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(Underlined sections above are hyperlinks. Click on them for their corresponding section)
BCH Key Contact Numbers

BLEEPS

PICU Registrar – 55006
Anaesthetic Registrar – 55427
Surgical Registrar – 55420
Surgical SHO – 55421
T&O Registrar – Via switchboard
Neurosurgical Registrar – Via switchboard
Theatre Co-ordinator – 55122
Radiologist – Via Switchboard
Radiographer – 55048 (1700h-0900h) (Phone in-hours)
Porter – 55140 (1700h-0900h) (Phone in-hours)
Haematology Technician – 55034 (1700h-0900h) (Phone in-hours)

*You can access the routine bleep system by dialing 9977, the 55*** bleep number, your 4 digit extension, #. To fastbleep, dial 2222 and tell switchboard to fastbleep person / bleep number to your location*

PHONE NUMBERS

PICU – 9652
KIDS Retrieval - 9687
Main Theatre – 9562
CT Control Room - 9752
MRI Control Room - 9751
Security - 8480
Blood Bank – 9867
Porters – 8444

West Midlands Major Trauma Desk - 01384 215696 (general enquiries)
Major trauma within the UK trauma network is defined as a patient with an injury severity score (ISS) greater than 16 (Appendix A). This is impossible to ascertain at point of injury and only becomes apparent after full assessment and investigation over hours (if not days) post injury.

For that reason, there will often be an over-estimation in paediatric patients needing to be transferred to a Paediatric Major Trauma Centre, with activation of the paediatric trauma team being more often - in retrospect - than was necessary. This will be audited at regional level, but will be inevitable in order to give the best care to all injured children in the West Midlands region.

Follow the guidelines for activation of trauma calls and do not worry about calling a trauma call wrongly – the team can be stood down quickly once the patient is assessed in the ED.

Trauma patients are complex and by definition will involve multidisciplinary teams.

Emergency trauma management will follow well-defined principles and will not be confined to any one specialty. The factors most commonly causing clinical problems are poor decision-making and lack of effective communication within and between teams.

*Particular attention needs to be paid to full documentation of decisions, interventions and times.* The role of the scribe is pivotal to good documentation.

Ensure you feedback any significant issues to the Trauma Team Leader to enable assessments, and changes to practice, to be made.
BCH Trauma Team

Activation Criteria

The paramedic at the scene of an incident will assess paediatric patients against the pre-hospital triage tool (see appendix B). If there are any severe injuries or alarming mechanism of injuries present, those will be the ‘triggers’ to activate a major trauma call.

Their call will be patched to BCH via the Major Trauma Desk at WMAS. This is staffed by senior paramedics, and all calls will be recorded and used for on-going training. The call to BCH will ultimately come through to the ED Alert Phone in the resuscitation room:

Responsibilities of the staff member taking the pre-alert calls:

- Obtain the information required of the ‘alert call’ form. This should be given in the ATMIST format (see appendix C, or resus room wall). Alert call forms are kept in the black folder by the alert phone (a copy can be found in appendix D).

- Call the switchboard on 2222 to notify the ED Consultant

- Call the switchboard on 2222 to send out either:-
  1. Trauma Alert – Road – ETA ** mins, or
  2. Trauma Alert – Helicopter – ETA ** mins

In the event of an unexpected / unannounced arrival of a major trauma patient to the ED, the triage nurse will quickly obtain:

- Patient’s age
- Mechanism of injury
- Estimated nature of injuries
- Notify ED doctors for immediate assessment of the patient
- Call the ED consultant / Trauma Team (if necessary)

(See flowchart of trauma alerts at BCH in appendix E)

Switchboards role in activating the trauma team alert –

Switchboard will be notified by the ED that a major trauma has either arrived or is expected. Switchboard will immediately contact the Trauma Team by giving the voice over message:

“Trauma Alert Road / Helicopter – ETA ** minutes” (no. of mins to estimated time of arrival)

Or

“Trauma Team to the Emergency Department”

For Helicopter Transfers, they may put out the message

“Helicopter landing – ETA ** minutes – No trauma team required”

All telephone calls regarding trauma, which are received by the switchboard, must be referred to ED.
Composition and Positions:

- **Anaesthetist / PICU**
- **ODP / Tech Team Nurse**
- **ED Middle Grade**
- **Nurse 1**
- **Nurse 2**
- **ED SHO**
- **Specialties Dr**
- **Parents Nurse (+/- Parents)**
- **Drugs Nurse**
- **Radiographer**
- **Scribe**
- **Trauma Team Leader**
**Trauma Team Leader:**

The Emergency Department Consultant will be responsible for directing the management of trauma on admission to Birmingham Children’s Hospital at which time he/she will take on the role of the trauma team leader. It will be expected that the Trauma Team Leader will be present in the Emergency Department before the arrival of the expected patient.

The Trauma Team Leader will be responsible for:

- Giving **paediatric-specific** advice at the request of the enhanced care team during the pre-hospital management of the patient.
- Ensuring that primary transfers into BCH, in conjunction with the Trauma Desk, are carried out appropriately (In conjunction with KIDS and Trauma Desk for secondary transfers).
- Performing the “five second round”, to quickly assess the patient’s responsive level, feel for a distal pulse and look for any obvious signs of external haemorrhage. If the Five second round does not cause concern, the TTL can “Release” the Trauma Team to complete the primary survey whilst they take handover from the ambulance crew.
- Receiving a rapid handover, using ATMIST (full tool in appendix C):
  - **Age** – Age and sex of casualty
  - **Time** – Time of the incident
  - **MOI** – Mechanism of incident. Includes gross mechanism of incident and other Factors known to be associated with major injuries
  - **Injuries** – Seen or expected
  - **Signs** – Vital signs, and whether they have improved or deteriorated over time
  - **Treatment** – Treatment given

- Supervising the primary survey, initiating resuscitation and directing immediate fluid resuscitation for hypovolaemic shock.
- Directing haemostasis and surgical procedures such as chest drain, surgical airway, and urethral catheter.
- Provision of advice on immediate investigations (radiological or laboratory).
- Secondary survey and checking of available results of investigations and handing over any outstanding results.
- Referral of trauma patients to other speciality services (e.g. neurosurgery, maxillo-facial, plastic, orthopaedic).
- Discussing the overall management of the trauma patient with the parents.
- Documentation of medical record sheet and admission notes.

The Trauma Team members will carry the trauma bleep at all times. If it becomes necessary that he/she will be unavailable for a period of time the bleep must be handed over to an alternative equivalent team member.
PICU Consultant / Registrar or Anaesthetic Consultant / Registrar

He/she will have responsibility for cervical spine stabilisation and management and stabilisation of airway and ventilation

He/she will be responsible for:

- Controlling the head and cervical spine of the patient
- Assessment of airway patency:
  - Notes facial injuries affecting airway
  - Cears oropharynx
  - Evaluates trachea for midline position
  - Evaluates bilateral breath sounds
  - Observes patient for retractions, stridor etc.
  - Notes presence of crepitation
- Provision of an effective airway based on patient’s condition and associated injuries. In consultation with TTL considers the need for a surgical airway.
- Where necessary, endotracheal intubation and subsequent ventilation of patient.
- Advise on oxygen therapy in non-ventilated trauma patients.
- Administration of anaesthetic agents.
- Co-ordinating cardio-pulmonary resuscitation of the patient.
- Provision of advice regarding admission to PICU.
- Advise on pain relief.

The PICU Consultant will assume position of the TTL in the absence of the ED Consultant

OPD / Tech team nurse

They will assist the PICU/Anaesthetic registrar/consultant by:

- Preparing the appropriately sized intubation equipment
- Applying cricoid pressure when required
- Establishing ETCO2 monitoring post intubation
- Taping down ET tubes

ED Registrar

The ED Registrar will be responsible for:

- Commencing primary survey and immediate resuscitation under the supervision of the TTL.
- Calling a trauma alert in the case of a deteriorating patient who was stable on arrival.
- Placing an IV cannula and collecting blood for investigations (Group and X-match, FBC, U&E/Glucose, Blood gases, Amylase)
- Taking part / carrying out the major part of the practical procedures i.e. IV/IO access, fluid boluses, under direction of TTL.
- Ensuring that proper equipment accompanies patient during transport.
ED SHO

The ED SHO will be responsible for:

- Placing an IV cannula
- Taking part / carrying out the major part of the practical procedures i.e. IV/IO access, fluid boluses, under direction of TTL
- If there are enough medical staff to continue management of patient, the ED SHO should discuss with the parents what is happening and also obtain a history if possible of the incident and previous medical history, start medical documentation.

Nurse 1

Nurse 1 (patient’s right hand side) is responsible for:

- Ensuring that the room is prepared prior to the patients arrival
- Assisting in the patient transfer onto trolley and with spinal immobilisation.
- Establishing a rapport with the child so that he/she will be able to communicate with the child throughout resuscitation.
- Helping with airway management and assisting the airway doctor
- Helping the ED Registrar with drips, collecting blood
- Assisting in log roll
- Ensuring that the proper equipment is available and accompanies the patient.
- Notifying the receiving area prior to the departure from the ED.
- Ensuring that all documentation accompanies the patient
- Providing a full report and handover to the receiving area personnel

Nurse 2

Nurse 2 (patients left hand side) is responsible for:

- Exposure
- Placing 02 probe, BP cuff and ECG leads. Checking temperature
- Ongoing monitoring of vital signs, with 5min update to team
- Assisting with insertion of NG/OG tube, urinary catheter, haemostasis or dressing, splinting for fractures and with any other interventions
- Will also help in preparation of intravenous lines, warming of Intravenous fluids/blood

Drugs Nurse

The drugs nurse will be responsible for:

- Drawing up a fluid boluses in advance
- Drawing up any medications requested by TTL or PICU / Anaesthetist in advance
- Prompting to establish if estimated weight needs to be recalculated on patient arrival
- Drawing up any medications or fluids requested by TTL
- Accurate monitoring of fluid input and output, liaising with scribe
- Accurate documentation of medications given, liaising with scribe
**Parent's Nurse**

The parent's nurse will be responsible for:

- Staying beside the parents at all times if they want to remain in the resuscitation room, keeping them informed of what is happening.
- Updating parents or relatives who want to remain in the family room of the situation
- Accompanying the parents to the X-Ray Department, a ward or PICU.

**Scribe**

The scribe will be responsible for:

- Documenting those present in the resuscitation room
- Documenting the patients time of arrival
- Documenting the ATMIST handover
- Documenting the observations given every 5mins by Nurse 2
- Documenting the fluids and medications administered by the drugs nurse
Management of Traumatic Cardiac Arrest

Traumatic cardiac arrest caused by trauma has a very high mortality, with an overall survival of 5.6% (range 0-17%). The subgroup of patients who arrest after hypoxic insults, (e.g. hanging, drowning, c-spine injury), have a slightly increased chance of survival. The following guidance aims to maximise the chances of survival in this critically injured cohort and should proceed in a horizontal fashion according to the <C>ABC paradigm.

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;C&gt; Catastrophic Haemorrhage</td>
<td>-Activate Massive Transfusion Protocol</td>
</tr>
<tr>
<td></td>
<td>-Give 2 units O neg blood stat</td>
</tr>
<tr>
<td></td>
<td>-Catastrophic limb haemorrhage should be treated with a CAT tourniquet or fully inflated manual BP cuff until the bleeding stops</td>
</tr>
<tr>
<td></td>
<td>-Haemostatic agents are indicated when catastrophic haemorrhage is uncontrollable by any other means and the patient needs emergency surgery for their injuries</td>
</tr>
<tr>
<td>&lt;A&gt; Airway</td>
<td>-Secure the airway and ventilate with 100% O₂</td>
</tr>
<tr>
<td></td>
<td>-Consider a suxamethonium only intubation if the patient has just arrested</td>
</tr>
<tr>
<td></td>
<td>-Look for airway obstruction / disruption</td>
</tr>
<tr>
<td>&lt;B&gt; Breathing</td>
<td>-Perform bilateral thoracostomies</td>
</tr>
<tr>
<td></td>
<td>-Perform an emergency thoracotomy in penetrating trauma if there were vital signs &lt;10mins prior to cardiac arrest and no return of spontaneous circulation</td>
</tr>
<tr>
<td></td>
<td>-Exclude life-threatening chest injuries (e.g. cardiac tamponade, massive haemothorax etc.)</td>
</tr>
<tr>
<td>&lt;C&gt; Circulation</td>
<td>-Insert two wide-bore IV cannula</td>
</tr>
<tr>
<td></td>
<td>-Use IO access if unable to secure iv access</td>
</tr>
<tr>
<td></td>
<td>-Apply pelvic splint and realign limb fractures</td>
</tr>
<tr>
<td></td>
<td>-Check the heart for shockable VT or VF</td>
</tr>
</tbody>
</table>

CPR and chest compressions are unlikely to be effective in hypovolaemic cardiac arrest but most survivors do not have hypovolaemia-related arrest so a standard ALS approach can be life-saving. Standard CPR should not delay the treatment of reversible causes (e.g. thoracotomy for cardiac tamponade). Adrenaline should be used cautiously as it can worsen intracellular hypoxia and increase bleeding. If there is no response within 20 minutes despite the above measures, the patient should be pronounced dead.

Commotio Cordis is a rare condition where actual or near cardiac arrest is caused by a blunt impact to the chest wall over the heart. A blow to the chest during the vulnerable phase of the cardiac cycle may cause malignant arrhythmias, (usually VF). Commotio cordis occurs mostly during sports and victims are young males, (mean age 14 years). The overall survival rate from commotion cordis is 15%, but 25% if resuscitation is started within 3 minutes.
Management of suspected cervical spine injuries

Indications for cervical spine immobilisation:

1. All patients with altered level of consciousness

2. Patients in whom the mechanism of the injury could have resulted in injury to the spine (see non-exhaustive list of mechanism triggers on page 5)

3. All patients with signs and symptoms consistent with spinal cord injury:
   - History of transient paraesthesia, dysesthesia, shooting pains or subjective extremity paralysis
   - Complaints of neck pain or discomfort, or presence of muscle spasm
   - Limited range of motion or tenderness over the spin
   - Presence of sensory-motor deficits

Note: Cervical spine in an unconscious patient can only be confidently cleared after the patient regains consciousness. In doubtful situations it is mandatory to continue with cervical spine immobilisation until an expert consultation is available preferably after negative radiology and normal clinical examination.

Immobilisation of patients arriving by ambulance

If an injured child arrives by ambulance and immobilisation is inadequate, the following steps should be taken:

- DO NOT transfer the child from ambulance stretcher to ED trolley until immobilisation is adequate.
- Ensure adequate manual in-line stabilisation is provided
- Replace all soft (or makeshift) collars with rigid collars.
- Log roll patient and place vacu-mattress under them
- Apply sand bags / blocks and remove air from vacu-mattress
- Move patient to ED trolley

Note: once applied, cervical spine immobilisation may be removed only by the order of the TTL. If collar, sandbags and tape are removed for any other reason before C-spines are cleared, document the reason and duration. The time that the C-spine is cleared must also be documented.

Immobilisation of patient arriving by private vehicle:

If an injured child arrives by private vehicle, and the potential for spinal injury exists, the following procedure should apply under the direction of a trained doctor:

- Instruct the parents NOT to move the child
- A nurse and a doctor with a rigid collar, long backboard, sandbags and tape are needed.
- The doctor should enter the vehicle and provide manual in-line stabilisation, while the nurse applies the rigid collar
- Whilst maintaining in-line stabilisation, the patient is rotated around and moved to the long board. Sandbags or head blocks are applied.
If parents are already carrying the child into ED, the following procedure should apply: -

- Instruct the parents to remain still.
- The doctor should apply in-line stabilisation while the child is being held.
- The nurse should obtain a stretcher and equipment.
- The doctor should then co-ordinate movement of the child onto the Vacu-Mattress.
- Apply collar, and either sandbags or headblocks once the child is on the mattress.

Note: a common sense approach is advocated in a fighting and uncooperative child

Full and correct immobilisation includes all of the following: -

- Vacu-Mattress with torso and extremity restraints
- If child is more than 3 years of age, use hard collar re-enforced by blocks or sandbags with tape.
- If child is less than 3 years of age, blocks or sandbags and tape.
- Where above not available, manual in-line immobilisation must be used.

Note: hard collar must be the correct size for the patient & soft collars are not acceptable
Children who require imaging of the cervical spine:

Are any of the following present?

Check both boxes

- Patient cannot actively rotate neck to 45 degrees to left and right (if felt safe to assess neck ROM)
- Not safe to assess ROM in the neck
- Neck pain or midline tenderness plus dangerous mechanism of injury (see list of mechanism triggers on page 5)
- Definitive diagnosis of cervical spine injury required urgently (for example, prior to surgery)

- Age >1yr: GCS <14 on assessment in the ED
- Age <1yr: GCS <15 on assessment in the ED
- Has been intubated
- Plain films inadequate (desired view unavailable), suspicious or definitely abnormal.
- Continued clinical suspicion of injury despite normal X-ray.
- Patient is being scanned for multi-region trauma

Yes

Request three view radiographs immediately

No

No imaging required at present

No

Yes

Request CT scan immediately

2 Safe assessment can be carried out if the patient was involved in a simple rear-end motor vehicle collision; is comfortable in a sitting position in the ED; has been ambulatory at any time since injury and there is no midline cervical spine tenderness; or if the patient presents with delayed onset of neck pain
Protocol for X-ray in trauma

Level 1 trauma patients will require: C-spine
CXR

This is the TRAUMA SERIES

If additional x-rays are required and the patient is well, these may be done in the Emergency Department. When a patient is going to be transferred to the main X-ray Department for a CT scan then it may be more appropriate to do additional X-rays in the main Department. When a patient is transferred either directly to PICU or the operating theatre the additional X-rays may be requested from there. If the patient is to remain in the resuscitation room and is not fit to move then further X-rays may be undertaken in the Resus room.

CT has become the gold standard for the secondary survey of the head, neck and trunk:

- CT should be obtained as soon as possible, ideally with the provisional report by 30 minutes after arrival in ED.
- Notify CT radiographer ASAP to enable scanner to be emptied for immediate use
- If a patient with hypotension is to go to CT, this must be approved by the trauma team leader as the patient may benefit from the diagnostic accuracy of a scan but the decision is difficult:
  - If high volumes of fluid are needed to maintain BP a CT may not be safe.
  - If intra-abdominal bleeding suspected, Consultant General Surgeon must be aware.
  - Trauma team should accompany patient to CT
- Patients with hypotension not responding to fluids should probably go to theatre, not CT.
- A decision about a CT of chest and abdomen should be made between the TTL and the Consultant Radiologist, as a CT of the chest and abdomen will require contrast
- Oral contrast delays immediate scans, so has limited role in emergency trauma CT.
- Resuscitation continues during CT, take blood products to CT if relevant and continue to monitor and warm the patient throughout.
- Transfer using a vacuum mattress
Children who require CT scanning of the head:

Are any of the following present?

- Witnessed loss of consciousness lasting >5mins
- Amnesia (antegrade or retrograde) lasting >5mins
- Abnormal drowsiness
- 3 or more discreet episodes of vomiting
- Clinical suspicion of non-accidental injury
- Post-traumatic seizure, but not history of epilepsy
- Age >1yr: GCS <14 on assessment in the ED
- Age <1yr: GCS <15 on assessment in the ED
- Suspicion of open or depressed skull fracture
- Any sign of base-of-skull fracture:
  - Haemotympanum
  - ‘Panda’ eyes
  - CSF leakage from ears or nose
  - Battles signs
- Focal neurological deficit
- Dangerous mechanism of injury (see list of mechanism triggers on page 5)

Yes

Request CT scan immediately

No

No imaging required at present

A clinician with expertise in non-accidental injuries should be involved in any suspected case of NAI. Consider: skull X-ray as part of skeletal survey; ophthalmoscopic exam for retinal haemorrhage; examination for pallor, anaemia, tense fontanelle and other suggestive features. Imaging such as CT or MRI may be required to define injury.
When to involve the Neurosurgeon:

Discuss the care of all patients with new, ‘surgically significant’ abnormalities on imaging with a neurosurgeon. Regardless of imaging, other reasons for discussion a patient’s care plan with a neurosurgeon include:

- GCS <14
- Unexplained confusion for >4hrs
- Progressive, focal neurological signs
- Seizure, without full recovery
- Definite or suspected penetrating injury
- CSF leak

Criteria for admission:

- Signs of neurological dysfunction
- Severe headache or vomiting
- Presence of serious co-existing medical conditions such as haemophilia, anticoagulant therapy, diabetes mellitus or epilepsy
- Poor social conditions at the patient’s home or a lack of a responsible adult to carry out observations after discharge from hospital
- Difficulty in assessing the nervous system because of a child being too young or uncooperative. *(A common sense approach is required)*
Management of pelvic fractures

*Beware! – paediatric patients are not always tachycardic at presentation. Apply pelvic splint if there is suspicion of potential injury.*

The initial management aims to:

- Splint the pelvis to provide tamponade and prevent movement.
- Detect the presence of a pelvic fracture with an early x-ray / CT.
- Differentiate between pelvic and intra-abdominal bleeding.

The following is the Standard Operating Procedure:

- Apply pelvic binder with history of blunt trauma and hypotensive (see below)
- Pelvic binder can be applied even if lateral compression injury is suspected.
- The Binder should be placed around the trochanters, not the iliac crests.
- If Binder applied pre-hospital leave it. Check position and x-ray.
- If hypotensive, begin fluid resuscitation
- Do NOT examine the pelvis for mechanical stability.
- Do NOT logroll the patient until the pelvis is cleared.
- Obtain an *early* pelvic x-ray (or immediate CT) to clear the pelvis.

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

Application of the SAM Splint:

This is a two-person technique and should be performed by people trained in the application of the splint

1. Unroll splint and place underneath the patients feet
2. Slide towards the patient’s head and if necessary, elevate buttocks to facilitate correct placement
3. The splint should be at the level of the greater trochanters and no higher.
4. One person holds the orange handle and the other tightens the splint until a click is heard.
5. The splint is fastened using the Velcro.

*If a pelvic fracture is present:*

- You can leave binder in place for up to 24 hours unless patient has severe neurological deficit (e.g. paraplegia).
- Examine carefully for open wounds, especially in the perineum.
- If there is an open wound, including vaginal lacerations, antibiotics must be administered. Unless contraindicated, Augmentin, Gentamycin and Metronidazole are recommended.
- How essential is the logroll?
- If unilateral pelvic injury: log-roll to opposite side
- If bilateral pelvic injury: avoid log-roll if at all possible.
- Female patient: catheterise if able. See catheterisation guidance below.
- Male patient: refer to catheterisation guidance below.
Catheterisation +/- contrast cystogram / urethrogram after pelvic fracture

In the absence of any concerning features, in particular blood at the meatus, or any history of haematuria since the accident, a single, gentle attempt at passing a urinary catheter may be undertaken. Sterile technique must be used and the procedure performed by an experienced surgeon or urologist: this is not the time to teach the technique.

- If clear urine drains, then all is good
- If there is any element of blood staining in the fluid draining from the catheter, then a contrast study (retrograde cystogram) is mandated

If there is any blood at the meatus prior to catheterisation, or any history of haematuria since accident, then a retrograde urethrogram is indicated before attempts at catheterisation.

- Urethrogram positive: call Consultant Urologist. Decisions now very difficult. If a suprapubic catheter is needed suggest discussion with the pelvic and acetabular surgeons as this will have major implications for any internal fixation.
- Urethrogram negative: catheterise. If haematuria present, perform a retrograde cystogram
Management of open fractures

Based on BOAST 4, 2009

**Wound management**

- Photograph wound
- Remove gross contamination e.g. leaves.
- Do **NOT** wash out wound at this stage
- Cover wound with saline soaked gauze
- Leave wound and dressing undisturbed
- Check tetanus status
- Give intravenous antibiotics:
  - Grade I or II: Augmentin
  - Grade III: Augmentin and Gentamicin

  (Farm / river, etc add Metronidazole)

**Fracture Management**

- Neurovascular exam and documentation
- Align and splint fracture
- Repeat neurovascular examination
- Xray
- Document all findings

**Definitive management**

- Discuss with consultant
- Timing depends on other injuries and available expertise
- Debridement, wound closure and definitive fixation should be within 24 hours
- Severely contaminated injuries, farm and aquatic remain a surgical emergency and must be debrided ASAP
BOAST 4: THE MANAGEMENT OF SEVERE OPEN LOWER LIMB FRACTURES

Background and Justification:
The British Orthopaedic Association and the British Association of Plastic, Reconstructive and Aesthetic Surgeons have reviewed their 1997 guidance and now publish a review of all aspects of the acute management of these injuries using an evidence-based approach, leading to the "Standards for the Management of Open Lower Limb Fractures," which are free to download from www.boa.ac.uk and www.bapras.org.uk. This BOAST is derived from these standards. Contrary to traditional teaching, best outcomes are achieved by timely, specialist surgery rather than emergency surgery by less experienced teams.

Included Patients:
All patients with high energy open fractures as manifest by the following injury patterns:

Fracture Pattern:
- Multifragmentary (comminuted) tibial fracture with fibular fracture at same level
- Segmental fractures
- Fractures with bone loss, either from extrusion or after debridement

Soft tissue injury:
- Swelling or skin loss, such that direct, tension-free wound closure is not possible
- De-gloving
- Muscle injury that requires excision of devitalised muscle via wound extensions
- Injury to one or more major arteries of the leg
- Wound contamination with marine, agricultural or sewage material

Standards for Practice Audit:
1. Intravenous antibiotics are administered as soon as possible, ideally within 3 hours of injury: Co-amoxiclav (1.2g) or Cefuroxime (1.5g) 8 hourly and are continued until wound debridement. Clindamycin 600mg, 6 hourly if penicillin allergy
2. The vascular and neurological status of the limb is assessed systematically and repeated at intervals, particularly after reduction of fractures or the application of splints
3. Vascular impairment requires immediate surgery and restoration of the circulation using shunts, ideally within 3-4 hours, with a maximum acceptable delay of 6 hours of warm ischaemia
4. Compartment syndrome also requires immediate surgery, with 4 compartment decompression via 2 incisions (see overleaf)
5. Urgent surgery is also needed in some multiply injured patients with open fractures or if the wound is heavily contaminated by marine, agricultural or sewage matter.
6. A combined plan for the management of both the soft tissues and bone is formulated by the plastic and orthopaedic surgical teams and clearly documented
7. The wound is handled only to remove gross contamination and to allow photography, then covered in saline-soaked gauze and an impermeable film to prevent desiccation
8. The limb, including the knee and ankle, is splinted
9. Centres that cannot provide combined plastic and orthopaedic surgical care for severe open tibial fractures have protocols in place for the early transfer of the patient to an appropriate specialist centre
10. The primary surgical treatment (wound excision and fracture stabilisation) of severe open tibial fractures only takes place in a non-specialist centre if the patient cannot be transferred safely
11. The wound, soft tissue and bone excision (debridement) is performed by senior plastic and orthopaedic surgeons working together on scheduled trauma operating lists within normal working hours and within 24 hours of the injury unless there is marine, agricultural or sewage contamination. The 6 hour rule does not apply for solitary open fractures. Co-amoxiclav (1.2g) and Gentamicin (1.5mg/kg) are administered at wound excision and continued for 72 hours or definitive wound closure, whichever is sooner
12. If definitive skeletal and soft tissue reconstruction is not to be undertaken in a single stage, then vacuum foam dressing or an antibiotic beads pouch is applied until definitive surgery
13. Definitive skeletal stabilisation and wound cover are achieved within 72 hours and should not exceed 7 days.
14. Vacuum foam dressings are not used for definitive wound management in open fractures.
15. The wound in open tibial fractures in children is treated in the same way as adults
Management of penetrating torso trauma

**Chest injury – cardiac origin:**

If penetrating cardiac injury is suspected, the following actions should be taken:

Put out a trauma call, and pre-alert:

- Consultant cardiac surgeon on-call
- Emergency Department consultant on-call
- Anaesthesia consultant on-call
- General surgery consultant on-call
- Theatre co-ordinator

There is an emergency thoracotomy set kept in the resus room in the ED. A thoracotomy should only be performed if the patient arrests in ED, is peri-arrest, or has arrested within 5 minutes of hospital arrival. A decision will need to be made by the trauma team leader and the most senior surgeon present.

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

Transfer patient to theatre immediately. Resuscitation should continue there if required.

**Chest injury – non cardiac origin:**

The general surgical consultant or registrar will be expected to perform thoracostomies / place chest drains in patients with diagnosed or suspected haemothorax in the trauma resuscitation.

Unstable patients with significant haemothorax will require a thoracotomy:

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

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

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

In the more stable patient, on-going blood loss should be discussed with the general surgery consultant with view to surgery.
Abdominal injury – gunshot wound (GSW):

GSW’s are rare in the UK, and an immediate laparotomy is the most appropriate investigation. CT and occasionally plain x-rays have a role in stable patients to assess for associated fractures, foreign body retention and track of the bullet.

Always check THOROUGHLY for an exit wound.

Abdominal injury – stab wound:

‘Stable’ patients with stab wounds to the torso may undergo CT. This is a good investigation for stab wounds to the back

With a completely normal CT the patient can be observed with regular clinical evaluation. Otherwise:

- Development of peritonitis requires a laparotomy
- Abnormal CT (free air, fluid etc) requires a laparotomy
- CT is poor in patients with thoraco-abdominal wounds – these patients should undergo laparoscopy to exclude diaphragmatic injury
- Evisceration or omental herniation requires a laparotomy

Do NOT remove weapons from the torso (or neck) in ED.

Do not forget to consider pregnancy testing.
Reporting knife wounds

The police are responsible for assessing the risk posed by members of the public who are armed with knives. They need to consider:

- the risk of a further attack on the patient
- risks to staff, patients and visitors in the ED or hospital
- the risk of a further incident near to, or at, the site of the original incident.

For this reason, the police should be told whenever a person arrives at hospital with a wound inflicted in a violent attack with a knife, blade or other sharp instrument. Police should not be informed where the injury to the patient is accidental, or a result of self-harm. If you have responsibility for the patient, you should ensure that the police are contacted, but you may delegate this task to any member of staff. Identifying details, such as the patient's name and address, should not usually be disclosed at the stage of initial contact with the police.

**Make the care of your patient your first concern**

When the police arrive, you should not allow them access to the patient if this will delay or hamper treatment or compromise the patient's recovery. If the patients treatment and condition allow them to speak to the police, you or another member of the health care team should ask the patient whether they are willing to do so. You, the rest of the health care team and the police must abide by the patient's decision.

**Disclosing personal information without consent**

Where it is probable that a crime has been committed, the police will seek further information. If the patient cannot give consent (because they are unconscious, for example), or refuses to disclose information or to allow health professionals to do so, information can still be disclosed if there are grounds for believing that this is justified in the public interest or disclosure is required by law. Disclosures in the public interest are justified where:

- failure to disclose information may put the patient, or someone else, at risk of death or serious harm.
- disclosure would be likely to assist in the prevention, detection or prosecution of a serious crime and failure to disclose would be prejudicial to those purposes.

If there is any doubt about whether disclosure is justified, the decision to disclose information without consent should be made by, or with the agreement of, the consultant in charge, or the Trust's Caldicott Guardian. Wherever practicable, you should seek the patients consent to the disclosure or tell them that a disclosure has been made unless for example it may put you or others at risk of serious harm, or may be likely to undermine the purpose of the disclosure, by prejudicing the prevention, detection or prosecution of crime. The reasons for disclosure should be recorded in the patient's notes.
Massive Transfusion Guidelines

**Indications for use:**

- Severe traumatic haemorrhagic shock, i.e. hypotensive despite fluid resuscitation

**Activation process:**

- TTL to nominate a co-ordinator to liaise with blood bank
- TTL to assess whether patient triggers “Code Red” criteria (see below)
- Co-ordinator to telephone blood bank on 9874 (0900h and 1700h), or bleep haematology technician 55034 (out-of-hours) and either:
  
  (i) Declare “Code Red” (if appropriate) and get shock packs released, OR
  (ii) Liaise with lab regarding timings and availability of blood and clotting products

- If “Code Red” declared, co-ordinator to also call on-call Consultant Haematologist
- Co-ordinator to identify a runner to go between ED and the labs
- Co-ordinator to inform labs if ‘flyer’ packs of O neg blood have been used

---

**CODE RED Definition**

Consider if:

**ACTIVE HAEMORRHAGE SUSPECTED AND**

> 20 ml/kg Red Cells given in 1 hr
> 40 ml/kg fluid given in 3 hr
> 2 ml/kg/min blood loss

Code red activation enables release of ‘shock pack’ blood products i.e. red cells and FFP in 1:1 ratio with platelets and cryoprecipitate if available.

Blue light delivery of platelets can be requested if they are unavailable.

In severe trauma red cells, FFP and Platelets can be given in 1:1:1 ratio.
Massive Transfusion Guidelines

The Management of Paediatric Massive Haemorrhage

Is Massive Haemorrhage present or likely?
- Senior Clinician to Assess
- Triggers ‘Massive Haemorrhage Alert’
- Nominates Co-ordinator to liaise with Blood Bank

Blood Bank BCH:
- Ext. 9876 (9am-5pm)
- On-Call Bleep 55934 (all other times)

Does patient fulfil CODE RED criteria?

TRIGGER CODE RED

Shock Pack Available on Request

RE-ASSESS – is there ongoing bleeding?

Results NOT Available

- Request further products based on weight (Chart A) and continue resuscitation
- After every 40ml/kg RBC give:
  - 20ml/kg Fresh Frozen Plasma
  - 10ml/kg cryoprecipitate
  - 20ml/kg platelets

Results Available

- Regular blood gas analysis and core temperature
- Treat:
  - Hypothermia
  - Acidosis
  - Hypocalcaemia
  - Hyperkalaemia

Request and replace blood and components based on results:
- Hb <10g/dl – give RBCs
- If Platelet Count <100x10^9/l give platelets
- If PT or APTT > 1.5 x normal range – give FFP
- If Fibrinogen <1g/l give cryoprecipitate

Repeat FBC, PT, APTT and fibrinogen until bleeding stopped

If ongoing bleeding consider recombinant factor 7:
- Discuss with on-call Haematology Consultant

Nominated Co-ordinator

Designate a Runner to Blood Bank and instruct

Discuss timing and availability of blood and clotting products

Liaise with blood bank:
- Blood Bank BCH:
  - Ext. 9876 (9am-5pm)
  - On-Call Bleep 55934 (all other times)

Activate CODE RED on instruction from Senior Clinician

Call blood bank & state:
- Code Red
- Patient Name, Hospital ID, Age, Weight, Gender
- Name of Clinician in Charge of Resuscitation

Contact Duty Consultant Haematologist via Switchboard

CODE RED Definition

Consider if:
- ACTIVE HAEMORRHAGE SUSPECTED AND
  - >20ml/kg Red Cells given in 1 hr
  - >40ml/kg fluid given in 3 hr
  - >2mls/kg/min blood loss

Blood Products to request by weight

<table>
<thead>
<tr>
<th>Blood Products</th>
<th>up to 10kg</th>
<th>10-20kg</th>
<th>20-50kg</th>
<th>over 50kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed Cells</td>
<td>One Unit</td>
<td>Two Units</td>
<td>Three Units</td>
<td>Four Units</td>
</tr>
<tr>
<td>FFP</td>
<td>One Unit</td>
<td>Two Units</td>
<td>Three Units</td>
<td>Four Units</td>
</tr>
<tr>
<td>Platelets</td>
<td>One Unit</td>
<td>Two Units</td>
<td>Three Units</td>
<td>Four Units</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>Five Units</td>
<td>Eight Units</td>
<td>Twelve Units</td>
<td>Fifteen Units</td>
</tr>
</tbody>
</table>

Code red activation enables release of ‘shock pack’ blood products i.e. red cells and FFP in 1:1 ratio with platelets and cryoprecipitate if available.

Blue light delivery of platelets can be requested if they are unavailable.

In severe trauma red cells, FFP and platelets can be given in 1:1:1 ratio.
A child is defined as anyone under the age of 18. Anyone under the age of 18 must not be allowed to die as the result of a lack of blood transfusion and in common law, clinicians are open to prosecution if this occurs. Children aged 16 to 17 years have a legal right to consent to their own treatment, even if it is against the wishes of their parents. Furthermore, there is no necessity to seek consent from their parents regarding treatment. Conversely, a child under the age of 18 does not have the legal right to refuse treatment and lawful consent to life saving procedures can be given by the parents or by the courts.

If a child is under the age of 16, they can consent to treatment provided they are Gillick competent, hence must satisfy the following test:

1. Can the child understand the nature, purpose and hazards of the treatment?
2. Can the child make a value judgment and balance the risks and benefits?

If a child under the age of 16 is Gillick competent and agrees to a transfusion, this over-rides any parental objections. However, if the child is not Gillick competent and parental consent is not forthcoming, it may be necessary to obtain consent through the courts.

In emergency situations, such as patients fulfilling the criteria for massive transfusion protocol activation, blood transfusion should be given without waiting for a court order. In these circumstances, two doctors of consultant status should make a written, unambiguous entry in the patient’s notes that blood transfusion is essential to save life or prevent serious permanent harm. At the same time, the Trusts solicitors should be contacted in order to obtain a court order.

The 1989 Children’s Act outlines who may have parental responsibility and this includes:

- The Mother
- The Father provided he is married to the mother when the child was born or has acquired legal responsibility by:
  1. Parental responsibility order made by the mother
  2. Parental responsibility order made by the court
  3. Jointly registering the birth of the child with the mother

- Legally appointed guardian – court appointed or appointed by parent in the event of their death
- A person in whose favour a court has made a residence order concerning the child
- A local authority designated in a care order in respect of the child (but not where the child is being looked after under section 20 of the Children Act, also known as being 'accommodated' or in 'voluntary care').
- A local authority or other authorised person who holds an emergency protection order in respect of the child
CELOX Gauze / Granules

*Used in attempt to stop potentially lethal bleeding*
*(kept in resus cupboard)*

![Flowchart Diagram]

**Celox is suitable for:**
- Arterial & venous bleeds
- Bullet & knife wounds
- Blast & shrapnel wounds
- Wound packing

**Severely bleeding wound identified**

**Direct pressure and elevate when appropriate**

**Indirect pressure when appropriate**

**Apply tourniquet if limb wound still bleeding**

**Ensure senior ED staff are aware and surgeons alerted to arrange definitive management of haemorrhage**

**Catastrophic haemorrhage and direct surgical intervention to stop the bleeding immediately available**

**Delay to surgical intervention for haemorrhage control**

**CELOX usage**

**Formal wound assessment and surgical control of haemorrhage**
Celox Gauze

1. Impact Skin
2. Trauma
3. Step 1: Fill wound with Celox Gauze
4. Step 2: Tightly pack the whole space
5. Step 3: Compress
6. Stable Wound

Celox Granules

1. Penetrating trauma
2. Bleeding stops
3. Step 1: Insert applicator
4. Step 2: Push in plunger to dispense Celox
5. Step 3: Withdraw applicator and cover
6. Step 4: Compress
7. Stable Wound

CELÖX™ is easy to use
Secondary survey

This should include:

- Top to toe examination of the patient listing all injuries found and diagnoses confirmed by investigations to date.
- Listing all neurology – ideally before intubation and paralysing drugs administered.
- Examining fundi, pupils and tympanic membranes.
- Documenting a temperature – both core and peripheral in serious burns cases.
- Ensuring the back is examined with log roll, and PR whenever possible.
- Clear documentation if anything is unable to be done e.g. spinal clearance / logroll so this can be included in subsequent management plans when the clinical condition allows.

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

The ED SpR is responsible for the secondary survey of the limbs:

They will:

- Evaluate each joint and long-bone for dislocation / stability / fracture.
- Undertake neurovascular examination of all limbs.
- Record presence or absence of key peripheral pulses & neurological findings.
- Assist with splinting fractures.
- Repeat neurovascular examination after splinting.
- Arrange appropriate x-rays (peripheral x-rays must not delay trauma CT scan).
- In some cases it may be best to delay x-rays until the patient is in theatre and good quality traction x-rays can be obtained.

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

Open fracture treatment:

- See guidelines on pages 20-21
Tetanus Prevention

**USUAL TETANUS IMMUNISATION SCHEDULE**

- Tetanus immunisation is given at:

<table>
<thead>
<tr>
<th>Age</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months</td>
<td>Primary immunisation -3 doses As DTaP/IPV/Hib</td>
</tr>
<tr>
<td>3 months</td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td></td>
</tr>
<tr>
<td>3 years 4 months – 5 years</td>
<td>Booster as DTaP/IPV or dTaP/IPV</td>
</tr>
<tr>
<td>13 – 18 years</td>
<td>Booster as Td/IPV</td>
</tr>
</tbody>
</table>

**MANAGEMENT OF TETANUS-PRONE WOUNDS**

- All wounds require thorough cleaning, whatever the tetanus status.

<table>
<thead>
<tr>
<th>IMMUNISATION STATUS</th>
<th>CLEAN WOUND</th>
<th>TETANUS-PRONE WOUND</th>
<th>Human Tetanus Immunoglobulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully immunised, i.e. has received a total of 5 doses of vaccine at appropriate intervals</td>
<td>None required</td>
<td>None required</td>
<td>Only if high risk</td>
</tr>
<tr>
<td>Primary immunisation complete, boosters incomplete but up to date</td>
<td>None required (unless next dose due soon and convenient to give now)</td>
<td>None required (unless next dose due soon and convenient to give now)</td>
<td>Only if high risk</td>
</tr>
<tr>
<td>Primary immunisation incomplete or boosters not up to date</td>
<td>A reinforcing dose of vaccine and further doses as required to complete the recommended schedule (to ensure future immunity)</td>
<td>A reinforcing dose of vaccine and further doses as required to complete the recommended schedule (to ensure future immunity)</td>
<td>Yes: one dose of human tetanus immunoglobulin in a different site</td>
</tr>
<tr>
<td>Not immunised or immunisation status not known or uncertain</td>
<td>An immediate dose of vaccine followed, if records confirm the need, by completion of a full 5-dose course to ensure future immunity</td>
<td>An immediate dose of vaccine followed, if records confirm the need, by completion of a full 5-dose course to ensure future immunity</td>
<td>Yes: one dose of human tetanus immunoglobulin in a different site</td>
</tr>
</tbody>
</table>

**Tetanus-prone wounds** include:

- Wounds or burns that require surgical intervention that is delayed for more than six hours.
- Wounds or burns that show a significant degree of devitalised tissue.
- Puncture-type injuries particularly where there has been contact with soil or manure.
- Wounds containing foreign bodies.
- Open fractures.
- Wounds or burns in patients who have systemic sepsis.

**High-risk** is regarded as heavy contamination with material likely to contain tetanus spores and/or extensive devitalised tissue.
**Immunosuppressed patients** may not be adequately protected against tetanus, despite having been fully immunised – they should be managed as if they were incompletely immunised.

**WHICH VACCINE TO USE?**

<table>
<thead>
<tr>
<th>Age</th>
<th>Components</th>
<th>Vaccine stocked in BCH</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary immunisation for children &lt; 10 years</td>
<td>DTaP/IPV/Hib</td>
<td><em>Pedia</em> or <em>Infanrix-IPV+Hib</em></td>
<td>0.5 ml IM</td>
</tr>
<tr>
<td>Booster for children 3 – 10 years</td>
<td>dTaP/IPV</td>
<td><em>Repevax</em></td>
<td>0.5 ml IM</td>
</tr>
<tr>
<td>Primary immunisation for children ≥ 10 years</td>
<td>Td/IPV</td>
<td><em>Revaxis</em></td>
<td>0.5 ml IM</td>
</tr>
<tr>
<td>Booster for children ≥ 10 years</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HUMAN TETANUS IMMUNOGLOBULIN**

- Standard dose: 250 units IM
- If > 24 hours since injury or heavy contamination or following burns: 500 units IM.
**Intra-hospital transfers**

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

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

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

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

Ensure transfer is safe with all equipment and drugs needed (e.g., patient monitoring, Thomas bag, patient specific drugs, oxygen and suction). Lines and drains must be secured and all documentation complete. Handover to a lead specialist for ongoing care is vitally important. These patients will potentially be critically ill so transfer staffing should include:

- ED Nurse / ODP / PICU Tech Team nurse
- TTL and PICU Consultant
- Porter

Documentation to move with the patient from ED includes:

- A copy of the trauma chart
- Fluid prescription / drugs chart
- A copy of the ED notes
- Patients notes, or temporary folder
- Ambulance chart if brought in by ambulance
Inter-hospital transfers

For a paediatric patient(s) in a trauma unit (TU) or local emergency hospital (LEH) that requires paediatric MTC level of care for immediate intervention, there should be no delays to transfer. A principle of “call and send” will be used. The regional trauma coordinating desk (RTD) will be the hub for communication via the KIDS office.

The TU / LEH will be responsible for ensuring that the paediatric patient(s) are safe to transfer. It will not be possible to ensure that all patients are completely stable as the intervention to achieve stability may also be the reason for the transfer.

As a basic principle, the TU / LEH should be satisfied that:

- The airway is safe for the duration of transfer or secured
- That life threatening chest injuries have been excluded or treated
- That appropriate haemorrhage control has been achieved
- That the cervical spine immobilisation is maintained.
- That an escort is provided who is clinically capable of dealing with the patient’s condition.
- That all relevant imaging is transferred electronically to the receiving MTC

The selected MTC is responsible for ensuring that the patient is received in an appropriate clinical area (as per discussion with BCH TTL and KIDS for paediatrics) and that the trauma team is alerted to the arrival of the patient.

BCH will:

- Be available to offer advice to the TU TTL if necessary or requested.
- Review the TU images on the Imaging Exchange Portal prior to patient arrival if possible.
- Notify relevant tertiary services as necessary.
- Assemble the trauma team

The Regional Trauma desk is responsible for coordinating the communication between MTC, TU and transporting ambulance provider. Specifically the RTD will:

- Take the call from the TU and note basic details of transfer
- Set up “conference call” with BCH TTL and KIDS, and monitor the call.
- Task appropriate vehicle to TU.
- Update MTC on departure of transport vehicle from TU and expected time of arrival
- Coordinate calls between vehicle and MTC TTL when advice or updated information needs to be passed.

Standards for service.

1. That from call to RTD to transfer commencing should be less than 30 minutes
2. That 90% patients are transferred to nearest MTC
3. That all patients are received in an MTC by a consultant led trauma team.

A trauma unit should refer patients for hyper-acute transfer when the patient meets the criteria for needing immediate MTC level of care.
Pre transfer actions at TU

1. Undertake full primary survey.
2. Secure airway if necessary
3. Radiological investigations as indicated
4. Decompress pneumothoraces or haemothoraces. Use transport type drains not under water seal.
5. Control haemorrhage
   5.1. Stop external bleeding
   5.2. Activate massive transfusion protocol if required
   5.3. If exsanguinating internal haemorrhage perform damage control laparotomy or definitive care
6. Apply pelvic binder if required
7. Splint femoral fractures with traction splint
7.1. Immobilise all other fractures with splints or plaster.

Do not delay transfer to insert invasive monitoring, use non invasive methods.

Escort

If KIDS are not retrieving the paediatric patient, the appropriate escort should be determined by the TU TTL.

For intubated and ventilated patients this will normally be an anaesthetist or ITU doctor however there may be some centres that have advanced nurse practitioners providing this level of care.

For non intubated patients the escort must be capable of dealing with the anticipated complications on route.

The ambulance service will not routinely return escorts to the referring TU. The MTC will arrange taxi transfers to return the escort and their equipment.

Ambulance Transport

West Midlands Ambulance Service (WMAS) will be the provider for most hyper acute transfers, (although for paediatric patients, KIDS may be the secondary provider). WMAS will provide a double manned ambulance from the emergency fleet. It will be equipped with a defibrillator and portable ventilator. The crew may not always contain a paramedic, if there is no paramedic the senior clinician on board will be an emergency medical technician (EMT). When a doctor escort is being provided by the TU it is not necessary to insist on a paramedic crew as the EMT will be more than capable of providing the support required.
Appendix A - Injury Severity Score & Abbreviated Injury Scale

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

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

Abbreviated Injury Scale (AIS)

The AIS is taken from a catalogue listing types of injury and describes the severity of injury to one defined body region:
1. Minor
2. Moderate
3. Serious
4. Severe
5. Critical
6. Maximal (lethal injury)

Injury Severity Score (ISS)

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

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

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

The ISS takes scores from 0 to 75 (i.e. AIS scores of 5 for each category). If any of the three scores is a 6, the score is automatically set at 75. Since a score of 6 ("unsurvivable") indicates the futility of further medical care in preserving life.

Example:

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

Injury Severity Score (ISS) = 50
Entry criteria for triage is a judgment that the patient may have suffered significant trauma.

**A:** Airway injury or compromise

**B:** Respiratory distress or failure

**C:** Clinical evidence of hypovolaemia

**D:** GCS <14

**E:**
- Penetrating trauma (except a limb)
- Spinal cord injury
- Traumatic extremity amputation (proximal to wrist or ankle)
- 2 or more long bone fractures
- Abdominal or pelvic injury
- Peripheral neurovascular signs
- Depressed or open skull #
- CSF leak
- Significant burn

**M:**
- Traumatic death in same passenger compartment
- Fall > 3m or twice patient’s height
- Patient trapped under vehicle or ejected from vehicle
- Bull’s-eye windscreen
- Enclosure with fire
- All motorcycle or quad bike incidents

---

*Pre-alerts should be given in the ATMIST format*
# Appendix C – A.T.M.I.S.T tool

## A.T.M.I.S.T Handover Tool

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Age and sex of casualty (demographic).</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Estimated Time of Arrival and the time of incident.</td>
</tr>
<tr>
<td><strong>M.O.I</strong></td>
<td>Mechanism of incident. This should include:</td>
</tr>
<tr>
<td></td>
<td>- The gross mechanism of injury (e.g. motor vehicle crash or stab wound to the chest) and.</td>
</tr>
<tr>
<td></td>
<td>- Details of other factors known to be associated with major injuries e.g. entrapment, vehicle rollover, occupant ejected from vehicle.</td>
</tr>
<tr>
<td><strong>Injuries</strong></td>
<td>Seen or suspected.</td>
</tr>
<tr>
<td><strong>Signs</strong></td>
<td>- Vital signs: including heart rate, blood pressure, respiratory rate, oxygen saturation and Glasgow Coma Score.</td>
</tr>
<tr>
<td></td>
<td>- An indication as to whether the physiological state of the patient has improved or deteriorated since first seen.</td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td>Treatment given.</td>
</tr>
</tbody>
</table>
## Appendix D – Alert Call Form

### TRAUMA ALERT

- **Age**: 
- **Time of arrival**: ________ (estimated)
- **Mechanism**: 
- **Injuries**: 
- **Signs**:
  - RR ________________________
  - SpO<sub>2</sub> ________________________
  - HR ________________________
  - BP ________________________
  - GCS ________________________
  - Other ________________________
- **Treatment so far**: 
- **Time ED Consultant informed**: ________
- **Trauma Team call?** Yes [ ] (time): ________ No [ ]
- **Other specialties informed**:
  - Team ________________________ (time): ________
  - Team ________________________ (time): ________

### NON-TRAUMA ALERT

- **Age**: 
- **Time of arrival**: ________ (estimated)
- **History**: 
- **Prehospital findings**: 
- **Signs**:
  - RR ________________________
  - SpO<sub>2</sub> ________________________
  - HR ________________________
  - BP ________________________
  - AVPU A V P U (circle)
  - Other ________________________
- **Treatment so far**: 
- **2222 call?** Yes [ ] (time): ________ No [ ]

### Update Information (time): __________
Appendix E – Flowchart for trauma alerts at BCH

1. **Patient self presents with major trauma**
   - WMAS Major Trauma Desk
     - Alert Phone in BCH ED Resus
       - Details of Major Trauma Pt
         - Call ED consultant via 2222 immediately (24/7)

2. ED consultant in BCH
   - ED consultant off site
     - ED consultant may decide other specialties are required in addition to the standard team, based on the alert information
     - Call switchboard on 2222 and put out a trauma call, plus any other specialties required
     - Bleep 55122 and liaise with theatres re situation.
       - Consider the need for team 1 to be recalled back from home if 0000-0800

3. Patient stabilised in ED
   - CT scan
     - Ward, Theatre or PICU
Appendix F – Immediate transfer from TU to BCH

**Immediate Transfer from Trauma Unit or LEH to BCH MTC**

1. Paediatric Patient with life-threatening injuries arrives in TU
2. Identify need for immediate transfer to BCH
3. Contact RTD on 01384------
   - RTD sets up call to BCH TTL and KIDS 0300 200 1100
4. Optimise and arrange transfer immediately
5. Respond to advice while transferring patient immediately
6. Transfer decision confirmed immediately and specific advice given
7. Communication within MTC and review of imaging to prepare action on arrival
8. Share imaging immediately (IEP)
9. Patient with life-threatening injuries arrives in MTC

**Open Door: Call and Send**

Decision not dependent on bed availability

---

<table>
<thead>
<tr>
<th>Action</th>
<th>Completed by</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call RTD and speak to MTC team leader (+ KIDS for paeds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of MTC TTL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upload images to IEP/PACS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airway secured?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest decompressed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pelvis splinted?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femurs splinted?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External bleeding stopped?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranexamic acid given?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cx Spine immobilised?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Escort personal briefed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer bag checked?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer drugs ready?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCN transfer form available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy of trauma chart and ambulance PRF ready?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G - Midlands Trauma Networks Transfer Policy - January 2012

This policy relates to the transfer of Trauma patients, either as emergency or urgent transfers of critically ill patients (level 2 and 3), or non-urgent transfers for enhanced care or the repatriation of patients for continued care nearer to home.

Primary Transfers – from scene directly to appropriate level of care facility, usually to MTC or TU. Communication to the receiving hospital will be through the Regional Trauma Desk.

Secondary transfer – from existing care provider to enhanced, specialised or step-down care closer to home / rehabilitation care provider. E.g. TU to MTC, MTC to Specialised Rehabilitation, MTC back to TU, Specialised Rehabilitation onto ‘continued care closer to home’.

*No critically ill patient will be transferred without first being adequately resuscitated and stabilised.*

All relevant parties, including the relatives, must be informed that the transfer is taking place.

The transfer of a patient for continued care closer to home should take place within 48 hours of referral therefore transport should be booked in a timely fashion.

For secondary transfers, the patient is to be transferred in an appropriately equipped vehicle and accompanied by skilled and competent staff (Medical staff, Nurse Consultant, operating department practitioner, paramedic or Accident and Emergency nurse). All accompanying personnel should be familiar with the patient’s clinical condition, transfer procedure and associated equipment.

A critically ill patient should be transferred in line with the Midlands Critical Care Networks Transfer policy. 2 Midlands Trauma Networks – Transfer Policy *This policy should be used in conjunction with the Midlands Critical Care Networks Transfer Policy May 2011.*

Longer and time critical journeys may require air transport. The decision to move a patient by air should take into consideration all the difficulties currently associated with this mode of transport.
**Transfer Checklist**

**Equipment:**

There should be a dedicated set of equipment available for transfer which should be stored near or on the critical care unit or Emergency Department. The staff accompanying the patient are responsible for checking the correct functioning of this equipment prior to departure. In particular, there should be sufficient battery power in any monitors and infusion pumps. Back-up equipment should be taken on longer journeys. A basic box of emergency drugs should also be available. The accompanying doctor should decide what other drugs and fluids, e.g. sedation and inotropes, should be taken in addition.

**Preparation for Transfer:**

Meticulous preparation, resuscitation and stabilisation of the patient before transfer is the key to avoiding complications during the journey. The transfer personnel should fully familiarise themselves with the patient’s history, present condition and treatment up to the point of departure. Prior to departure they should make a full clinical assessment to ensure that the patient is ready for transfer. In addition, the accompanying personnel should ensure that they are adequately prepared for the journey. Suitable clothing should be worn, refreshments must be available for longer journeys, mobile phones and money should be taken in case of emergency. They should also know the precise destination of the patient and have a named contact in the receiving unit. The team must contact the receiving hospital as they set out for confirmation that a bed is still available at the receiving unit. For enhanced care (TU to MTC) this should be communicated through the Trauma Desk.

**Monitoring during Transfer:**

During transfer, the standard of monitoring should reflect the patient’s condition and for critically ill patients this should remain as high as in the Resuscitation room or Critical Care Unit. End tidal carbon dioxide monitoring should be used with all ventilated patients.

**Paediatric Patients:**

The trauma desk should ring KIDS 0300 200 1100 to arrange any paediatric transfers. The normal receiving area will be the ED for primary transfers and for children secondary transfers will be to the PICU. Documentation: The network transfer form should always be used to record details of ALL transfers.
**BBCCCN/CNet/NWMCCN Transfer Form**

### Patient Details
- **Name:**
- **DOB:**
- **NHS Number:**
- **Postcode:**

### Staff Arranging Transfer
- **Referring Doctor:**
  - **Name:**
  - **Specialty:**
  - **Grade:**
  - **Receiving Hospital:**
  - **ITU Clinician:**
    - **Name:**
    - **Grade:**
  - **Specialist Clinician:**
    - **Name:**
    - **Specialty:**

### Escorting Personnel
- **Escort 1:**
  - **Name:**
  - **GMC/NMC:**
  - **Signed:**
  - **Grade:**
- **Escort 2:**
  - **Name:**
  - **GMC/NMC:**
  - **Signed:**
  - **Grade:**

### Transfer Details
- **Transferring Hospital:**
- **Transferring from:**
  - ICU / HDU / A&E / Theatre / Ward / Other
- **Speciality:**
  - Cardiac / Renal / Neuro / Resp / Liver / Other
- **Recipient Hospital:**
- **Recipient Unit:**
  - ICU / HDU / TH / WD / Other
- **Reason:**
  - Tertiary referral / No ICU bed / Repeat / Other
- **Date of Transfer:**
- **Time:**

### Monitors
- **ECG:**
- **ETCO2:**
- **IBP:**
- **CVP:**
- **NIBP:**
- **SpO2:**
- **Other:**

### Spinal Immobilisation?
- **Yes:**
- **No:**

### Lines and Catheters
- **Arterial Line:**
- **Site:**
- **Insertion date:**
- **CVP:**
- **Canula 1:**
- **NGT:**
- **Urinary Cath:**
- **Chest Drain:**
- **Other:**

### Airway & Ventilation
- **Mechanical:**
- **Spont:**
- **Vent Mode:**
- **PEEP:**
- **ETT size:**
- **@ cm**
- **Tidal Vol:**
- **FIO2:**
- **Trachy:**
- **Size:**
- **Peak Press:**
- **Resp Rate:**

### Clinical Diagnosis/Patient History
- **Description:**

### Ambulance Details
- **Time ambulance booked:**
- **Time patient Ready for transfer:**
- **Time ambulance arrived:**
- **Time of departure:**
- **Time of arrival at receiving unit:**

### Start Time:
- **Drugs & Fluids (miu/hr):**
  - **Pupil L size/reaction:**
  - **Pupil R size/reaction:**
  - **Pulse:**
  - **BP:**
  - **SAP:**
  - **ETCO2:**
  - **CVP:**

---

# KIDS Clinical Guideline:
## Checklist for transfer of children with neurosurgical emergency

### Checklist:
- Use this checklist to assist in ensuring adequate therapy and monitoring are in place prior to and during transfer

### Airway and Breathing:
- Oral ETI, firmly taped, T2 on CXR
- Cervical spine immobilisation if trauma
- PaCO₂ 4.5–5.3 kPa
- Orogastic tube on free drainage

### Circulation:
- 2 peripheral IV lines
- Request crossmatch (Aim Hb >10gms)
- Aim for normovolaemia
- Avoid hypotension
- 0.9% Saline maintenance (and dextrose if hypoglycaemia)
- Volume expansion 0.9% Saline 10ml/kg boluses
- Consider noradrenaline infusion to maintain BP (see KIDS drug calculator)
- CVL and arterial line if sufficient time

### Disability and other management:
- 15 mins Neuro Obs
- CT scan (discuss with Neurosurgeon/KIDS)
- Normothermia (36–37°C)
- Phenytoin 18 mg/kg over 20 mins if seizures
- Maintain plasma Na >140mmol
- Hyperosmolar therapy (discuss with Neurosurgeon/KIDS see KIDS drug calculator)
- Secondary survey if trauma

### Preparing for transfer:
- Adequate sedation and analgesia with morphine/midazolam infusion – see KIDS drug calculator for dosing
- Muscle relaxant infusion – see KIDS drug calculator for dosing
- Urinary catheterisation – especially if mannitol used
- Strategy for managing raised ICP:
  - (discuss with Neurosurgeon/KIDS regarding sedation, pCO₂, ABP target for cerebral perfusion, hyperosmolar therapy)
- Secure child to trolley (not on spinal board)
- Connect long extension to allow additional drug and fluid administration en route
- Sufficient portable oxygen for whole journey x2
- Sufficient battery life on monitor and infusion pumps
- Use ambulance oxygen gas and electricity supply where possible
- Transfer documentation, radiology, blood results
- Regular observations (at least once every 15 mins) – including pupillary reactions, heart rate, blood pressure ETCO₂, SpO₂
- Seat belts at all times
- Travel safe – Lights/Sirens only when necessary to manage traffic congestion or unstable patient or time critical

### References:
- APLS 4th edition 2004
- Joint statement from the Society of British Neurological Surgeons (SBNS) and the Royal College of Anaesthetists (RCoA)
- Regarding the Provision of Emergency Paediatric Neurosurgical Services (document)
Appendix J – Paediatric Normal Values and Formulas

**Normal Values**

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Respiratory Rate</th>
<th>Heart Rate</th>
<th>Systolic B.P (50th centile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>30 - 40</td>
<td>110 - 160</td>
<td>80 - 90</td>
</tr>
<tr>
<td>1 – 2</td>
<td>25 - 35</td>
<td>100 - 150</td>
<td>85 - 95</td>
</tr>
<tr>
<td>2 – 5</td>
<td>25 - 30</td>
<td>95 - 140</td>
<td>85 - 100</td>
</tr>
<tr>
<td>5 – 12</td>
<td>20 - 25</td>
<td>80 - 120</td>
<td>90 - 110</td>
</tr>
<tr>
<td>&gt; 12</td>
<td>15 - 20</td>
<td>60 - 100</td>
<td>100 - 120</td>
</tr>
</tbody>
</table>

**Calculating Weights**

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Weight Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>Weight (in kg) = (0.5 x age in months) + 4</td>
</tr>
<tr>
<td>1 – 5</td>
<td>Weight (in kg) = (2 x age in years) + 8</td>
</tr>
<tr>
<td>6 - 12</td>
<td>Weight (in kg) = (3 x age in years) + 7</td>
</tr>
</tbody>
</table>

**Emergency Treatment Calculations (WETFAG)**

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
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</tr>
<tr>
<td>E</td>
<td>Energy</td>
</tr>
<tr>
<td>T</td>
<td>Tube</td>
</tr>
<tr>
<td>F</td>
<td>Fluids</td>
</tr>
<tr>
<td>A</td>
<td>Adrenaline</td>
</tr>
<tr>
<td>G</td>
<td>Glucose</td>
</tr>
</tbody>
</table>