

P7 Overview: The initial assessment and management of the trauma paediatric patient

Paediatric Trauma Module

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Trauma is one of the leading causes of paediatric morbidity and mortality. The injuries sustained by children are physical and psychological, with patterns of injury that may differ from the adult population due to both anatomic variation and risks of trauma. The majority of paediatric trauma is related to motor vehicle accidents, both as a passenger and pedestrian, drownings and a small number from non-accidental injury. The traditional structured approach to assessment and management forms the basis for trauma care, regardless of age. It is essential to recognise the need for age appropriate communication, and to involve the parents where possible, as this is a frightening situation for all involved.

Pre-notification - BAT call

Once a BAT call comes through, or the unexpected patient arrives in the emergency department, preparation, planning and assembling the right team needs to occur in an efficient manner to manage the trauma patient. This is especially valid in the management of paediatric trauma.

Based on the BAT call the environment and equipment need to be rapidly prepared for the expected patient and predicted injuries based on the information provided.

- ✓ **Staff** – activate a trauma call and notify other services as required e.g. paediatrics, social work, surgery, anaesthetics, radiology or others as required.
- ✓ **Drugs** - fluids, intubating/analgesia drugs and blood.
- ✓ **Equipment** - airway, pelvic binders (consider putting on the bed prior to arrival), ultrasound.
- ✓ **Department** - secure the rest of the department as much as possible, delegating staff to monitor the other patients.

Remember in paediatrics to calculate the estimated weight, drug doses and equipment sizes.

This preparation and planning time is invaluable for these patients, as doses and drawing up of medications can be challenging and systematic double checking is essential. There are many tools that are available to improve efficiency and reduce error when calculating doses and sizes. These include the Broselow tape and trolley, the NETS calculator and other locally available tables or charts.

A structured team approach is the ideal management strategy for dealing with major trauma, although this will vary significantly between hospitals, and within hospitals depending on the available resources. Knowing and following pre-prepared trauma plans will create a coordinated approach.

One version of a trauma team may include -

- A medical and nursing team leader, who will provide direction and situational awareness, with overall command and control of the trauma team.
- An airway doctor and nurse to provide airway management of the patient, in the awake patient they should provide reassurance to the patient.
- A circulation doctor and nurse to obtain IV access, take bloods and often will prepare drugs and IV fluids for the ongoing management of the patient.
- A procedural doctor and nurse to perform required procedures on the patient such as inserting chest drains.
- Ideally, when managing paediatric trauma a member of the team should be allocated to be with the parents, explaining and updating the parents. This person should elicit the AMPLE history and further details from the parents. In many centres this is a social worker or other team member with an understanding of the process, this allows the team to clinically manage the child knowing the parents are cared for.

- This is only one of many models of trauma team styles, important factors include allocating roles, providing team leadership and communicating effectively as a coordinated team.

The Primary Survey

The Primary survey is a rapid initial assessment of the child. The aim is to recognise and treat life-threatening conditions within the first 5-10 minutes. This gives you a framework to help assess and begin treatment but also makes it less likely that you will miss anything.

Whilst the primary survey is being conducted a member of the trauma team should be attaching monitoring to the patient: ECG monitoring; non-invasive blood pressure monitoring; a saturation probe and end tidal carbon dioxide sensor, if the patient is intubated.

DRS CACBCDE approach to the trauma patient is commonly used, with the first C meaning looking for and stopping any exsanguinating haemorrhage. As with many updates in trauma care this has come from combat trauma. This may still have relevance in civilian traumas, especially in this age of knives, guns and terrorism. The challenge in children is to perform the primary survey in an age appropriate and calm manner, to avoid further frightening and distressing the child.

Danger – Traumas can be messy and involve taking imaging during the primary survey. To this end remember to wear PPE and lead gowns to protect yourself and your team from blood, body fluids and radiation.

Responsiveness – This may help you to quickly have an idea of how unwell the patient is. Can they speak? Do they understand? Are they very scared and need a parent or sympathetic team member assigned to look after their wellbeing? Do you need an interpreter? This quick check of responsiveness may help you to assess the airway and also their AVPU or GCS scores. If the patient is able to speak coherently, without added sounds and with a normal volume then they have a patent airway; enough of a tidal volume to speak in a full sentence; enough perfusion to their brain to support their hearing, thinking and communication centres as well as a pretty well functioning brain.

Shout for help – Some trauma patients will require specialist intervention to treat their injuries. If you are working at a hospital that has these specialties, you must keep in mind that early intervention is key and help (when and where appropriate) should be considered. The when and where will depend on skills and experience of your team, the complexity of the patient and also on the geography and capabilities of your hospital. If a major trauma patient is not at a major trauma centre, early involvement of the Aeromedical Retrieval Service may be required.

Catastrophic Haemorrhage - First stop any catastrophic external haemorrhage. If the child is bleeding profusely from the stump of a leg that has been traumatically amputated, it may be that by the time you progress through A and B that they may have lost their circulating volume and expired on you. In these cases it is thought to be worth stopping this bleeding before assessing A. In a hospital environment, where you have multiple members of staff, it is likely that you will be able to assess A and deal with the catastrophic haemorrhage with simple direct pressure and elevation at the same time.

Airway is also combined with **c**. This is because stabilisation or control of the cervical spine is important in the majority of trauma patients. Oversight of this can result in catastrophic damage, morbidity and mortality. It is a small c as protection or securing of the airway take precedence over the cervical spine. There is no point in having a well-protected cervical spine in a patient who dies of an obstructed airway! A trauma patient should be greeted with the “trauma handshake” until a C-spine injury is excluded. A can be rapidly assessed in a brief conversation with the patient. The AMPLE history should be obtained as early as possible in trauma assessment, in paediatrics this usually comes from the parents. Life threatening airway injury or compromise should be sought and treated if found. In trauma there may be direct trauma to the airway itself or to related structures, which may impinge on the airway. Bleeding is a common cause of airway compromise, especially in the supine trauma patient. Other foreign bodies may occlude the airway including, teeth, bones, vomit, food, drink or even shrapnel. The use of a good jaw thrust to open the airway and airway adjuncts (guedel airway, nasopharyngeal,

LMA, ET tubes) can help to open an obstructed airway with minimal movement of the cervical spine. Evidence of airway burn should be taken seriously and early intubation may be indicated, before swelling of the airway causes the patient's demise. These problems should be tackled as with any other patient but with the risk of spinal injury taken into consideration.

It is important to remember that the neck forms part of the airway and should be thoroughly assessed.

- ✓ Trachea – central?
- ✓ Wounds – front and back
- ✓ Emphysema – sign of pneumothorax or penetrating injury
- ✓ Laryngeal crepitus – sign of laryngeal fracture
- ✓ Veins – are they distended as a sign of superior vena cava obstruction or are they under filled indicating hypovolaemia?
- ✓ Every time (TWELVE).

Breathing is assessed as in other patients. Inspection for damage, bruising, flail segments and respiratory rate. Palpation for tender areas, crepitus from fractures or emphysema. Auscultation to assess for equal bilateral air entry or lack of. In trauma patients the life threatening 'B' conditions are: Tension Pneumothorax; Massive haemothorax; open pneumothorax and flail chest. In children an assessment of work of breathing should be completed, as the respiratory effort is an early sign of critical illness.

Circulation is also assessed as in other patients, heart rate, blood pressure, colour, warmth of peripheries and capillary refill time. In major trauma patients at least 2 large bore (as large as you can site in the patient) cannulae should be placed. Intraosseous cannulation should be performed if difficulty with access continues after 90 seconds or two attempts (see module 3). Remember to take some bloods at this point, including a tube for the cross matching of blood. Depending upon the injury the rapid infusion of fluids may not be appropriate. Within C we need to look for blood loss – on the floor and 4 more (chest/abdomen/pelvis/long bones). The patient will usually have signs and symptoms of blood loss (light headed, chest pain, breathlessness, cool peripheries, prolonged capillary refill time, hypotension, tachycardia, amongst others). Remember that younger patients will compensate for longer, but rapidly deteriorate. Children also have a smaller blood volume to begin with, so smaller volumes may be significant.

Disability – AVPU is a quick and easy tool for assessment (Alert, Voice, Pain, Unresponsive). For head injury patients it may be more appropriate to assess the patient with the Paediatric Glasgow Coma Scale. A drop of 2 or more points is significant and should be investigated. Eyes should be examined for movement and papillary reaction to light – direct and consensual reactions. A quick assessment of limb movement should be done – “move your fingers and toes please”. Note also any areas of altered sensation that the patient is aware of. In children who are unable to obey commands (or refuse to), careful observation of spontaneous movement is essential. Remember that children will often display fear by not talking, keeping their eyes closed and not moving to commands, consider these reactions as pathological initially until it can be proven otherwise.

Don't Ever Forget Glucose!! Trauma patients use up a lot of energy staying alive and to do this they consume their glucose and glycogen stores, this is especially so in children.

Exposure is especially important in trauma. The history may not be complete or even correct. We need to look for all life threatening injuries in our patients. This requires the removal of all clothing – whilst maintaining the patient's dignity if possible. It also requires an examination of the patient's back. This is likely to require a log roll, which is covered in module T4. During the log roll the back of the patient is examined and palpation of the patient's thoracic, lumbar and sacral spine is completed.

Following exposure the Environment needs to be controlled and the patient warmed, to avoid the lethal triad, as cold patients don't clot. Remember that children lose a larger proportion of their heat from the head.

Trauma patients tend to be in pain, even the unconscious patients. Children may not be able to express this in the usual manner. Analgesia will help the child keep calm, improve rapport with the child and will help to allow the

team to complete their assessments. Pain relief should be considered before any intervention that may cause additional pain to the patient. One example of this would be the log roll.

Some adjuncts may well help treat and assess the trauma patient and can be inserted during the primary survey. Examples of this may be a nasogastric tube and an indwelling catheter. The NG tube can be useful to decompress the stomach – the patient may have been fed prior to their trauma, had large volumes of swallowed air from crying, or if bag-mask-ventilation was required the patient's stomach may be distended by air. The use of an NG tube can decrease the risk of aspiration and also allows the institution of early enteral feeding, if this is required. Urine output is an indicator of fluid status and end organ perfusion. This can be vital in complicated trauma patients. Remember to look for possible urethral damage (meatal blood/perineal bruising) prior to insertion of a urethral catheter. If there is some suspicion then think about a supra-pubic catheter.

If there is **any change** in the patient (improvement or deterioration) or if any treatment is instituted then a **full AcBCDE** assessment must be undertaken. Trauma patients' physiology can change quickly and reassessment is vital to maintain abreast of changes and to maintain situational awareness.

The **DRS AcBCDE** approach to the trauma patient is a structured way of assessing all trauma patients quickly and safely. We need to seek and treat life-threatening emergencies in a rapid and systematic manner.

AMPLE history in the ED

The AMPLE history should be rapidly obtained in any patient capable of talking, especially if deterioration is expected. For children this is commonly obtained from the parents and bystanders.

All components are important and should be recorded and a further, more detailed history can be asked during the secondary survey and subsequent assessment process.

- Allergies
- Medications
- Previous medical history
- Last meal or drink (time)
- Events – anything special about the event/illness.

Imaging used with the Primary Survey

As stated above the Primary survey is a rapid assessment of the trauma patient for life threatening injuries with coordinated treatment of these injuries, if possible, and stabilisation of the patient. Imaging should be used to improve and hasten this process; it should not delay the completion of the primary survey!

The trauma series of X-rays has historically been the only imaging to occur during the primary survey. In more recent years, as an addition to this, extended -Focused Assessment with Sonography for Trauma or e-FAST scan had also been included. Though there is limited evidence for this in children, it is considered to be advised if the skill set is available within the team.

The Trauma Series

A set of X-rays that assess for life threatening injuries. With a skilled radiographer the interruption is minimal and the whole series can be completed in less than 5 minutes. The small risk of radiation is always balanced against the risk of missed injuries.

The trauma series consists of:

- Lateral cervical spine X-ray (often omitted if CT scanning will occur),
- AP Chest X-ray,
- AP Pelvic X-ray.

In respect to the cervical spine, it must be remembered that children are more susceptible to spinal cord injury without radiological evidence and that further consultation and imaging may be required.

FAST scan

Is being incorporated into the primary survey for trauma patients in an increasing number of hospitals around the globe. It requires an ultrasound machine and a person qualified to undertake the examination and to interpret the images.

It is a rapid investigation that involves 4 views looking for fluid. In the case of trauma this fluid is likely to be blood.

The 4 views are:

- A substernal view looking at the heart. This view is primarily to look for blood in the pericardium, which can lead onto cardiac tamponade. A skilled sonographer may also be able to make some assessment of the cardiac function, but this is not the main purpose of the view.
- Subdiaphragmatic views on each side. These views look just above the diaphragm to look for intrathoracic blood and below the diaphragm (between the diaphragm and the liver or spleen) to look for blood in these potential spaces. The examination also looks at the spaces between the kidneys and the liver or spleen.
- The final view is a pelvic view through the bladder. Again this is looking for pooling of blood within the pelvis.

Although this scan has a high positive predictive value it cannot rule out blood or injury within any of these compartments. It is also patient and operator dependent. You must always treat the patient you have in front of you. A patient with a suggestive mechanism of injury who is hypotensive and has a tachycardia without external signs of bleeding and a negative FAST scan may still require further investigation or surgery to rule out bleeding into a body cavity.

Some practitioners also have a quick look at the lung fields with the ultrasound machine, during the primary survey. They can use it to look for the normal sliding of the lungs against the pleura. If this is absent then the patient is likely to have a pneumothorax. The e-FAST is important in decisions of disposition, especially in the haemodynamically unstable patient.

As with all ultrasound examinations, obesity is an increasing problem. The increased distance from the probe to the organ or area of interest decreases the image quality and thus the ability to interpret these images.

The Secondary Survey

The secondary survey is a head to toe review of the patient to assess for injuries not identified in the primary survey. During the primary survey the life threatening injuries should have been identified and treated.

Sometimes the treatment of these life-threatening injuries requires the patient to be transferred to theatre, or another area, before the secondary survey can take place. If this is the case it is **IMPERATIVE** that this is handed over to the team that will be receiving the patient after this.

A secondary survey must take place to identify other injuries that may not be life threatening but may harm the patient later or be a source of long-term morbidity if it is not treated.

The secondary survey requires a team member to take a complete history (injury/PMHx/medications/allergies/social history/family history) and an in-depth examination of the patient from the top of their head right down to the ends of their toes. This gives the team an opportunity to fully examine all systems, including the ones inspected during the primary survey. All areas should be palpated, auscultated, percussed and visually examined. All joints should be fully assessed.

Any abnormalities should be documented as well as a plan for further investigation as needed. Consults from specialist teams may be needed for certain issues.

The secondary survey is the time where further imaging such as CT and MRI scans can be undertaken. Less urgent blood tests are also taken at this time, if they were not sent at the time of the original bloods. Think about drug screens, alcohol levels, levels of known medications, etc.

Documentation is a very important part of trauma patient care. Ideally there should be a person allocated to the role of documenting all proceedings during the trauma, from arrival of the patient with handover to their end disposition. Staff members present, mechanism of injury, primary survey findings and treatments/drugs given and their effects should all be clearly documented with timings. It is important to document everything that has been done to the patient. As stated above it is equally important to document what has not been done.

Treating trauma patients can be very stressful and involve many different specialities and professionals. It is important that the team works effectively to the same end goal. With all the activity, noise and stress it can be easy to forget to document some findings, results or omissions. Every care should be made to try to not let this happen.

A tertiary survey is the final step in the trauma care cycle; this will often take place within 24 hours of the presentation, during the admission to the trauma service.

Ambulance Handover

IMIST – AMBO is the handover technique used by the NSW ambulance service

I – Introduction of who they are and who the patient is

M – Mechanism of injury

I – Injuries sustained

S – Signs and symptoms

T – Treatment administered enroute

A – Allergies

M – Medications

B – Background problems (significant PMHx)

O – Other important information (family, circumstances, opinions)

The 7 Non-Technical Team Tasks

- Plan and Prepare
 - o Planning and preparation starts well before the trauma patient even has their trauma. This long term planning, if done well, can really improve the functioning of the trauma team and the whole of the ED.
 - o Short term planning - If prior warning is given about the arrival of a trauma patient, it allows the formulation of a plan and gathering of patient specific equipment and personnel. Use the time you have before the patient arrives wisely. The team leader should lead the pre-arrival organisation with team members feeling comfortable to suggest and improve the plan.
- Assemble the correct team
 - o At every trauma it is worth thinking about whom you need on your trauma team for this specific patient. Who is normally on your trauma team? Which of these people are guaranteed to show up promptly? Is it worthwhile to contact the laboratories/radiology/theatres to give them over the phone information?
 - o Is this patient a “special case”? Will they need speciality input from services that are not available 24hrs a day? Is there an on-call service? Can you arrange over the phone advice? Is it worth contacting these services before the patient arrives?
- Manage resources
 - o The resources that you have at your disposal will depend upon where you are working and may depend upon what is or has been going on in your ED prior to this trauma arriving. If you are pre-warned of an arrival then it is worth taking the time to make sure that all the equipment that you may need is clean, prepared and that there is someone there who can operate it.
 - o What kind of kit might you need in a trauma that take a bit of time to find or set-up, in your department?
 - Rapid fluid infusers?
 - Ultrasound scanner?
 - IO kit?

- Chest drains?
- Pelvic binder?
- Airway equipment?
- o People generally prefer to be notified about potential involvement rather than being told 15 minutes later that they are needed immediately. It is courteous and people will tend to appreciate the opportunity to organise their own situations and plan and prepare, as they need to. This may also give them the opportunity to say that that service is unavailable so you are able to switch to an alternate plan.
- Manage people
 - o The team leader should make sure that members of the team are introduced to each other and that each member is assigned a role that they are happy to undertake and competent to do (or supported within that role).
 - o If you are thinking of the management of people then take the opportunity to think about whom else you may need or want on your team.
 - o For some roles it may be worth talking through plan A, plan B and plan C so that the individual, the leader and the rest of the team are aware of what may happen. This may also help to maintain situational awareness throughout the trauma. For example prior to a rapid sequence induction/intubation.
 - o Teams and individuals within that team require emotional support as well as clinical and knowledge support. Teams function better if all members of the team feel as if they are valued and that their input is important and will be listened to.
- Provide leadership/followership and support
 - o As you will know from both clinical and non-clinical environments, leadership styles vary widely. This depends upon the situation, the task at hand, the environment, the team and the urgency of the situation.
 - o In the trauma setting, decision-making should occur through the team leader. At times the team leader may need to be more towards the autocratic end of the spectrum – this may be when decisions need to be made quickly e.g. what a severely injured patient is deteriorating. When the patient is more stable there may be more time to pause and take suggestions from the team. Asking for suggestions (at the appropriate times) from team members should not be seen as a sign of incompetence but rather a sign of good and flexible leadership with the inclusion of the team members.
 - o Communication of decision-making and plans is an important aspect of being a team leader. Mini-summaries can be very useful to update the team on the history, examination and investigations that have been undertaken. One example would be to talk through the primary survey as it is being done and then giving a summary of the findings once it is complete. Differential diagnoses should be shared as well as a continuing plan. Keeping the team updated will increase their involvement and will also encourage the members to suggest alternatives or challenge incorrect thought processes.
 - o If you are the team leader, acknowledge the members of your team. Say please and thank you. Use people's names and if a job has been done well (no matter what the outcome) make sure that the team members know this. It is also worth keeping in mind when a team debrief may be beneficial. Stressful situations (children, mothers, suicides) should be acknowledged and support should be given. If a trauma ran particularly well do not forget to debrief these too, it promotes further good practice.
 - o The team leader is human too. They will need support. They feel stress, they make mistakes and they have emotions. The other team members should be mindful of these points and support the team leader as possible. It may also be that for that particular situation that another team leader

would be more appropriate. If this is the case it is our responsibility as medical professionals to make sure that the best team possible is taking care of the patient. If the leader is having a bad day, give them a rest and find another team leader to run this trauma. Remember to check if that person is alright, after the patient has been cared for.

- Monitor and evaluate
 - o During a major trauma huge amounts of information are relayed constantly to the team. Incorrect assumptions and plans can result from misinterpretation of data. Constant monitoring and re-evaluation of the data, with an open mind, helps to mitigate this.
 - o We are familiar with cross checking each other (doses, labels etc), but crosschecking also means verifying data and information sources. We can develop fixed ideas about what the problem is and then find data to support that false assumption.
 - o Any intervention must be evaluated to see whether it achieved the expected outcome and if not, why not. Changes in the patient need to be fed up to the team leader and changes in plans fed down to the team
 - o Do not assume that someone else has noticed what you have. Voice your observation and make sure that it has been heard.
 - o Re-evaluate regularly
- Communicate effectively – The 6 Cs
 - o Clarity – Be specific, be succinct avoid jargon and abbreviations
 - o Coordination – Use people’s names, confirm you have heard instructions, relay information via the leader
 - o Cohesion – Clarify goals, share information, invite input, acknowledge effort
 - o Cool and calm – Speak low and slow, be positive, use appropriate humour to good effect
 - o Concerns – Should be freely expressed, use graded assertion (attention, enquiry, clarify and then demand).
 - o Conflict – To be avoided. Listen to opinions, clarify and reach a consensus.
 - The first four are elements that should be encouraged and practiced within communication
 - The last two are elements that we hope do not happen but that we need to be aware of and have strategies of how to voice concerns or manage conflict.

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