Midline tenderness | |
| Deformity | |
| Radiologically cleared | |
| Clinically cleared | |

<table>
<thead>
<tr>
<th>Chest:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Wall Movement</td>
<td>□</td>
</tr>
<tr>
<td>Gross Injuries</td>
<td>□</td>
</tr>
<tr>
<td>Surgical Emphysema</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drains:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>□</td>
</tr>
<tr>
<td>Right</td>
<td>□</td>
</tr>
<tr>
<td>Swinging</td>
<td>□</td>
</tr>
<tr>
<td>Surgical Emphysema</td>
<td>□</td>
</tr>
<tr>
<td>Swinging</td>
<td>□</td>
</tr>
<tr>
<td>Surgical Emphysema</td>
<td>□</td>
</tr>
<tr>
<td>Breath sounds</td>
<td>□</td>
</tr>
<tr>
<td>Heart sounds</td>
<td>□</td>
</tr>
<tr>
<td>Sternum</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abdomen:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross injuries</td>
<td>□</td>
</tr>
<tr>
<td>Cullens sign</td>
<td>□</td>
</tr>
<tr>
<td>Distension</td>
<td>□</td>
</tr>
<tr>
<td>Guarding</td>
<td>□</td>
</tr>
<tr>
<td>Rigidity</td>
<td>□</td>
</tr>
</tbody>
</table>

| Bowel sounds | □ |
| NG in situ | □ |
| Pregnant (MUST D/W Obstetrics) | □ |

<table>
<thead>
<tr>
<th>Pelvis:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Binder in situ</td>
<td>□</td>
</tr>
<tr>
<td>When fitted: Date</td>
<td>□</td>
</tr>
<tr>
<td>Pressure Points</td>
<td>□</td>
</tr>
<tr>
<td>Gross Injuries</td>
<td>□</td>
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<table>
<thead>
<tr>
<th>Perineum:</th>
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<tbody>
<tr>
<td>Genetalia</td>
<td>□</td>
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<tr>
<td>Speculum required?</td>
<td>□</td>
</tr>
<tr>
<td>Tone</td>
<td>□</td>
</tr>
<tr>
<td>Prostate</td>
<td>□</td>
</tr>
<tr>
<td>Binder in situ</td>
<td>□</td>
</tr>
<tr>
<td>Bleeding / malaena</td>
<td>□</td>
</tr>
<tr>
<td>Urethral bleeding</td>
<td>□</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Limbs:</th>
<th>Left Upper</th>
<th>Right Upper</th>
<th>Right Lower</th>
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</thead>
<tbody>
<tr>
<td>Reflexes</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Capillary refill</td>
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<tr>
<td>Pulses</td>
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<td></td>
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<tr>
<td>Tone</td>
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<tr>
<td>Power</td>
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<tr>
<td>Sensation</td>
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<tr>
<th>Other:</th>
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<tbody>
<tr>
<td>ECG</td>
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<tr>
<td>B-HCG</td>
<td>□</td>
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<tr>
<td>Anti-D</td>
<td>□</td>
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<tr>
<td>Urine dip</td>
<td>□</td>
</tr>
<tr>
<td>Tetanus up to date</td>
<td>□</td>
</tr>
<tr>
<td>Tetanus required</td>
<td>□</td>
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</tbody>
</table>
Please document all visible injuries and palpate every bone (especially scaphoid, hands/feet)

<table>
<thead>
<tr>
<th>Coding system</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Pain</td>
<td>P</td>
</tr>
<tr>
<td>Abrasion</td>
<td>A</td>
</tr>
<tr>
<td>Bruising</td>
<td>///</td>
</tr>
<tr>
<td>Fracture</td>
<td>#</td>
</tr>
<tr>
<td>Laceration (cm)</td>
<td>+++</td>
</tr>
<tr>
<td>Incision</td>
<td>O</td>
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<tr>
<td>GSW</td>
<td>X</td>
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<table>
<thead>
<tr>
<th>Movement restrictions</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>What is restriction</td>
<td>Decision made by whom</td>
<td>For review when</td>
</tr>
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<tr>
<td>Type of Scan</td>
<td>Reviewed (please tick)</td>
<td>Reported (please tick)</td>
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</table>

**VTE Prophylaxis:**

Has VTE prophylaxis been prescribed?  
Yes ☐  No ☐

If not then document the reason why:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

**Date and Time to review:**

________________________________________________________________________

**Findings / Concerns or injuries detected during TTS:**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

**Outstanding investigations / Plans / Wound management / Follow up**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

**When is a further TTS required? Not required? When GCS 15 prior to D/C**

Signature: ____________________________ (Junior)  Date: ________  Time: ________

Signature: ____________________________ (Consultant)  Date: ________  Time: ________

Please complete \traumatertiary [SPACEBAR] on TRAK
36. Major Trauma Service

Please refer to the NICE’s guidelines on Major Trauma Services available here.
37. **Scottish Trauma Audit Group (STAG)**

### 37.1. Outline

Contribution to STAG is a fundamental component of trauma care. STAG data will be reviewed regularly by the STAG consultant lead and fed into the Major Trauma governance process. This data includes:

- Survival & outcome
- Patient related outcome measures
- Key Performance indicators (KPIs)

### 37.2. KPIs

1. Patients who have suffered significant trauma are assessed by the SAS using the SASTTT
2. Patients who are triaged as requiring MTC care are notified to the receiving hospital (pre-alert)
3. Patients who are triaged as requiring MTC care are taken directly to a MTC if they are within 45 minutes travel time
4. Patients who are triaged and taken to MTC care are received by a consultant led trauma team
5. Patients who are triaged to MTC care and are taken to a TU should be seen by a consultant within 60 minutes of arrival
6. Major Trauma patients who are not taken directly to a MTC and are later transferred to a MTC are transferred within 24 hours
7. Time to secondary transfer to a MTC for patients who have suffered major trauma (ISS>15) is minimised to <4 hours from the time of call to SAS departure
8. Patients with a severe head injury have a CT scan within 0 minutes of arrival
9. Patients with a severe head injury have a CT scan written report sent within one hour of the CT scan
10. Patients who have suffered a severe head injury are managed in a MTC
11. Patients with a severe open long bone fracture will receive intravenous antibiotics within 3 hours of arrival
12. Trauma patients with severe haemorrhage should be given Tranexamic Acid within three hours of first contact with emergency services

Please also refer to the Scottish Trauma Audit Group (STAG) website for more information on Governance and KPI’s. (Click here)

Some Key Performance Indicator’s differ for Paediatric services!

Click here to read more about Paediatric KPI’s
13. Patients who have suffered major trauma and are taken to a MTC, are admitted under the care of a Major Trauma Service
14. Major trauma patients admitted to a MTC have a rehabilitation plan written
15. Major trauma patients admitted to a MTC, who have a rehabilitation plan, have it written within 3 days of admission
16. Patients who have survived major trauma have their functional outcomes assessed as specified time intervals.
38. Transfer Protocol

38.1. Purpose, Definitions and Principles

38.1.1. Purpose

To describe in detail the South East Scotland regional Major Trauma Network transfer policy from Trauma Units (TUs) and Local Emergency Hospitals (LEH) to the Edinburgh Major Trauma Centre (MTC) at the Royal Infirmary of Edinburgh (RIE)

38.1.2. The Scottish Ambulance Service (SAS) Trauma Triage Tool (TTTT)

Triage is the process of sorting patients by urgency and priority. It is a dynamic process and should be reassessed at multiple points. There is a nationally agreed SASTTT in the pre-hospital arena to decide the initial destination of the patient. This can, and should initially be applied by SAS to determine suspected Major Trauma patients. The majority of suspected Major trauma patients will undertake primary transfer including bypassing nearby hospitals, to the MTC.
38.1.3. Defining Suspected Major Trauma Patients

Major Trauma patients are often only defined days after their injury, when their injury severity score (ISS) has been calculated as >15. This document uses the term Major trauma patients to encompass any patient taken to a TU or MTC who is suspected to have suffered Major Trauma based upon a triage tool or clinical judgement, regardless of their eventual ISS score.

38.1.4. Defining Secondary Transfers

Please also refer to SAS Guidance on booking transfers (Appendix 13)

<table>
<thead>
<tr>
<th>Type of Transfer</th>
<th>Definition</th>
<th>Examples</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate ‘Now’ Transfer</td>
<td>Life or limb threatening injury has been mis-diagnosed, self-presented or diverted to Trauma Unit.</td>
<td>Uncontrolled haemorrhage, Ischaemic limb, Intracranial bleed with mass effect, post thoracotomy</td>
<td>Patients should leave within 30 minutes. Telephone 0333 3990111.</td>
</tr>
<tr>
<td>Within one or two hours transfer</td>
<td>Require MTC care though not in imminent danger</td>
<td>Non limb threatening open long bone fractures</td>
<td>One or two hour response. Telephone 0345 6023999</td>
</tr>
<tr>
<td>Within four hour transfer</td>
<td>Require urgent transport for ongoing care but do not need to be managed as an emergency.</td>
<td>Patients being transferred to inpatient wards for ongoing management or for elective and semi elective procedures or investigations would be included in this group.</td>
<td>Within four hour response. Telephone 0345 6023999</td>
</tr>
<tr>
<td>Scheduled patient transfer request –</td>
<td>Repatriations or step-down transfers</td>
<td>Repatriations or step-down transfers</td>
<td>0300 123 1236 For a scheduled patient transfer request or for an admission which requires transport only, please contact the Patient Transport Service</td>
</tr>
<tr>
<td>Same day or in the future</td>
<td></td>
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</tr>
</tbody>
</table>
38.1.5. Major Trauma Patients in TU’s / LEH

The majority of Major Trauma patients will be brought to the MTC by SAS using the TTT. Major Trauma patients may be in other Emergency Departments (ED) if the patient:

- Was under triaged or mistriaged by the TTT.
- Deteriorates following triage.
- Has a compromised airway and SAS need immediate assistance
- Self presents.

The following units may be involved in Secondary Transfers to the MTC at RIE.

- St John’s Hospital (LEH)
- Borders General Hospital (TU)
- Victoria Hospital, Kirkcaldy (TU)
- Forth Valley Royal Hospital (TU)

38.1.6. Key Principle – Automatic Patient Acceptance

Automatic patient acceptance is a fundamental principle of the network. In essence, if a phone call is made about a critically injured patient the patient is accepted. Critical Care bed availability in the MTC is not a pre-requisite for automatic acceptance. The MTC trauma team leader (TTL) should be called by the TU consultant to notify them of the patient and allow the MTC to make preparation for their arrival. Such patients are not for discussion about whether or not to be transferred. The SAS will still place a 15 minute pre alert call stating trauma unit transfer with the standardised ATMIST handover. The following patents may be transferred under automatic acceptance criteria though these are by no means mandatory criteria:-

- See separate TBI transfer guideline
- Major vessel injuries.
- Flail chest
- Crushed, de-gloved, mangled or pulseless extremity.
- Amputation proximal to wrist or ankle.
- Pelvic fracture with haemodynamic instability
- Spinal cord injury
- Multisystem injuries and a suspected ISS>15
- Grade III or above solid Organ that may require Interventional Radiology
- High energy open long bone fracture (as decided by senior Orthopod)
- Post Damage Control Surgery performed at TU
- TU TTL believes the patient would benefit from MTC care

Even if a patient fits the above criteria it is still permissible for the patient to remain in TU care if this is deemed appropriate by the TU TTL. Similarly, the TU TTL consultant may wish to discuss with the MTC TTL at consultant level the suitability of transfer of certain major trauma patients where remaining at the TU may be more appropriate. Examples may include:

- Patients with a DNACPR, advance directive with Major injuries where interventions may not be appropriate

38.1.7. Transfer Algorithm

The process for undertaking TU to MTC transfers is detailed in the Transfer algorithm.

38.1.8. Responsibility for Transfer

Once the decision to transfer the patient and contact has been made with MTC, it remains the responsibility of the TU TTL consultant to determine the appropriate person and equipment to undertake the transfer (using the transfer checklist). The escorts should have appropriate training and skills to manage the patient during the transfer, be familiar with equipment and process surrounding the transfer of critically ill or injured patients.

For intubated patients the following specialties include transfer training in their curricula:

- Anaesthesia
- Intensive Care Medicine
- Pre-Hospital Emergency Medicine

For non-intubated patients the TU consultant must decide if an escort is necessary or the patient can be transported with SAS and no escort. If an escort is necessary the TU TTL should decide on the most appropriate person. Escort not routinely required, only consider if specific complication
expected. These decisions should take into account the severity of injuries, ongoing treatment and staffing levels in the TU/LEH.

In some circumstances liaise the trauma desk as the availability of an Enhanced Care Team to facilitate transfer. SAS will not routinely return the team to their base hospital.

38.1.9. Trauma Unit / LEH Transfer Principles

- A send and call policy exists, so patient transfers can occur without delay.
- The TU Consultant should call the MTC TTL as soon as possible but this should not delay transfer. The MTC TTL can be contacted on 0131-242-3687/xxxxxxx
- All TU to MTC referrals must have been discussed with the TU consultant prior to referral.
- The MTC at RIE cannot refuse a patient whom the TU consultant is concerned requires MTC care.
- All time critical transfers will be arranged through the trauma triage desk.
- Patient stability is not a prerequisite for transfer. The TU is responsible for ensuring the patient is as safe as possible for transfer but it is recognised that stability may be impossible to achieve, particularly when this may be the reason for MTC transfer.

38.2. Trauma Unit / LEH Responsibilities Prior to Transfer

38.2.1. Primary Survey

Consider leaving the patient on the ambulance scoop stretcher if the MTC transfer is imminent. SAS to consider using the same crew for onward transfer.

<C> Treat with pressure / dressing / bandage / tourniquets / haemostatics
A Secure Airway
B If indicated, decompress the chest with thoracostomy and/or intercostals drainage (using transport drains rather than underwater seal bottles if possible and available.
C Secure and tape IV access x2
Do not waste time / delay transfer with arterial lines.
Pelvic Binder as indicated.
1g TXA if indicated
Apply traction to femoral shaft fractures (use Kendrick splints as available)
H haemostatic resuscitation +/- Major Haemorrhage protocol as indicated.
D Prevent secondary brain injury
E Use a Bair Hugger blanket or similar if hypothermic or shocked.
Immobilise / reduce fractures / dislocations.

38.2.2. ADJUNCTS (Only if immediately available and will not delay transfer)

- CXR/Pelvis XR/FAST
- A blood gas (venous or arterial)
- Urinary catheter where indicated
- An orogastric or nasogastric tube in intubated patients
- ECG (major chest injury or > 45 yrs old)

38.2.3. CT Imaging

CT scans can considerably delay time to definitive care where it is not immediately available. The TU TTL must balance the information gained from CT against delays to definitive care and it is perfectly acceptable to send a patient to the MTC without imaging. Prompt immediate CT may be of overall benefit in many patients though a 5 minute verbal report is often all that is required before sending the patient. It is not necessary to wait for the full written report before departure.

38.2.4. Documentation and Communication

A structured checklist and standardised documentation is used for all transfers. (See Appendix 3). The TU TTL should update the MTC TTL with clinical information and timings. The SAS should still place a pre alert to the RIE within a 16 minute ETA.

38.2.5. Peri-Arrest Patients

Patients who are peri-arrest with a positive FAST where a consultant surgeon and theatre are immediately available (within 30 minutes) should receive
damage control intervention at the TU. The TU consultant should then
arrange for urgent transfer to the MTC post operatively. Transfer patients
immediately to the MTC if theatre or surgical staff are not readily available.

Patients who are peri-arrest with penetrating trauma should undergo
resuscitative thoracotomy at the TU. If trained staff are not immediately
available transfer to MTC
38.2.6. Algorithm for Network Transfers

Network Transfer Protocol for Time Critical Transfers from TU/LEH to MTC at RIE

Does your patient meet any of the following automatic criteria?
- See separate TBI transfer guideline
- Major vessel injuries.
- Flail chest
- Crushed, degloved, mangled or pulseless extremity.
- Amputation proximal to wrist or ankle.
- Pelvic fracture with haemodynamic instability
- Spinal cord injury
- Multisystem injuries and a suspected ISS>15
- Grade III or above solid Organ that may require Interventional Radiology
- High energy open long bone fracture (as decided by senior Orthopaed)
- Post Damage Control Surgery performed at TU
- TU TTL believes the patient would benefit from MTC care

*Even if a patient fits the above criteria it is still permissible for the patient to remain in TU care if this is deemed appropriate by the TU TTL.

YES

Complete Primary Survey and Adjuncts (1)
Consider Leaving patient on ambulance scoop stretcher if MTC transfer looks imminent.

Is your patient peri-arrest?

NO

Call SAS and request whether a ‘NOW,’ ‘1-2 hour transfer’ or ‘within 4 hour transfer’ as appropriate.

YES

Patients with penetrating injury should undergo thoracotomy.

Patients with positive FAST scan should undergo damage control laparotomy.

Where skills do not exist or theatre space, staff and surgeon are not available within 30 minutes transfer immediately to MTC.

Transfer to MTC with appropriately trained staff (3)
Complete checklist and transfer document.
Place an ATMIST SAS pre alert call 15 minutes before arrival stating trauma unit transfer.

1. Spent only enough time to give life-saving interventions at the TU before transferring patients to the MTC. Patients who need critical interventions at the MTC should leave the TU within 30 minutes of the decision to transfer.

2. Provide verbal and written information to the patient, family or carer including the reason for transfer, the location of the RIE and destination within the RE and the name and contact person responsible for care at the TU.

Patients that have been admitted to a ward and deteriorate or are subsequently found to have injuries that would benefit from MTC care can be transferred using this pathway if it is deemed time critical.

Stable patients who are being transferred for specialist care should not use this pathway but all cases should be discussed with the Major Trauma Service.
38.2.7. Regional Head Injury Protocol

Head injury (<24 hrs old) in adult ≥16 years old presenting to TU/LEH

CT Head indicated?

CT Head abnormal

In the absence of concerning signs** the risk of clinically important injury is low.

Admit or discharge as per NICE Head Injury guidelines

During observation escalate any concerns to a Senior doctor as per NICE Head Injury guidelines.

ARE ANY OF THE FOLLOWING PRESENT?

- GCS <13
- Focal Neurology/abnormal pupils
- Extravascular haemorrhage >4mm
- Subdural haemorrhage >4mm
- Intraparenchymal haemorrhage/contusion >4mm
- Diffuse SAH (IVH or circle of Willis/Sylvian fissure or blood in basal cisterns)
- Penetrating injury
- Open, Depressed, Base of Skull fracture or pneumocephalus
- On antiplatelet/anticoagulants (ensure prompt reversal)

The patient may benefit from MTC care though care closer to home may be more appropriate and the following factors should be considered. Involve the patient and those close to them in any decision and/or any power of attorney.

Are there treatment escalation plans and advanced directives to consider

Is there pre-existing frailty (e.g., *Clinical Frailty Score ≥5)?

Discuss with ED Senior +/- Neurosurgery for further management

Does the patient have a traumatic brain injury assessed as an immediate threat to life or incompatible with good functional recovery AND where early limitation or withdrawal of therapy is being considered?

Consider Devastating Brain Injury pathway. Discuss with ED Senior and Neurosurgery as appropriate

All other patients are suitable for MTC transfer under automatic acceptance. This should be agreed by the Senior ED physician. The treating team may decide that the patient should remain local. (Any case can always be discussed with the neurosurgical registrar).

**CONCERNING SIGNS - discuss with neurosurgery

- GCS ≤8
- CSF Leak
- Definite or suspected penetrating injury
- Seizure without full recovery
- Unexplained confusion persisting >4 hrs
- Deterioration in GCS
- Progressive focal neurological

*Clinical Frailty Scoring

- Not to be used in the following patients
  - <65 years
  - learning disabilities
  - Stable long term disabilities
- Score verified by 2 doctors (including 1 consultant)
- To score - Ask patients, carers, NOK, paramedics and care home staff regarding capability 2 weeks ago, not today
- Patients acutely close to death or terminally ill score 9
- Patients with mild, moderate and severe dementia map to scores of 5, 6 and 7 respectively
38.2.8 Critical Secondary Transfer Checklist

**Time Critical 'Now' Secondary Transfer Checklist TU to MTC**

- TU / LEH Consultant aware
- Name of consultant: 
- SAS trauma triage desk aware
- Imaging Uploaded on PACS
- Clinical records with patient
- Escort able to deal with all likely complications
- External haemorrhage controlled
- Airway secure
- Chest decompressed
- Tamponade decompressed
- IV access secured
- TXA
- Pelvic Binder
- Femoral Fractures Splinted
- Reduce dislocations if shocked / vascular compromise
- Immobilise obviously deformed bones / joints
- Utilise damage control resuscitation principles as appropriate
- Blood products
- Consider anticoagulant reversal as indicated
- Patient skin to scoop
- Transfer bag checked
- Transfer drugs checked
- Enough Oxygen
- FAST Scan (If indicated)
38.2.9. SAS Booking Guidance for Transfers for Immediate/Time Critical Interventions

Where transfer is required for immediate (time critical) intervention or for patients who urgently require a level of care not available in the current facility

Ring 0333 3990111

Examples of specific pathways which may require immediate transfer:

- Obstetrics emergency
- Life-threatening haemorrhage transfer
- Diagnosed AAA
- Diagnosed STEMI for PCI
- Major Trauma
  - (Local Emergency Hospital or Trauma Unit → Major Trauma Centre transfer)
- Hyperacute Stroke

We will then ask some questions around patient location, destination and weight.

Remote and rural immediate transfer requests

Inter-hospital transfer requests from remote and rural locations will be handled by the Specialist Services Desk to ensure that patients receive an appropriate escort and transport platform. If you are calling from one of the following locations:

- Shetland
- Orkney
- Western Isles
- Wick
- Inverness
- Elgin
- Skye
- Fort William
- Argyll & Bute
- Millport
- Arran
- Stranraer

and require an immediate **Now** transfer, please call:

ScotSTAR Emergency Line 03333 990 222

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38.2.10. SAS Booking Guidance for Transfers Required in Between One and Four Hours

For patients who do not need immediate intervention but require transport within 1, 2 or 4 hours for admission or assessment.

Ring 0345 602 3999

**What you must provide:**
- Contact Telephone number
- Pickup/Drop Off Location
- Patient Condition/Working Diagnosis

**You will be asked:**
- What is the reason for the admission/transfer?
- Does the patient need any equipment? ECG monitoring, carry chair etc?
- Does the patient require any medication? Oxygen, pain relief, fluids etc
- An approximate patient weight

For a scheduled patient transfer request or for a patient requiring repatriation from any geographical region.

Ring 0300 123 1236

**What you must provide:**
- Pickup/Drop Off Location
- An approximate patient height/weight
- Patient mobility?
- Any equipment required for transfer?
- DNACPR Status?

For a scheduled patient transfer request or for an admission which requires transport only, please contact our Patient Transport Service

If you require to cancel this booking please call 0800 389 1333

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38.2.11. Paediatric Transfer Protocol

Paediatric Trauma Transfers
Royal Hospital for Children and Young People, Paediatric Major Trauma Centre

- Email: paedsMTC@nhslotian.scot.nhs.uk
- Twitter: @PaediatricMTC

Indications
- ✔ Children (<16y) sustaining major trauma requiring emergency transfer from South East Scotland Trauma Units to the Paediatric Major Trauma Centre (MTC)
- ✗ Not to be used for non-urgent trauma transfers, or non-trauma transfers.

Pathways

**Multi-system**
Patient with multi-system traumatic injuries or critical care requirements during transfer (actual or potential)

- Call ScotSTAR Specialist Services Desk: 03333 990 249 (24/7)
- State time critical paediatric trauma transfer required to South East Paediatric MTC (PMTC)
- Call-conferencing will be initiated with:
  - ScotSTAR Paediatric Retrieval Consultant
  - RHCYP Paediatric Critical Care Unit (PCCU) Consultant: 0131 312 1131
  - ✓ PMTC Emergency Department Single Point of Contact (SPOC) if patient requires trauma pause: 0131 312 0958
  - ✓ PMTC Specialty Consultants as needed (via switch: 0131 536 1000)
- Specialist Services Desk will co-ordinate most appropriate transport option after discussion – this may involve paramedics, local TU team or ScotSTAR team.

**Single System**
Patient with stable single-system injuries and no critical care requirements during transfer (actual or potential)

- Call Paediatric Major Trauma Centre (PMTC) Single Point of Contact (SPOC): 0131 312 0958 (24/7)
- Pass details on patient injury, clinical needs and any specialty requirements
- PMTC SPOC will activate PMTC in-house trauma team ± specialists to receive the patient in Emergency Department (ED) Resuscitation as clinically indicated
- Call SAS NOW line stating emergency paediatric trauma transfer to ED Resus in South East PMTC:
  - Ring 0333 3990111 NOW
  - One or two hours
  - Within 4 hours

Where transfer is required for immediate (time critical) intervention or for patients who urgently require a level of care not available in the current facility.
39. Repatriation Policy
# 40. Appendix

## 40.2. Appendix 1 – Approved Abbreviations and Actions

**NHSL General List of Approved Abbreviations and Acronyms for use in Health Records and Prescriptions 2016**

**Guidance**

Staff must ensure that the following abbreviations and acronyms, recognised and approved by the Clinical Policy Documentation and Information Group for general use within patient records (paper and electronic) are used within NHS Lothian. Any other abbreviations used locally but not approved **MUST be written out in full.** This list is accurate at the time of approval, but it is not uncommon that teams/groups/partnerships names can change over time.

Please note, under no circumstances must abbreviations or acronyms be used when completing a **Medical Certificate of Cause of Death (MCCD/Form 11).**


### DO NOT use at all

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>μg (microgram)</td>
<td>can be mistaken for mg (milligrams)</td>
</tr>
<tr>
<td>&lt; or &gt; (less than or greater than)</td>
<td>can be mistaken for 7 or L</td>
</tr>
<tr>
<td>IU (international unit)</td>
<td>can be mistaken for IV or one unit</td>
</tr>
<tr>
<td>Trailing 0 (e.g. 3.0mg). Write 3mg – the decimal point could be missed.</td>
<td></td>
</tr>
</tbody>
</table>

### The only ACCEPTED abbreviations on PRESCRIPTIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>g (gram)</td>
<td>Jej (Jejunostomy Port)</td>
</tr>
<tr>
<td>mg (milligram)</td>
<td>SL (Sublingual)</td>
</tr>
<tr>
<td>ml (millilitres)</td>
<td>NG (Nasogastric)</td>
</tr>
<tr>
<td>Gstat (Gastrostomy Tube)</td>
<td>NJ (Nasojejunal)</td>
</tr>
<tr>
<td>iD (Intradermal)</td>
<td>PR (Per Rectum)</td>
</tr>
<tr>
<td>IM (Intramuscular)</td>
<td>PV (Per Vaginum)</td>
</tr>
<tr>
<td>IV (Intravenous)</td>
<td>SC (Subcutaneous)</td>
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<td>TOP (Topical)</td>
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### A-Z

**List of the only APPROVED AND ACCEPTED acronyms and abbreviations on clinical documentation/patient records**

### A

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA (Abdominal Aortic Aneurysm)</td>
<td>ALS (Advanced Life Support)</td>
</tr>
<tr>
<td>ABG (Arterial Blood Gases)</td>
<td>AMT (Abbreviated Mental Test)</td>
</tr>
<tr>
<td>ACL (Anterior Cruciate Ligament)</td>
<td>Appt (Appointment)</td>
</tr>
<tr>
<td>ACP (Anticipatory Care Plan)</td>
<td>ASAP (As soon as possible)</td>
</tr>
<tr>
<td>ACS (Acute Coronary Syndrome)</td>
<td>ASD (Atrial Septal Defect)</td>
</tr>
<tr>
<td>ADD (Attention Deficit Disorder)</td>
<td>AV (Atrial Ventricular/ Arteriovenous)</td>
</tr>
<tr>
<td>ADHD (Attention Deficit Hyperactivity Disorder)</td>
<td>AWI (Adults with Incapacity)</td>
</tr>
<tr>
<td>ADL (Activities of Daily Living)</td>
<td>Ax (Assessment)</td>
</tr>
<tr>
<td>AF (Atrial Fibrillation)</td>
<td>AXR (Abdominal Xray)</td>
</tr>
</tbody>
</table>
### A
- **AIDS**: Acquired Immune Deficiency Syndrome

### B
- **Ba**: Barium
- **BBV**: Blood Borne Virus
- **BCG**: Bacille Calmette Guerin
- **BGL**: Blood Glucose Level

### C
- **Ca2+**: Calcium
- **CAUTI**: Catheter Associated Urinary Infection
- **CCF**: Congestive Cardiac Failure
- **CD**: Controlled Drug
- **C-Dif**: Clostridium Difficile
- **CHD**: Coronary Heart Disease
- **CHI**: Community Health Index
- **Chol**: Cholesterol
- **CNA**: Could Not Attend (Cancelled)
- **CNS**: Central Nervous System
- **C/O**: Complaining Of
- **CO2**: Carbon Dioxide

### D
- **D & C**: Dilation and Curettage
- **Detox**: Detoxification
- **DNA**: Did not attend
- **DNA CPR**: Do not Attempt Cardiopulmonary Resuscitation
- **DOB**: Date of Birth

### E
- **EC**: Elbow Crutches
- **ECG**: Electrocardiogram
- **ECHO**: Echocardiogram
- **ECT**: Electro-Convulsive Therapy
- **EDD**: Estimated Date of Discharge

### F
- **FBC**: Full Blood Count
- **FFP**: Fresh Frozen Plasma
- **FM**: Fetal Movements

### G
- **GA**: General Anaesthetic
- **Gast**: Gastrostomy Port
- **Gluc**: Glucose
- **GU**: Genito-urinary
<table>
<thead>
<tr>
<th>GCS</th>
<th>Glasgow Coma Scale</th>
<th>GT/GGT</th>
<th>Gamma-Glutamyl Transferase</th>
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<tbody>
<tr>
<td>GI</td>
<td>Gastro Intestinal</td>
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<th>H</th>
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<tbody>
<tr>
<td>Hb</td>
<td>Haemoglobin</td>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>HD</td>
<td>Haemodialysis</td>
<td>H/O</td>
<td>History Of</td>
</tr>
<tr>
<td>Hep A</td>
<td>Hepatitis A</td>
<td>HR</td>
<td>Heart Rate</td>
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<td>Hepatitis B</td>
<td>HS</td>
<td>Heart Sounds</td>
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<td>Hep C</td>
<td>Hepatitis C</td>
<td>Ht</td>
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<tbody>
<tr>
<td>IBD</td>
<td>Inflammatory Bowel Disease</td>
<td>IP</td>
<td>In-Patient</td>
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<tr>
<td>IBS</td>
<td>Irritable Bowel Syndrome</td>
<td>IQ</td>
<td>Intelligence Quotient</td>
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<tr>
<td>ICP</td>
<td>Intracranial Pressure</td>
<td>IRD</td>
<td>Initial Referral Discussion</td>
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<tr>
<td>IgA</td>
<td>Immunoglobulin A</td>
<td>IUD</td>
<td>Intra Uterine Device</td>
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<td>IgG</td>
<td>Immunoglobulin G</td>
<td>IUCD</td>
<td>Intra Uterine Contraceptive Device</td>
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<td>IgM</td>
<td>Immunoglobulin M</td>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>IM</td>
<td>Intramuscular</td>
<td>IVF</td>
<td>In Vitro Fertilisation</td>
</tr>
<tr>
<td>IMP</td>
<td>Impression</td>
<td>IVI</td>
<td>Intravenous Infusion</td>
</tr>
<tr>
<td>INR</td>
<td>International Normalised Ratio</td>
<td>IVI</td>
<td>Intravenous Infusion</td>
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<td>IX</td>
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<td>Investigations</td>
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<tr>
<td>Jej</td>
<td>Jejunostomy</td>
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<td>JVP</td>
<td>Jugular Venous Pressure</td>
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<td>K+</td>
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<td>Key Information Summary</td>
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<td>Left Iliac Fossa</td>
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<tr>
<td>LIH</td>
<td>Left Inguinal Hernia</td>
<td></td>
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<tr>
<td>LOC</td>
<td>Loss of Consciousness</td>
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<td>Mini Mental State Examination</td>
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<td>Methicillin Sensitive Staphylococcus Aureus</td>
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<td>MSSU</td>
<td>Midstream Specimen of Urine</td>
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<td>POP</td>
<td>Plaster of Paris</td>
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<td>Removal of Sutures</td>
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<td>RTC</td>
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<td>Right Upper Quadrant</td>
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<td>Staphlococcus Aureus</td>
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<td>S/C</td>
<td>Subcutaneous</td>
<td>STI</td>
<td>Sexually Transmitted Infection</td>
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<td>SVT</td>
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<td>TIA</td>
<td>Transient Ischaemic Attack</td>
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<td>-----</td>
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<td>Transfer</td>
<td>TPR</td>
<td>Temperature Pulse Respiration</td>
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<td>Treatment</td>
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<td>UV</td>
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| Y | |

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<tr>
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<th>Zimmer Walking Aid</th>
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**Numerical/Alphabetical/Symbols**

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<td>grams</td>
<td>mmol</td>
<td>millimole</td>
</tr>
<tr>
<td>kg</td>
<td>kilograms</td>
<td>1/7</td>
<td>Once a week</td>
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<tr>
<td>mm</td>
<td>millimetres</td>
<td>1/12</td>
<td>Once a month</td>
</tr>
<tr>
<td>cm</td>
<td>centimetres</td>
<td>1/52</td>
<td>Once a year</td>
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<td>m</td>
<td>metres</td>
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**Teams/Services/Departments**

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<thead>
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<th>Acute Medical Unit</th>
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<th>Genito-Urinary Medicine</th>
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<td>CAMHS</td>
<td>Child and Adolescent Mental Health Service</td>
<td>Gynae</td>
<td>Gynaecology</td>
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<td>CBT</td>
<td>Cognitive Behavioural Therapy</td>
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<td>Hospital At Night Team</td>
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<td>CCH</td>
<td>Community Child Health</td>
<td>HBCCC</td>
<td>Hospital Based Continuing Complex Care</td>
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Version 3, Approved by: Clinical Policy, Documentation & Information Group
Approved: Apr 2016, Review: Apr 2019
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<td>Intensive Psychiatric Care Unit</td>
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<td>CDPS</td>
<td>Community Drug Problem Service</td>
<td>ITU</td>
<td>Intensive Therapy Unit</td>
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<td>Community Equipment Service</td>
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<td>Lauriston Building</td>
</tr>
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<td>Community Learning Disability Team</td>
<td>LUCS</td>
<td>Lothian Unscheduled Care Service</td>
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<td>CMHT</td>
<td>Community Mental Health Team</td>
<td>MDT</td>
<td>Multidisciplinary Team</td>
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<tr>
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<td>Drug and Alcohol Action Team</td>
<td>MHAS</td>
<td>Mental Health Assessment Service</td>
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<td>MW</td>
<td>Midwife</td>
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<td>Dietetics</td>
<td>MWC</td>
<td>Mental Welfare Commission</td>
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<td>Emergency Department</td>
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<td>Out of Hours</td>
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<td>Edinburgh Dental Institute</td>
<td>OPD</td>
<td>Outpatient Department</td>
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<td>ORS</td>
<td>Orthopaedic Rehabilitation Service</td>
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<td>PICU</td>
<td>Paediatric Intensive Care Unit</td>
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<td>RIDU</td>
<td>Respiratory and Infectious Diseases Unit</td>
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<td>Special Care Baby Unit</td>
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<td>SMD</td>
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**Places/Sites**

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<td>ADC</td>
<td>Andrew Duncan Clinic</td>
<td>RIE</td>
<td>Royal Infirmary of Edinburgh</td>
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<td>CTC</td>
<td>Community Treatment Centre</td>
<td>RGH</td>
<td>Roodlands General Hospital</td>
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<td>East Lothian</td>
<td>RVB</td>
<td>Royal Victoria Building (WGH)</td>
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<td>IB</td>
<td>Integration Joint Boards</td>
<td>RVH</td>
<td>Royal Victoria Hospital</td>
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<td>SJH</td>
<td>St Johns Hospital</td>
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<td>West Lothian</td>
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**Professions**

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<th>Name</th>
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<td>ANP</td>
<td>Advanced Nurse Practitioner</td>
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<td>Mental Health Officer</td>
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<td>Community Children's Nurse</td>
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<td>Occupational Therapist</td>
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<td>Charge Nurse</td>
<td>PN</td>
<td>Practice Nurse</td>
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<td>PT/Physio</td>
<td>Physiotherapist</td>
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<td>SCN</td>
<td>Senior Charge Nurse</td>
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<td>Core Trainee Doctor</td>
<td>SLT</td>
<td>Speech &amp; Language Therapist</td>
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<td>SN</td>
<td>Staff Nurse</td>
</tr>
<tr>
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<td>Doctor</td>
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<td>Specialist Registrar</td>
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</table>
40.3. Appendix 2 – Paediatric Trauma Triage Tool

Use this tool to triage all children under 16 years old who have suspected major trauma.

**Clinical Judgement is important and valued.**

If you are concerned that your patient's triage category does not reflect their needs, you require clinical or logistical advice, please contact the Trauma Desk directly on 03333 990 211 or by phone by placing a callback to your local area dispatcher who will arrange a callback from the Trauma Desk.

**Physiological Reference Ranges**

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<thead>
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<th>Value</th>
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<td>&lt; 40</td>
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<tr>
<td>1 - 4</td>
<td>26-30</td>
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<tr>
<td>5 - 9</td>
<td>20-25</td>
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<tr>
<td>&gt; 10</td>
<td>11-20</td>
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</table>

**Triage Questions**

**Step 1: Assess your Patient’s Physiology**

- Does your patient have any of the following:
  - Abnormal vital signs for age
  - Abnormal respiratory rate
  - Abnormal chest x-ray
  - Abnormal haemorrhage

**Step 2: Assess your Patient’s Injuries**

- Does your patient have any of the following:
  - Fracturing injury to head, neck, spine
  - Suspected open, displaced or closed skull fracture
  - Suspected spinal injury with normal neurological examination
  - Significant trauma to chest or abdomen
  - Traumatic amputation/amputation or injury causing amputation
  - Suspected pelvic fracture
  - Multiple and/or single open long bone fractures
  - Hemorrhage >20% Hb or fall or facial or circumferential trauma from fall

**Step 3: Assess the Mechanism of Injury**

- Does your patient have any of the following:
  - Traumatic death in known motor vehicle mechanism
  - "Hit and run" damage to windshield or damage to "A" post from pedestrian striking outside of vehicle
  - Ejection from motor vehicle
  - Pedestrian/cyclist struck by vehicle at >25mph
  - Indeterminate fall over 3 meters' height (not involving down stairs)
  - Bicycle handlebar injury with abdominal and/or groin pain

**Step 4: Special Considerations**

- Does your patient have any of the following present:
  - Breathing disorder or anticipated treatment
  - Isolated injuries (fracture to trauma chest)
  - Pregnancy >10 weeks
  - Significant non-concentrated (discuss case with Trauma Desk prior to transfer)

**Response Category**

**Major trauma centre care**

Your Patient requires Major Trauma Centre (MTC) Care

- Your patient should, if possible, be taken to an MTC by another hospital in an ambulance. If you think that it will take more than 45 minutes to reach the nearest MTC, contact the Trauma Desk to discuss air ambulance retrieval.

**Trauma unit care**

Your Patient requires Trauma Unit (MU) Care

- Your patient should, if at all possible, be taken to a Trauma Unit (e.g., Major Trauma Center).
- If you think that it will take more than 45 minutes to reach the nearest Trauma Unit (Major Trauma Center), contact the Trauma Desk to discuss air ambulance retrieval.

**Local care**

Convey your patient to the nearest Local Emergency Hospital

- Your patient can be taken to the nearest hospital with an Emergency Department regardless of designation.
40.4. Appendix 3 - Trauma Team Document

South East Scotland Trauma Network
ED Trauma Documentation

Arrival by:
Road  [ ]  Air  [ ]

Pre-hospital:
SAS  [ ]  Medic One  [ ]  EMRS  [ ]
SCAA  [ ]  MOD  [ ]  Coastguard  [ ]

Standby Received:  [ ]
Time received:  [ ]

Affix Label Here

---

### Pre Alert

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**Mechanism:**

**Injuries Suspected:**

**Signs**
- RR
- SpO2
- HR
- BP
- Temp

**ETA**

**Requirements**

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</tr>
</thead>
<tbody>
<tr>
<td>Trauma Team Leader</td>
<td></td>
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<tr>
<td>Anaesthetics</td>
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<td></td>
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<td>ODP</td>
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<tr>
<td>General Surgery</td>
<td></td>
<td></td>
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<tr>
<td>Orthopaedics</td>
<td></td>
<td></td>
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<tr>
<td>Critical care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vascular</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pre Hospital Handover

Age & Sex:

Time of Incident:

Mechanism of Injury:

Injuries Sustained:

Signs & Symptoms:
A –
B –
C –
D –
E –

GCS
E □ V □ M □
BP
RR
HR
SATS

Treatments / Trends:
A – Self NP Guedel LMA RSI CRIC Collar
B – Thoracostomy Thoracotomy O2
C – Fluid Blood Cannula IO TXA Splint
D –
E – Binder Femoral

Drugs Administered
Blood in mls:
Fluid in mls:
Other:

Other information:
## Primary Survey

### Assessment

<table>
<thead>
<tr>
<th>C</th>
<th>External haemorrhage Site Y</th>
<th>N</th>
<th>Tourniquet/site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Site</td>
<td></td>
<td>Haemostatics</td>
</tr>
</tbody>
</table>

### B - Air Entry

- **O₂**
- **Visible Wound**
- **Tenderness**
- **Crepitus**
- **Surgical Emphysema**
- **1st RR**
- **1st SpO²**

### C - Abdomen

- **Pelvic Binder**
- **TXA**
- **Blood (mLs)**
- **FAST Report (include name of operator)**
- **PXR Comments**

### D - Head Injury

- **GCS**
- **Pupils**
- **Priapism**
- **Limbs Mvt**

### E - 1st Temp

- **Bair Hugger**
- **Warm Blankets**
### Secondary Survey/Injury Summary

<table>
<thead>
<tr>
<th></th>
<th>Injuries</th>
<th>Investigation Results</th>
<th>Outstanding Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MaxFax/ENT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T / L spine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Spine/neck</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pelvis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Limbs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Limbs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perineum, rectum, vagina.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Spinal Injuries please print separate ASIA Chart.

In Burns please print separate Burns Chart.
<table>
<thead>
<tr>
<th>Time</th>
<th>List of Events/Decisions</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>List of Events/Decisions</td>
<td>Signature</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Invasive Devices Record

## Peripheral Venous Catheter

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Operator</th>
<th>Date</th>
<th>Time</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size (circle): Blue</th>
<th>Pink</th>
<th>Green</th>
<th>Brown</th>
<th>Grey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site: Right Hand ACF Forearm Foot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Procedure Checklist:**

- Hand hygiene
- CHG skin prep
- Aseptic insertion
- Needle free port
- Dressing dated

**Days in situ**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>

**Site Clean Y/N**

<table>
<thead>
<tr>
<th>Site Clean Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Still req’d Y/N**

<table>
<thead>
<tr>
<th>Still req’d Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

## Invasive Line

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Operator</th>
<th>Date</th>
<th>Time</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line Type (circle): CVC</th>
<th>Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site:</td>
<td></td>
</tr>
</tbody>
</table>

**Procedure Checklist:**

- Antiseptic hand scrub
- Overgloves/hat/mask
- CHG skin prep
- Aseptic insertion
- Stitched to secure
- Line transected
- Line saved for TPN

**Operator’s Signature:**

<table>
<thead>
<tr>
<th>Post Insertion</th>
<th>N/A</th>
<th>reviewed by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in situ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Site Clean Y/N**

<table>
<thead>
<tr>
<th>Site Clean Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Still req’d Y/N**

<table>
<thead>
<tr>
<th>Still req’d Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Intubation - Endotracheal

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
<th>Operator:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of View (circle appropriate):</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Tube Size:</td>
<td>Tube Type:</td>
<td></td>
</tr>
<tr>
<td>Distance @ Lip:</td>
<td>Distance @ Teeth:</td>
<td></td>
</tr>
<tr>
<td>Procedure Checklist:</td>
<td>Difficulties/Adjuants/Complications:</td>
<td></td>
</tr>
<tr>
<td>Preoxygenation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cricoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capnography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CXR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator's Signature:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Days in situ</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
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<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
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</table>

<table>
<thead>
<tr>
<th>Cuff Pressure</th>
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<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Distance @ Lip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dressing/Tapes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### Nasogastric Intubation

<table>
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<tr>
<th>Date:</th>
<th>Time:</th>
<th>Operator:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Type:</td>
<td>Standard 7 day Fine bore 31 days Nostril:</td>
<td>R / L</td>
</tr>
<tr>
<td>Post Procedure Checklist:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirate Yes No</td>
<td>pH confirms placement? Yes No</td>
<td></td>
</tr>
<tr>
<td>CXR required? Yes No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External tubes/wires removed pre CXR?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length at Nostril:</td>
<td>Aspirate pH:</td>
<td></td>
</tr>
<tr>
<td>Endile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Doctor confirming tube safe to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length at nostril - record each day/pm *change to fine bore</td>
<td></td>
<td></td>
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### Indwelling Urinary Catheter

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<thead>
<tr>
<th>Date:</th>
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<th>Operator:</th>
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<tbody>
<tr>
<td>Catheter - Size: 10g</td>
<td>12g</td>
<td>14g</td>
</tr>
<tr>
<td>Type:</td>
<td>PTFE Silicone</td>
<td>Male Female Suprapubic</td>
</tr>
<tr>
<td>Volume in balloon: Catheter expiry date: 28 days 12 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedure Checklist:</td>
<td>Difficulties/Complications:</td>
<td></td>
</tr>
<tr>
<td>Hand hygiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic insertion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catheter secured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricant used, expiry date/batch number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator's Signature:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Days in situ</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>14</th>
<th>15</th>
<th>16</th>
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<th>18</th>
<th>19</th>
<th>20</th>
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<table>
<thead>
<tr>
<th>EO cath care Y/N</th>
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</table>

<table>
<thead>
<tr>
<th>Still required Y/N</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Drain bag dated</th>
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<tbody>
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### Generic Device Record

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
<th>Device:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Date:</td>
<td>Time:</td>
<td></td>
</tr>
<tr>
<td>Size:</td>
<td>Type:</td>
<td></td>
</tr>
<tr>
<td>Insertion details:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring requirements:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator's Signature:</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Device:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

| Insertion Date: | Time: |
| Size: | Type: |
| Insertion details: |
| Monitoring requirements: |
| Operator's Signature: |
40.5. Appendix 4 – Radiology Trauma Primary Survey

**NHS LOTHIAN RADIOLOGY – TRAUMA PRIMARY SURVEY**

*Hot report only - written report (provisional/ final) to follow (KPI target 60 minutes)*

*If blank, then no significant finding*

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
</tr>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>TRAUMA TEAM LEADER</th>
<th>CHI</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>RADIOLOGIST NAME</th>
<th>RADIOLOGIST GRADE</th>
<th>TIME OF CT ARRIVAL</th>
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<table>
<thead>
<tr>
<th>RADIOLOGY PRE-ALERT</th>
<th>YES // NO</th>
<th>TIME OF 1° REPORT</th>
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<th>AIRWAY</th>
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<td>ETT SATISFACTORY</td>
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<td>---------</td>
</tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>BREATHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIGHT CHEST DRAIN</td>
</tr>
<tr>
<td>PNEUMOTHORAX</td>
</tr>
<tr>
<td>PULM. CONTUSION</td>
</tr>
<tr>
<td>FLAIL CHEST</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CIRCULATION (BLEEDING)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIASTINUM</td>
</tr>
<tr>
<td>AORTIC ARCH</td>
</tr>
<tr>
<td>PERICARDIUM</td>
</tr>
<tr>
<td>AORTOCAVAL</td>
</tr>
<tr>
<td>ILIAC ARTERIES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISABILITY (NEURO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRACRANIAL BLEED</td>
</tr>
<tr>
<td>MASS EFFECT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONCLUSION</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>DISCUSSED WITH (NAME / GRADE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM</td>
</tr>
</tbody>
</table>

---

V1 (August 2020); D Smith, T Blankenstein, D Kerslake

**SIGNED:** ________________________________
40.6. Appendix 5 – Pleural Procedures Documentation

Pleural Procedures Documentation
All pleural procedures must be adequately documented in the patient’s notes. Post procedure care must also be documented and easily accessible to staff managing these patients.

Useful tools to assist in appropriate documentation are highlighted below.

How to Document Pleural Procedures on TRAK
All pleural procedures should be inputted into patient’s records on TRAK. A pre-populated template is available for this purpose

Go to:
- EPR
- Progress note
- New
- Operation note or progress note
- Type \pleural in free text box then press space bar

Please complete this for all patients undergoing pleural procedures in NHS Lothian.

Example chest drain insertion documentation (pre-populated template on TRAK)

<table>
<thead>
<tr>
<th>CHEST DRAIN INSERTION</th>
<th>Date/Time________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Name:__________</td>
<td></td>
</tr>
<tr>
<td>Indication:___________</td>
<td></td>
</tr>
<tr>
<td>Px Information given: Y/N</td>
<td></td>
</tr>
<tr>
<td>Consent: Written/Adults with Incapacity</td>
<td></td>
</tr>
<tr>
<td>Pre-drain imaging: CXR/Ultrasound/CT chest</td>
<td></td>
</tr>
<tr>
<td>Ultrasound findings:</td>
<td></td>
</tr>
<tr>
<td>Suspected coagulopathy: Y/N</td>
<td></td>
</tr>
<tr>
<td>Warfarin/other antithrombotic: Y/N (INR______)</td>
<td></td>
</tr>
<tr>
<td>Pre-medication given: Y/N (Drug/Dose:__________)</td>
<td></td>
</tr>
<tr>
<td>Local anaesthetic: _____ % ______ml</td>
<td></td>
</tr>
<tr>
<td>(Maximum dose 20mls 1% lignocaine or 3mg/kg (Ideal body weight – care in obesity))</td>
<td></td>
</tr>
<tr>
<td>Aseptic technique achieved: Y/N</td>
<td></td>
</tr>
<tr>
<td>Site: Right/Left_______</td>
<td></td>
</tr>
<tr>
<td>Fluid/Air obtained with green needle: Y/N</td>
<td></td>
</tr>
<tr>
<td>Number of attempts:________</td>
<td></td>
</tr>
<tr>
<td>Technique: seldinger / blunt dissection</td>
<td></td>
</tr>
<tr>
<td>Size (F)_______</td>
<td>Suture: Y/N</td>
</tr>
<tr>
<td>Swinging Y/N</td>
<td>Bubbling Y/N</td>
</tr>
<tr>
<td>Drain depth:</td>
<td></td>
</tr>
<tr>
<td>Complications: Pain SOB Bleeding</td>
<td></td>
</tr>
<tr>
<td>Patient and nurse given drain instructions?</td>
<td></td>
</tr>
<tr>
<td>Post-procedure care documented?</td>
<td></td>
</tr>
<tr>
<td>Signature and grade ______________________</td>
<td></td>
</tr>
<tr>
<td>Supervisor (grade) ______________________</td>
<td></td>
</tr>
</tbody>
</table>
Example post procedure care documentation

POST PROCEDURE CARE

Post procedure CXR: Y/N req seen

Prescribe: Adequate regular and prn analgesia and a laxative

Drain Chart Started: Y/N
- Initial Fluid Appearance
- Initial Drainage volume
- Drain Clamped at:

3-way tap: Yes Currently: OPEN/CLOSED
- No - Clamp at bed side: Y/N (If for fluid)

SEWS (<30mins) post insertion 0 1 2 3 4

Drainage Instructions (delete as appropriate):
1) Start Drainage again at_________clamp after________mls
   restart after_________mns. (If unsure see guide).
2) DO NOT CLAMP DRAIN IF IT WAS INSERTED FOR PNEUMOTHORAX OR IF IT IS BUBBLING
3) Clamp drain (if inserted for fluid) IF: Persistent cough, chest pain, lightheadedness/ faint (presyncope) - INFORM DOCTOR

Medical Point of Contact:
Name/ Pager: ______________________ OOH___________
# 40.7. Appendix 6 – Chest Drain Chart

<table>
<thead>
<tr>
<th>Time</th>
<th>Hourly Volume</th>
<th>Running Total</th>
<th>Actual Chest Drain Level in Bottle</th>
<th>Chest Drain Bottle or Tubing Observation</th>
<th>Fluid Description (Haemorrhagic Fluid / Purulent Fluid / Blood / Gastric Contents)</th>
<th>Drain Insertion Site check</th>
<th>Drain Tubing Secure</th>
<th>Check for linking or twisting of drain tubing</th>
<th>Emergency blue clamps at bedside</th>
<th>Pain Score 0 - 10</th>
<th>Initial</th>
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</tr>
</tbody>
</table>

**Total for 24 Hours**

---

**NHS Lothian**

**Appendix 6 – Chest Drain Chart**

**Name:**

**Date of Birth:**

**CHI Number:**

<table>
<thead>
<tr>
<th>Chest Drain Chart</th>
<th>Chest Drain Insertion Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Tubing Observations: B – Bubbling SW – Swinging ST – Static</td>
<td></td>
</tr>
</tbody>
</table>

---

**Legend:**

- Tick ✓
- Emergency blue clamps at bedside
- Pain Score 0 - 10

---

**Footer:**

LOT 222 Revision 1 January 2013 Review Date: January 2017
40.8. Appendix 7 – Head Injury Proforma
# NEURO - National Early Warning Score (NEWS) Chart

**Addressograph**

**Name:**
**Consultant:**
**Date chart commenced:**
**This is chart number:**
**Nick name:**
**Weight:** Actual __________ lbs Estimated __________ lbs

**Special Instructions - to be completed by Medical Team:**
A total NEWS score of __________ or individual parameter of __________ is acceptable for this patient because __________.
Please escalate if __________.

**NEWS Score**

<table>
<thead>
<tr>
<th>Frequency of Observations</th>
<th>Total 0°</th>
<th>Total 1°-4°</th>
<th>Total 5°-6° or 7 in the parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum 12 hours / 4 hourly in admission areas</td>
<td>Continue routine NEWS monitoring with every set of observations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum 4 hourly</td>
<td>Inform registered nurse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consider Structured Response Tool</td>
<td>Consider Fluid Balance Chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase frequency to a minimum of 1 hourly</td>
<td>Start Structured Response Tool</td>
<td>Start Fluid Balance Chart</td>
<td></td>
</tr>
<tr>
<td>Total 5°-6° or 7 in the parameter</td>
<td>Registered nurse assessment</td>
<td>Inform Nurse in Charge</td>
<td></td>
</tr>
<tr>
<td>Continuous monitoring of vital signs</td>
<td>Start Structured Response Tool</td>
<td>Start Fluid Balance Chart</td>
<td></td>
</tr>
</tbody>
</table>

**Assess**

<table>
<thead>
<tr>
<th>AIRWAY</th>
<th>BREATHING</th>
<th>CIRCULATION</th>
<th>DISABILITY</th>
<th>EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate</td>
<td>Respiratory rate</td>
<td>Blood Pressure</td>
<td>Acute Painful</td>
<td>Painful Sternal Pain</td>
</tr>
<tr>
<td>SpO2</td>
<td>Accessory muscle use</td>
<td>Core temperature / colour</td>
<td>Acute Respiratory Distress Syndrome</td>
<td></td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>Oxygen saturation</td>
<td>Under output</td>
<td>Acute Respiratory Distress Syndrome</td>
<td></td>
</tr>
<tr>
<td><em>Hypercapnia &amp; Hypoxemia</em></td>
<td><em>Hypercapnia &amp; Hypoxemia</em></td>
<td>Oxygen saturation</td>
<td>Acute Respiratory Distress Syndrome</td>
<td></td>
</tr>
<tr>
<td>Position / posture</td>
<td>Position / posture</td>
<td>Oxygen saturation</td>
<td>Acute Respiratory Distress Syndrome</td>
<td></td>
</tr>
<tr>
<td><em>SpO2 alert</em></td>
<td><em>SpO2 alert</em></td>
<td>Oxygen saturation</td>
<td>Acute Respiratory Distress Syndrome</td>
<td></td>
</tr>
</tbody>
</table>

**Possible Actions**

- Obtain N/assess
- Prepare fluid challenge
- Inhibit Fluid Balance Chart
- Call 222 if no circulation
- Consider initiating Major Haemorrhage Protocol
- Monitor response to actions
- Re-assess x2D
- Check blood glucose if less than 4mmol/L
- Activate Hypoglycaemia protocol
- Check Drug Chart
- Remember accurate documentation
- Control bleeding
- Treat any underlying conditions identified
- Reassess
- Maintain patient’s dignity
- Evaluate actions

---

**Pain Assessment and Management Guidelines**

- **Cancer-related pain:** Always score worst pain in the last 24 hours or since last assessment; refer to Palliative Care Guidelines.
- **Acute Pain:** Score current pain on movement, e.g., deep breathing; refer to Acute Pain Guidelines.

---

**Using appropriate Local Guidelines**

**Pain Score**

<table>
<thead>
<tr>
<th>Score</th>
<th>Pain Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - None</td>
<td>Continue to assess pain at least daily</td>
</tr>
<tr>
<td>1 - 3 Mild</td>
<td>Continue to assess pain with routine observations, must be at least daily</td>
</tr>
<tr>
<td>4 - 5 Moderate</td>
<td>Assess, administer and review analgesia as appropriate for patient</td>
</tr>
<tr>
<td>6 - 10 Severe</td>
<td>Assess, administer and review analgesia as appropriate for patient</td>
</tr>
</tbody>
</table>

---

**Using guidelines prescribe / give analgesia and review**

---

**NHS Lothian**

---

**Author:** Clinical Decision Team

---

**Approved by Clinical Penny, Documentation & Information Group, Approved Oct 2017, Revised Oct 2020**

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**CLINICAL DOCUMENTATION – AWAITING APPROVAL**
40.9. Appendix 8 – Treatment of Raised Intracranial Pressure in Adults

Management of traumatic brain injury (TBI) in adults

Critical Care Guidelines

NHS Lothian

General Recommendations
- Sedation – titrate sedation to aid synchrony with mechanical ventilation.
- Consider if the patient is having seizures and treat them (link to seizure management)
- Normothermia (core temperature <38°C) treat pyrexia with regular paracetamol and cooling if necessary.
- Review indications for cervical collar placement and remove if appropriate.
- Consider repeat CT brain to rule out development of an unexpected intracranial lesion.
- Surgical management of TBI should be consistent with Brain Trauma Foundation Guidelines [www.braintrauma.org/coma-guidelines/]

Goals of therapy
- GCS≤8 intubated

A. Airway Management- patients with a GCS ≤ 8 should be intubated for airway protection tape tracheal tube

B. Oxygenation/Ventilation
- Avoid hypoxia SpO2 ≥ 95%, PaO2 ≥ 13kPa
- Continuous monitoring of ETCO2
- Avoid hyperventilation, target PaCO2 4.5-5 kPa.
- Although prophylactic hyperventilation (PaCO2 <4kPa) is contraindicated, therapeutic hyperventilation may be necessary for brief periods when there is acute neurological deterioration that coincides with a cerebral herniation syndrome or for refractory elevations in ICP (See management of ICP)
- Brain tissue oxygen monitoring eg. LICOX® should be employed when prolonged hyperventilation is utilised

Goals of therapy
- SpO2 ≥ 95%
- PaO2 ≥ 13kPa
- PaCO2 4.5-5 kPa

C. Blood Pressure, Volume Resuscitation, Anaemia, and Coagulopathy
1. Blood Pressure avoid hypotension, target MAP> 90mmHg
2. Volume Resuscitation - invasive monitoring is recommended. Initial resuscitation fluid should be PlasmaLyte 148; target volume resuscitation to achieve euolaema and should not be withheld to prevent cerebral oedema. Fluid overload should be avoided as it is associated with increased incidence of ARDS
3. Anaemia - the target haemoglobin concentration is 90 g/l or above
4. Vasoactive drugs noradrenaline should be used to achieve target MAP
5. Coagulation –target INR & APTT ratio ≤1.5 and maintain platelets > 75 x 10⁹/mm³

D. Intracranial pressure monitoring (page 2)

| Title: Management of traumatic brain injury in adults |
| ID: Management of traumatic brain injury in adults 220414 |
| Lead Author: P. Andrews |
| Co Authors: B. Hogg, L. Weir, B. Harris, J. Rhodes, G. Nimmo |
| Category: 1 |
| Document Version: 1 |
| Status Draft/Final: Draft |
| Review Date: April 2016 |
| Authoriser; e.g. QIT |
| Date Authorisation: April 2014 |
D. Intracranial pressure monitoring
Use intraparenchymal ICP monitor with PbtO₂ monitoring.

Increased ICP is defined as ≥ 20mmHg
Cerebral perfusion pressure (CPP) should be maintained at ≥70mmHg.

<table>
<thead>
<tr>
<th>Indication</th>
<th>signs and symptoms of increased intracranial pressure (ICP) and/or GCS ≤ 8 following initial resuscitation if the admission CT scan of the brain is abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>contraindication</td>
<td>Coagulopathy (this should be corrected prior to inserting ICP monitor)</td>
</tr>
<tr>
<td>Consideration</td>
<td>age &gt;40 years</td>
</tr>
<tr>
<td></td>
<td>unilateral or bilateral motor posturing</td>
</tr>
<tr>
<td></td>
<td>SBP &lt; 100 mmHg</td>
</tr>
<tr>
<td></td>
<td>all patients undergoing urgent surgical procedures (orthopaedic repair, etc) in whom a moderate to severe brain injury is suspected (GCS 3-12) to guide appropriate intra-operative CPP management.</td>
</tr>
</tbody>
</table>

Non-emergency surgery that requires general anaesthesia, such as orthopaedic procedures and plastic surgery, should be avoided in both moderate and severe TBI patients until it is clear that the brain injury has stabilised or resolved. In the case of emergency surgery priority should be given to maintaining target physiological parameters such as systolic blood pressure > 100 mmHg (or higher if ICP is elevated), and oxygenation.

Adjunctive medications and prevention of complications
1. **Seizure prophylaxis** – refer to phenytoin monograph Stop after 7 days if no seizure activity.
2. **Glucocorticoids** - glucocorticoids are not effective at improving outcome or reducing intracranial hypertension, and should not be administered.
3. **Stress ulcer prophylaxis** – as per unit policy
4. **Venous thromboembolism (VTE) prophylaxis** – all patients with a TBI requiring mechanical ventilation and sedation should receive VTE prophylaxis by graduated compression stockings from admission and intermittent pneumatic compression devices (flowtrons®) until chemoprophylaxis started as per unit VTE policy.

**Metabolic monitoring**
1. **Sodium and osmolality** - maintain within normal range [Na⁺] 135-145mmol/L
2. Patients with diabetes insipidus or SIADH should have 12 hourly monitoring of plasma osmolality and sodium and see stage 2 management of raised ICP
3. **Glucose monitoring** - hyperglycaemia and hypoglycaemia are both detrimental to the outcome of patients with TBI. Target glucose range 4.5-10mmol/L.

**Nutritional support**
1. Nutritional support should be established via enteral route as soon as possible (oro-gastric tube if base of skull fracture confirmed or suspected).
2. TPN should be used with caution in patients with TBI due to the high glucose concentrations.
3. Patients not on neuromuscular blockers should receive 140% and those on NMBs 100% of basal energy expenditure. 15% of calories should be provided as protein.
Critical Care Guidelines

**Treatment of raised intracranial pressure in adults**

Treatment of intracranial hypertension should be initiated when the ICP ≥ 20 mmHg.

- If ICP resistant to therapy consider repeat brain CT scan.
- NB Brain Trauma Foundation guidelines recommend a CPP of 60mmHg. This is calculated when both the MAP and ICP are zeroed at the external auditory meatus. However, in our practice the arterial line is zeroed at the left atrium and so when 30° head up tilt is used, the target CPP should be 70mmHg.
- Ventricular catheters - prophylactic antibiotic use and routine surveillance cultures are not recommended.

**STAGE 1**

- **Head of patient’s bed** to be placed at ≥ 30 degrees with head in neutral position.
- **Sedation and analgesia.** Titrate sedation and analgesia to optimise synchrony with mechanical ventilation in order to achieve target blood gases.
- **Hypertonic therapy** – first line sodium chloride 5% 125ml iv over 15 mins
  second line mannitol 20% 200ml with Plasmalyte-148 250ml iv over 15 mins
- If ventriculostomy in place - drain to 10 cmH₂O for ICP ≥ 20 mmHg sustained for ≥ 5min. The preferred method for ICP monitoring and drainage is to monitor the ICP continuously and to drain only for elevations above the threshold (20 mmHg). *(if ICP remains ≥ 20 mmHg proceed to Stage 2)*

**STAGE 2**

- **Hypertonic therapy** - euvoalaemia should be maintained. The serum sodium and osmolality must be measured every 12 hr. Alternatives to osmotherapy should be used if the plasma osmolality exceeds 320mOsm/L or the serum sodium exceeds 160 mmol/l.
- **Revise PaCO₂ goal** 4-4.5 kPa, if brain PbtO₂>20mmHg
- **Neuromuscular blockade (NMB):** pharmacologic NMB with a continuous infusion should be employed if the above measures fail to adequately lower the ICP. Adequate sedation must be utilised if NMB is employed & EEG monitoring applied to look for seizure activity.
  *(if ICP remains ≥ 20 mmHg proceed to stage 3)*

**STAGE 3** *(rescue therapies – all reduce ICP but positive effect on outcome remain unproven)*

- **Decompressive hemi-cranietomy or bifrontal craniectomy** should only be performed if stages 1 and 2 are not effective.
- **Thiopental coma** induced coma is an option for those patients who have failed to respond to stage 1 & 2 measures to control raised ICP (link to thiopental monograph). Hypotension is a frequent side effect.
- NB life-threatening hyperkalaemia may occur for up to 24hours after stopping thiopental infusion
  o target K⁺ 3mmol/l during infusion
  o measure K⁺ 2-3 hourly for 24 hours after stopping (ABG samples are adequate).
- **Hypothermia** (32 - 36 °C) avoid shivering, hypotension and metabolic side effects (limit propofol dose to 3mg/kg/hr)
40.10. Appendix 9 – Acute Limb Compartment Observation Chart

Acute Limb Compartment Syndrome Observation Chart

Patients at risk

- Tibial, forearm or high-energy distal radius fractures.
- Orthopaedic injury/intervention combined with known coagulopathies/patient taking anticoagulants.
- Crush injuries.
- High impact trauma, including open fractures.

Monitor hourly for the first 24 hours. From 24 to 48 hours monitor 4 hourly. However, if suspicions arise at any point revert back to hourly monitoring.

Other patients may be monitored following individual assessment. In particular, consider the risk from newly applied traction, a restrictive cast or a tight circumferential bandage which does not allow for swelling. Patients who start reporting pain out of proportion to the injury/treatment, especially on passive movement, should also be considered for monitoring.

Pain out of proportion to the injury/treatment and pain on passive movement of the muscles of the involved compartment are the key clinical findings.

Patients who have had an anaesthetic nerve block or epidural may not be able to report the pain associated with compartment syndrome. In addition the ‘pain’ section should not be used in situations where the patient has an impaired ability to report this symptom, for example, when the patient is unconscious.

Changes in pulse, sensation and skin colour are late symptoms of neurovascular compromise and should not be relied upon to diagnose compartment syndrome. However, these may be recorded as part of a ‘well limb’ assessment.

Passive movement of the fingers

Place your fingers underneath the patient’s fingers and gently extend the fingers.

Passive movement of the toes

Place your fingers underneath the patient’s toes and gently extend the toes.

An increase in pain when carrying out this test may indicate a developing compartment syndrome and should be recorded appropriately on the chart overleaf.

A second chart will be required to provide a minimum of 48 hours monitoring.

September 2016. Publication code: 005 457
# CLINICAL DOCUMENTATION – AWAITING APPROVAL

## Patient details

**Name:**

**Hospital no.:**

**Date of birth:**

## Circle affected limb and select options

Nerve block or epidural

- **Left leg**
- **Left arm**

Cast/traction/tight bandaging

- **Right leg**
- **Right arm**

A separate chart must be used for each limb being assessed.

## Pain

<table>
<thead>
<tr>
<th>Pain area</th>
<th>Pain on passive movement</th>
<th>Pain on passive extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – None</td>
<td>1 – Mild</td>
<td>2 – Moderate</td>
</tr>
<tr>
<td>3 – Severe</td>
<td>4 – Very severe</td>
<td>5 – Intolerable</td>
</tr>
</tbody>
</table>

## Pain

<table>
<thead>
<tr>
<th>Severity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – No pain/had improved</td>
<td>1</td>
</tr>
<tr>
<td>1 – Is the same</td>
<td>2</td>
</tr>
<tr>
<td>3 – Has worsened</td>
<td>3</td>
</tr>
</tbody>
</table>

A total score of 3 or above, an individual pain parameter score of 3, or a clinical concern should be escalated immediately to the responsible clinician as per trust guidelines, emphasising the severity and/or worsening nature of the pain.

## Pressures

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diastolic blood pressure (DBP)</td>
<td>70</td>
</tr>
<tr>
<td>Intracompartmental pressure reading (IPR)</td>
<td>95</td>
</tr>
<tr>
<td>Delta pressure</td>
<td>55</td>
</tr>
</tbody>
</table>

**Difference 29**

Intracompartmental pressure reading **greater than 40** or Delta pressure **equal/less than 29** should be escalated immediately to the responsible clinician as per trust guidelines.

## Neurovascular status

<table>
<thead>
<tr>
<th>Status</th>
<th>Present</th>
<th>Reduced in volume or rate since last assessment</th>
<th>Normal</th>
<th>Abnormal/had changed from last assessment</th>
<th>Normal, responsive capillary refill</th>
<th>Pallor and/or sowe/absent capillary refill</th>
</tr>
</thead>
</table>

Any abnormal neurovascular status observations should be escalated immediately to the responsible clinician as per trust guidelines.

**Initial:**

**DX:**

---

**CLINICAL DOCUMENTATION – AWAITING APPROVAL**
40.11. Appendix 10 – ASIA Chart
(Download at www.spinalunit.co.uk)
Muscle Function Grading

0 = Total paralysis
1 = Visible or visible contraction
2 = Active movement, full range of motion (ROM) with gravity eliminated
3 = Active movement, full ROM against gravity
4 = Active movement, full ROM against gravity and moderate resistance in a muscle-specific position
5 = Normal active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person

Sensory Grading

0 = Absent
1 = Altered, either decreased/absent sensation or hypalgesia
2 = Normal
3 = Not testable (i.e., due to immobilization, severe pain such that the patient cannot be grasped, amputation of limb, or contracture of > 50% of the normal range of motion)

Non Key Muscle Functions (optional)

May be used to assign a motor level to differentiate AIS B vs. C

Movement

Root level

Sacral: Hamstring, extensor, adductor, abductor, internal and external rotation
L5: Inversion and eversion
L4: At least 1 volitional and 1 non-volitional contraction
L3: At least 1 of the following: adductor or abductor, extensor, hip flexion (CSA), adductor or abductor
L2: Adductor, hip flexion, hip extension, tensor fascia lata
L1: Hip extension, hip adduction, internal rotation
L5: Knee, ankle
L4: Ankle, hip adduction, hip internal rotation
L3: Knee, ankle
L2: Hip adduction, hip flexion, hip extension
L1: Adductor, hip flexion, hip extension

ASIA Impairment Scale (AIS)

A = Complete
No sensory or motor function is preserved in the sacral segments S4-S5.

B = Sensory Incomplete
Sensory but no motor function is present below the neurological level and includes the sacral segments S4-S5 (light touch or pin prick at S4-S5 or deep and superficial pin prick in S2-S3, and no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete
Motor function is preserved below the neurological level, and more than half of the key muscle functions below the neurological level of injury (NLI) have a muscle grade less than 3 (Grades 0-2)

D = Motor Incomplete
Motor function is preserved below the neurological level; and at least half (half or more) of key muscle functions below the NLI have a muscle grade of 3 or greater

E = Normal
Sensation and motor function are normal as tested with the ENOSG. S1 and S2 are normal in all segments, and the patient has normal biceps reflexes. The NLI is = E. Thereafter, without the need for an AIS grade.

NOTE: For an individual to receive a grade of C or D, i.e., motor incomplete status, there must be either (1) voluntary and/or spastic muscle contraction or (2) need for spastic muscle contraction on more than three levels below the motor level for the side of the body. The International Standards of the time allows for not more than one key muscle group to be graded below the neurological level of injury.

Steps in Classification

The following is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.

The sensory level is the most caudal intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.

Define the lowest key muscle strength that has a grade of at least 3 (on a 0-5 scale) providing the key muscle function is preserved below that level; the level is also normal for all levels above and below.

3. Determine the neurological level of injury (NLI)

The NLI is the most caudal segment of the cord with intact sensation and voluntary or non-voluntary muscle function strength, provided that there is normal (full) sensitivity and motor function rated as 3 or better. The NLI is the most caudal segment of the cord with intact sensation and voluntary or non-voluntary muscle function rated as 3 or better. The NLI is the most caudal segment of the cord with intact sensation and voluntary or non-voluntary muscle function rated as 3 or better.

4. Determine whether the injury is Complete or Incomplete.

If voluntary or non-voluntary muscle function is rated as 3 or more, the injury is Complete.

5. Determine ASIA Impairment Scale (AIS) grade.

Is injury Complete? If yes, AIS-E.

Is injury Motor Incomplete? If no, AIS-B.

Is sensory level at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?

If yes, AIS-C.

If no, AIS-D.

International Standards for Neurological Classification of Spinal Cord Injury

ISCOS
40.12. Appendix 11 – Referral from SIU

![Referral Form](image)

**Acute Services Division**  
Queen Elizabeth National Spinal Injuries Unit, Scotland

### Referral to National Spinal Injuries Unit

<table>
<thead>
<tr>
<th>Date of Referral</th>
<th>Time of Referral</th>
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</thead>
<tbody>
<tr>
<td>Name</td>
<td>CHI No.:</td>
</tr>
<tr>
<td>Date of Adm at Ref Hosp</td>
<td>Time of Adm at Ref Hosp</td>
</tr>
<tr>
<td>Date of Injury</td>
<td>Time of Injury:</td>
</tr>
</tbody>
</table>

### DETAILS OF INCIDENT

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>YES □</th>
<th>NO □</th>
<th>Drugs</th>
<th>YES □</th>
<th>NO □</th>
<th>Name</th>
</tr>
</thead>
</table>

| Hosp & Wd: | Tel: | Consultant: | Tel: | Ref Doctor: | Page: |

### CLINICAL CONDITION

- **Airway:** Intubated □ Yes □ No □ Tracheostomy: □ Yes □ No □
- **Breathing:** Spontaneous □ Ventilated □
- **O₂ Saturation**
- **Blood Gases**

### SPINAL INJURY DETAILS

- **Spinal Fractures:**
- **Sensory Level:**
- **Motor Level:**
- **CT or MR Findings:**

### OTHER INJURIES

- **Head:**
- **Chest:**
- **Abdomen/Pelvis:**
- **Limb:**
- **Pressure Sores:**

### TREATMENTS SO FAR

| Surgical Procedures | YES □ | NO □ | If Yes Detail: |

### PAST MEDICAL HISTORY AND MEDICATIONS


# Appendix 12 – Transfer Checklist Referral to SIU

## Transfer Checklist

<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>DOB:</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
</table>

- **A** Airway is clear and can be maintained during transfer. Intubate prior to transfer if PCO₂ > 6kPa or if respiratory failure is likely to develop during a prolonged transfer.

- **B** Supplemental oxygen is being administered and ventilation is adequate.

- **C** Haemodynamically stable: Secure IV access and/or ionotrope support.

- **D** Immobilisation of the spine is adequate and secure. Recommend: Vacuum Mattress or Hard Collar - in definite or suspected cervical spinal injury.

- **E** Anaesthetic and nursing escort as indicated.

- **F** Nasogastric tube is in situ, draining freely, and connected to low suction if required as indicated.

- **G** Indwelling urethral foley catheter is in situ and draining freely.

- **H** Skin is protected from injury on a vacuum mattress.

- **I** Level and extent of spinal cord injury is documented.

- **J** Summary clinical note, copy of kardex, casenote and all imaging and investigation results to accompany the patient.

<table>
<thead>
<tr>
<th>Summary Clinical Note</th>
<th>Copy of Kardex</th>
<th>Casenote</th>
<th>Investigation Results</th>
<th>Imaging Results</th>
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<tbody>
<tr>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
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</tbody>
</table>

- **L** Hard copy
- **M** BCD
- **N** Image link

**Comments:**

<table>
<thead>
<tr>
<th>Transfer form completed with (name):</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
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| Form completed by (name): | Signature: |}

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*Page 191 of 204*
### CHECKLIST (PLEASE TICK IF DISCUSSED WITH REFERRING DOCTOR)

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<thead>
<tr>
<th>Item</th>
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<th>No</th>
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<tr>
<td>Spinal Immobilisation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Respiratory Care</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Pressure Area Care</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Pegsus/Egerion/Turning bed, Tel no: 08457 342 000</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>LMW Heparin</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Anti-embolism stockings</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>C2H5OH Withdrawal (sedative &amp; thiamine)</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Urinary Catheter</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>NG Tube</td>
<td>YES</td>
<td>NO</td>
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</tbody>
</table>

### Plan:
- Seniors Informed: ☐
- Name:
- Decision about admission:
- Information given to referring clinician:

### Signature: ____________________________  Print Name: ____________________________  Date & Time: ______________

### DAILY PROGRAMME FOLLOWING INITIAL REFERRAL

<table>
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<th>Date</th>
<th>Advice / Plan</th>
<th>Reason for Delay</th>
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</table>

1. Patient too unwell
2. Bed not available
3. Transport problems
4. Other

Date of Arrival at QENSIU: ____________________________
Time of Arrival at QENSIU: ____________________________

Chart 1: The NEWS Scoring System
Chart 2: NEWS Thresholds and Triggers
Chart 3: NEWS Observation Chart
Chart 4: Clinical Response to NEWS Trigger Thresholds

Chart 1: The NEWS scoring system

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<tr>
<th>Physiological parameter</th>
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<th>3</th>
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</thead>
<tbody>
<tr>
<td>Respiration rate (per minute)</td>
<td>≤8</td>
<td>9–11</td>
<td>12–20</td>
<td>21–24</td>
<td>≥25</td>
</tr>
<tr>
<td>SpO₂ Scale 1 (%)</td>
<td>≤91</td>
<td>92–93</td>
<td>94–95</td>
<td>≥96</td>
<td></td>
</tr>
<tr>
<td>SpO₂ Scale 2 (%)</td>
<td>≤83</td>
<td>84–85</td>
<td>86–87</td>
<td>88–92</td>
<td>93–94 on oxygen</td>
</tr>
<tr>
<td>Air or oxygen?</td>
<td>Oxygen</td>
<td>Air</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>≤90</td>
<td>91–100</td>
<td>101–110</td>
<td>111–219</td>
<td>≥220</td>
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<tr>
<td>Pulse (per minute)</td>
<td>≤40</td>
<td>41–50</td>
<td>51–90</td>
<td>91–110</td>
<td>111–130</td>
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<tr>
<td>Consciousness</td>
<td>Alert</td>
<td>CVPU</td>
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<tr>
<td>Temperature (°C)</td>
<td>≤35.0</td>
<td>35.1–36.0</td>
<td>36.1–38.0</td>
<td>38.1–39.0</td>
<td>≥39.1</td>
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</table>

Chart 2: NEWS thresholds and triggers

<table>
<thead>
<tr>
<th>NEW score</th>
<th>Clinical risk</th>
<th>Response</th>
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<tbody>
<tr>
<td>Aggregate score 0–4</td>
<td>Low</td>
<td>Ward-based response</td>
</tr>
<tr>
<td>Red score</td>
<td>Score of 3 in any individual parameter</td>
<td>Low–medium</td>
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<tr>
<td>Aggregate score 5–6</td>
<td>Medium</td>
<td>Key threshold for urgent response*</td>
</tr>
<tr>
<td>Aggregate score 7 or more</td>
<td>High</td>
<td>Urgent or emergency response**</td>
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</tbody>
</table>

*Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

**The response team must also include staff with critical care skills, including airway management.
### NEWS key

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#### FULL NAME

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#### A+B

**Respirations**

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**SPO2 Scale 1**

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**Air or oxygen?**

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#### C

**Blood pressure**

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**Pulse**

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#### D

**Consciousness**

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<td>Alert</td>
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<td></td>
</tr>
<tr>
<td>Vaguely Confused</td>
<td></td>
<td></td>
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<tr>
<td>Comatose</td>
<td></td>
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</table>

#### E

**Temperature**

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<tr>
<th>Score</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>38.1-39.0°</td>
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<tr>
<td>37.1-38.0°</td>
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<tr>
<td>36.1-37.0°</td>
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<td>35.1-36.0°</td>
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<td>&lt;=35.0°</td>
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#### NEWS TOTAL

<table>
<thead>
<tr>
<th>Monitoring frequency</th>
<th>Escalation of care Y/N</th>
<th>Initials</th>
</tr>
</thead>
</table>

### TOTAL
### Chart 4: Clinical response to the NEWS trigger thresholds

<table>
<thead>
<tr>
<th>NEW score</th>
<th>Frequency of monitoring</th>
<th>Clinical response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Minimum 12 hourly</td>
<td>• Continue routine NEWS monitoring</td>
</tr>
</tbody>
</table>
| Total 1–4 | Minimum 4–6 hourly      | • Inform registered nurse, who must assess the patient  
• Registered nurse decides whether increased frequency of monitoring and/or escalation of care is required |
| 3 in single parameter | Minimum 1 hourly | • Registered nurse to inform medical team caring for the patient, who will review and decide whether escalation of care is necessary |
| Total 5 or more  
Urgent response threshold | Minimum 1 hourly | • Registered nurse to immediately inform the medical team caring for the patient  
• Registered nurse to request urgent assessment by a clinician or team with core competencies in the care of acutely ill patients  
• Provide clinical care in an environment with monitoring facilities |
| Total 7 or more  
Emergency response threshold | Continuous monitoring of vital signs | • Registered nurse to immediately inform the medical team caring for the patient – this should be at least at specialist registrar level  
• Emergency assessment by a team with critical care competencies, including practitioner(s) with advanced airway management skills  
• Consider transfer of care to a level 2 or 3 clinical care facility, i.e. higher-dependency unit or ICU  
• Clinical care in an environment with monitoring facilities |
Appendix 14: SAS Transfer Booking Guidance

Inter-hospital transfer booking guide

Contents

This booking guide has been split into the various sections below to help with acuity, staffing and resources available:

1. Overview of transfer response categories
2. To book an emergency "Now" transfer
3. For an ambulance in One Hour or Within 4 Hours
4. For a remote and rural inter-hospital transfer
5. Different staff grades and capabilities
6. Vehicle and escort options
7. Safety Netting

1. Response to inter-hospital transfer requests

We will provide a number of different responses to requests from healthcare professionals dependent on the needs of the patient. This includes:

- Now
- One or two hours
- Within 4 hours

- Now Response: The response will be aligned to our emergency clinical response model and prioritised in the same way as 999 calls across the purple, red, amber and yellow response categories. Will require a conveying resource, paramedic crew and blue light response.

A Now transfer request would be appropriate in those rare situations where a facility is unable to provide immediate life-saving clinical intervention such as resuscitation or in the case of a declared obstetric emergency and requires the clinical assistance of the ambulance service in addition to a transporting resource. OR where the clinical condition of the patient requires a time critical transfer for further treatment and management at the destination facility.

Equivalent to Inter-facility transfer (IFT) category 1 or 2 of Intensive Care Society guidelines on transfer of critically ill adults. [https://www.ics.ac.uk/ICS/ICS/GuidelinesAndStandards/ICSGuidelines.aspx](https://www.ics.ac.uk/ICS/ICS/GuidelinesAndStandards/ICSGuidelines.aspx)

- One or Two Hour Response: A conveying resource and escort, appropriate to patient need, driving under normal road conditions. A One or two-hour response would be appropriate for patients who do not require immediate life or limb saving interventions but do require an increase in their level of clinical care within 1-2 hours. This level of response may include mental health crisis transfers or those solely for the purpose of creating a critical care bed.

Equivalent to Inter-facility transfer (IFT) category 3 of Intensive Care Society guidelines on transfer of critically ill adults.

- Within Four Hour Response: A conveying resource and escort, appropriate to patient need, driving under normal road conditions.

A Within 4-hour response is for all other patients who do not fit the above definitions and require urgent transport for ongoing care but do not need to be managed as an emergency. Patients being transferred to inpatient wards for ongoing management or for elective and semi elective procedures or investigations would be included in this group.

Equivalent to Inter-facility transfer (IFT) category 3 of Intensive Care Society guidelines on transfer of critically ill adults.

- Scheduled response – same day or in future: A conveying resource and escort, appropriate to patient need, driving under normal road conditions.

Repatriations or step-down transfers/discharges to non-hospital facilities and outpatient appointments, these types of transfer are not included in the Intensive Care Society Framework.

2. How to book an ambulance needed NOW

RING 0333 3990111

What you must provide:

- Telephone number (direct line, not switchboard for re-contact)
- Patient pickup location
- Details of any escorts/equipment travelling

You will be asked:

- Is the patient breathing?
- Is the patient conscious?
- Approximate patient weight?
- Reason for transfer?

3. How to book an ambulance needed in up to One or two hours, or Within four hours

RING 0345 6023999

What you must provide:

- Patient pickup location
- Telephone number (direct line, not switchboard for re-contact)
- What is the reason for the admission or transfer?
- Does the patient require any active intervention i.e. oxygen, ECG monitoring etc. or is this for transport only?
- Does the patient have any known infection control issues?
- Approximate weight for the patient
4. How to book an ambulance from a geographically remote location

For ambulance response to geographically remote locations where air ambulance resource or ScotSTAR retrieval team escort may be appropriate, contact the Specialist Services Desk (SSD) in the first instance on 03333 990 222.

The SSD may facilitate a conference call with a retrieval consultant to help determine the most appropriate transport platform and escort.

5. Our staff

We employ over 5,000 highly skilled staff, and are helped by over 1,500 volunteers working in roles such as Community First Responders and volunteer car drivers.

We have a range of different skilled roles including:

- **Ambulance Care Assistants** can drive a range of ambulances and provide safe and comfortable transport of walking, chair and stretcher patients, ensuring their dignity and respect is maintained. Ambulance Care Assistants can provide basic first aid and administer up to 6L/min of oxygen.

- **Ambulance Technicians** provide treatment and transportation for all acuities of patients. Technicians have completed the Diploma in Emergency Care Support at SCQF level 6 and perform a full range of monitoring and assessment skills for patients including all baseline observations, 3 and 12 lead ECG diagnostics and monitoring and blood glucose monitoring. Technicians can also administer a range of oral, buccal and IV drugs.

- **Paramedics** are registered healthcare professionals with a Diploma of Higher Education in Paramedic Practice at SCQF level 8. From 2021 all new entry paramedics will be degree educated. Paramedics can perform the same monitoring and assessment skills as technicians, however also have the ability to undertake cannulation (venous and intravenous), intubation, needle thoracostomy, needle cricothyroidotomy. Paramedics can also administer a wider range of medications i.e. atropine, morphine and diazepam.

6. Transporting resources – staff and vehicles

We have a range of resources which can respond to your request for transport depending on the needs of the patient.

- **Patient Transport Service (PTS)** is staffed by Ambulance Care Assistants with a range of vehicles that can accommodate patients on stretchers, seated patients and patients in wheelchairs. The vehicles can accommodate multiple patients at the same time.

- **Urgent Tier** vehicles are staffed by an Ambulance Technician and Ambulance Care Assistant who will have full emergency driving capability. If it is required. Urgent tiers are fully equipped ambulances and are targeted towards acute patients, up to two hours and inter-hospital transfer requests however have the ability to respond and transport under emergency conditions if required.

- **Accident and Emergency Ambulances** are staffed by Paramedics and Ambulance Technicians and are fully equipped to attend to the full range of pre-hospital patients.

**NOW** responses will always be attended by emergency vehicles.

**NOW** responses will likely be attended by urgent tier vehicles.

**NOW** responses will either be attended by PTS or urgent tier vehicles.

7. Safety netting

On occasions where we are unable to attend the patient in the timescale requested due to geographical or demand implications we will safety net all patients from within our control rooms.

For any **NOW** response patients, one of our clinicians will call back and undertake a full clinical triage after 45 minutes. This may result in the response level staying the same or being elevated.

For **NOW**, or **NOW** response levels, our call handlers will undertake welfare calls at hourly intervals if we are unable to make the initial response time. If, in the unlikely event we are unable to attend within 3 hours, a clinician will undertake a full clinical triage.

We will never knowingly re-categorise a patient lower than that booked of the booking HCP, we will always strive to contact the booking HCP for professional discussion. Please help by ensuring we have a direct telephone number on which to reach the ordering clinician.
40.15. Appendix 15 - Paediatric Tranexamic Acid Guidelines

Tranexamic Acid in Paediatric Trauma – Local Guidance for RHSC Edinburgh

Indication: to be administered within 3 hours of injury to:

1. Any child who requires RCC transfusion within 3 hrs of injury
2. Any child considered (by the treating clinician) to be at significant risk of major bleeding (e.g. liver lac, splenic lac), especially if being managed conservatively

Dosage:

Loading Dose – 15mg/kg (max 1g) diluted in a convenient volume of Sodium Chloride 0.9% or Glucose 5% and given over 10 minutes

Maintenance infusion – 2mg/kg/hour. Suggested dilution 500mg in 500ml of sodium chloride 0.9% or glucose 5% given at a rate of 2mls/kg/hour. For at least 8 hours or until bleeding stops.

Reference: Evidence Statement: Major trauma and the use of tranexamic acid in children,

*RCPCH, November 2012*
40.16. Appendix 16 - Paediatric Traumatic Cardiac Arrest Protocol

Please also refer to the full protocol here:

![Paediatrics]

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**Figure 1** Paediatric TCA algorithm. ETCO₂, end tidal carbon dioxide; PICU, paediatric intensive care unit; ROSC, return of spontaneous circulation; TCA, traumatic cardiac arrest.
40.17. Appendix 17 – Child Protection Triage in Children Presenting in Trauma

Child Protection Triage in Children
Presenting with Major Trauma

NOT INDEPENDENTLY MOBILE
- NOT yet crawling, bottom shuffling, pulling to stand, cruising or walking independently.
- Includes all infants under the age of six months and most under 9 months.
- Rolling does NOT constitute mobility
- Consider with non mobile physical disability

Bruises rarely seen in Accidental Trauma
- Back, buttocks, abdomen, upper limbs, cheeks, eyes, ears, palms of hands, soles of feet

A.B.C
TRAUMA MX........

Independently mobile?

Any concerns re presentation?*

Senior review +/- discussion with child protection team

Any concerns?

Child Protection Alert on system?

*Senior review +/- discussion with child protection team

Any concerns?

NO FURTHER CP CONSIDERATION

- Assess briefly for all injuries
- Document bruising including diagram
- Contact Child Protection Team

*History potentially suggestive of NA1
- Unwitnessed injury or inconsistent history
- Injury not consistent with developmental stage
- Changing history
- Late presentation
- Frequent attender
- Features of possible neglect
- Other concerning injuries identified