Trauma assessment

The initial assessment and management of seriously injured patients is a challenging task and requires a rapid and systematic approach.

This systematic approach can be practised to increase speed and accuracy of the process but good clinical judgement is also required.[1] [2] Although described in sequence, some of the steps will be taken simultaneously.

The aim of good trauma care is to prevent early trauma mortality. Early trauma deaths may occur because of failure of oxygenation of vital organs or central nervous system injury, or both.

Injuries causing this mortality occur in predictable patterns and recognition of these patterns led to the development of Advanced Trauma Life Support (ATLS) by the American College of Surgeons. A standardised protocol for trauma patient evaluation has been developed.[3] [4] The protocol celebrated its 40th anniversary in 2018.[5] Good teaching and application of this protocol are held to be important factors in improving the survival of trauma victims worldwide.[6]

Different systems of trauma scoring have been developed.

Aims of the initial evaluation of trauma patients

- Stabilise the patient.
- Identify life-threatening conditions in order of risk and initiate supportive treatment.
- Organise definitive treatments or organise transfer for definitive treatments.

Preparation and co-ordination of care

Assessment and management will begin out of hospital at the scene of injury and good communication with the receiving hospital is important. The preparatory measures are outlined below to 'set the scene'.

The pre-hospital phase

- Co-ordination and communication with the receiving hospital so that the trauma team can be alerted and mobilised.
- Airway maintenance.
- Control of external bleeding shock.
- Keeping the patient immobilised.
- Information gathering: time of injury; related events; patient history. Key elements are the mechanism of injury to alert the trauma team to the degree and type of injury.
- Keeping time at the scene to a minimum.

The hospital phase

- Preparation of a resuscitation area.
- Airway equipment - laryngoscopes, etc (accessible, tested).
- Intravenous (IV) fluids (warming equipment, etc).
- Immediately available monitoring equipment.
- Methods of summoning extra medical help.
- Prompt laboratory and radiology back-up.
- Transfer arrangements with trauma centre.

Guidelines on protection when dealing with body fluid should be followed throughout this and subsequent procedures.

Triage and organisation of care

See the separate related article Trauma Triage and Scoring.

This is the sorting of patients according to their need for treatment and the resources available. It starts at the scene (see above) and continues at the receiving hospital.[7] Priority is given to patients most likely to deteriorate clinically and triage takes account of vital signs, pre-hospital clinical course, mechanism of injury, age and other medical conditions. In trauma centres, teamwork should ensure critically injured patients are evaluated, as diagnostic procedures are performed simultaneously, thus reducing the time to treatment. A team approach is demanding of personnel and resources and, in smaller institutions, non-hospital settings or with mass casualties, available personnel and resources can rapidly be overwhelmed:

- **Triage**: is done according to the 'ABCDE' principles (**A**irway maintenance with cervical spine protection, **B**reathing and ventilation, **C**irculation with haemorrhage control, **D**isability: neurological status, **E**xposure/environmental control)*.
- **Selection of hospital**: is according to available services, so that trauma patients should be taken to trauma centres.
- **Multiple casualties**: where the number of patients and severity of injury do not exceed the capacity of the treatment centre, life-threatening injuries and multiple system injuries are treated first.
- **Mass casualties**: when the the number of patients and severity of injury do exceed capacity of the treatment centre, patients are selected for treatment according to best chance of survival with least expenditure of resources (time, personnel, equipment, supplies).

*__NB__: see however the comments below regarding catastrophic haemorrhage, the development of the cABCD approach and the re-evaluation of cervical spine protection.

Initial assessment

This comprises:

- Resuscitation and primary survey.
- Secondary survey.
- Definitive treatment or transfer for definitive care.

Resuscitation and primary survey

For speed and efficacy a logical sequence of assessment to establish treatment priorities must be gone through sequentially although, with good teamwork, some things will be done simultaneously (resuscitation procedures will begin simultaneously with the assessment involved in the primary survey, *ie lifesaving measures are initiated when the problem is identified*). Special account should be taken of children, pregnant women and the elderly as their response to injury is modified.[8] The primary survey is according to:

A = Airway maintenance cervical spine protection

- Are there signs of airway obstruction, foreign bodies, or facial, mandibular or laryngeal fractures? Management may involve secretion control, intubation or surgical airway (eg, cricothyroidotomy, emergency tracheostomy).
- Establish a clear airway (chin lift or jaw thrust) but protect the cervical spine at all times.[9] If the patient can talk, the airway is likely to be safe; however, remain vigilant and recheck. A nasopharyngeal airway should be used in a conscious patient; or, as a temporary measure, an oropharyngeal airway in an unconscious patient with no gag reflex. Definitive airway should be established if the patient is unable to maintain integrity of airway; mandatory if Glasgow Coma Scale (GCS) is less than 8.
- Cervical spine protection is an issue which is being re-evaluated. There is a growing body of evidence that the routine fitting of cervical collars and rigid backboards in pre-hospital trauma care may do more harm than good.[10] X-rays can be taken once immediately life-threatening conditions have been dealt with.

B = Breathing and ventilation

Provide high-flow oxygen through a rebreather mask if not intubated and ventilated.[11] Evaluate breathing: lungs, chest wall, and diaphragm. Chest examination with adequate exposure: watch chest movement, auscultate, percuss to detect lesions acutely impairing ventilation:

- Tension pneumothorax - requires needle thoracostomy followed by drainage.
- Flail chest - management involves ventilation.

- Haemothorax - will usually require intercostal drain insertion.
- Pneumothorax - may require intercostal drain insertion.

NB: it can be difficult to tell whether the problem is an airway or ventilation problem. What appears to be an airway problem, leading to intubation and ventilation, may turn out to be a pneumothorax or tension pneumothorax which will be exacerbated by intubation and ventilation.

C = Circulation with haemorrhage control
Blood loss is the main preventable cause of death after trauma. Experiences from military operations suggest that the management of catastrophic haemorrhage should take predominance over all other resuscitative techniques, including airways management. This is because even if the airway is maintained, the hypovolaemia and hypoxia resulting from catastrophic haemorrhage will result in significant loss of life. The military have used the cABCD approach (where 'c' = catastrophic haemorrhage) for many years and it is now beginning to be used by civilian emergency services.[12]

To assess blood loss rapidly observe:

- Level of consciousness.
- Skin colour.
- Pulse.

- Bleeding - this should be assessed and controlled:

    - IV access should be achieved with two large cannulae (size and length of cannula is determinant of flow not vein size) in an upper limb. Access by cut down or central venous catheterisation may be done according to skills available. At cannula insertion, blood should be taken for crossmatch and baseline investigations.
    - Fluid boluses are required while awaiting blood products. However packed red cells, platelets and plasma are required. Large volumes of crystalloid will dilute clotting factors, and also tend to dislodge any blood clots by increasing blood pressure.
    - Direct manual pressure should be used to stem visible bleeding (not tourniquets, except for traumatic amputation, as these cause distal ischaemia).
    - Transparent pneumatic splinting devices may control bleeding and allow visual monitoring; surgery may be necessary if these measures fail to control haemorrhage.
    - Occult bleeding into the abdominal cavity and around long-bone or pelvic fractures is problematic but should be suspected in a patient not responding to fluid resuscitation.

NB: response to blood loss differs in:

- The elderly - limited ability to increase heart rate; poor correlation between blood loss and blood pressure.
- Children - tolerate proportionately large volume loss but then rapidly deteriorate.
- Athletes - do not show the same heart rate response to blood loss.
- Chronic conditions and medication - may affect response and early on in trauma management will not be known about.

D = **Disability: neurological status**
After A, B and C above, rapid neurological assessment is made to establish:

- Level of consciousness, using GCS.

- Pupils: size, symmetry and reaction.
- Any lateralising signs.
- Level of any spinal cord injury (limb movements, spontaneous respiratory effort).
- Level of consciousness - oxygenation, ventilation, perfusion, drugs, alcohol and hypoglycaemia may all also affect this.

Patients should be re-evaluated frequently at regular intervals, as deterioration can occur rapidly and often patients can be lucid following a significant head injury before worsening. Signs such as pupil asymmetry or dilation, impaired or absent light reflexes, and hemiplegia/weakness all suggest an expanding intracranial mass or diffuse oedema. This requires IV mannitol, ventilation and urgent neurosurgical opinion. Hypertonic saline can be used as an alternative to mannitol especially in hypovolaemic patients.

E = **Exposure/environmental control**
Undress the patient, but prevent hypothermia. Clothes may need to be cut off but, after examination, attend to prevention of heat loss with warming devices, warmed blankets, etc. Also check blood glucose levels.

Additional considerations to primary survey and resuscitation

ECG monitoring: this can guide resuscitation by diagnosing dysrhythmias, ischaemia, cardiac injury, pulseless electrical activity (PEA) - which may indicate cardiac tamponade - hypovolaemia, tension pneumothorax, and extreme hypovolaemia. Hypoxia or hypoperfusion should be suspected if there is bradycardia, aberrant conduction, and premature beats. Hypothermia produces dysrhythmias.

Urinary/gastric catheters:

- Output of urine can guide fluid replacement (reflects renal perfusion). Adequate output is 0.5-1 ml/kg/hour. **Note**: prior to catheter insertion urethral injury should be excluded - suspect if there is blood at meatus, pelvic fracture, scrotal blood, perineal bruising. Per rectum and genital examination are mandatory prior to catheter insertion.

- Gastric catheters are inserted to reduce aspiration risk. Suction should be applied. **Note**: care should be taken not to provoke aspiration by triggering gagging.

Other monitoring: monitoring of resuscitation by measuring various important parameters measures adequacy of resuscitation efforts. Values for various parameters should be obtained soon after the primary survey and reviewed regularly. Important parameters are:

- Pulse rate,[13] blood pressure, ventilatory rate, arterial blood gases, body temperature and urinary output.
- Carbon dioxide detectors may identify dislodged endotracheal tubes.
- Pulse oximetry measures oxygenation of haemoglobin colorimetrically (sensor on finger, ear lobe, etc.).

Remember: blood pressure is a poor measure of perfusion.

Diagnostic procedures: care should be taken that these do not hamper resuscitation. They may be best deferred to the secondary survey. Modifications to the ATLS guidelines have been suggested.[14] [15] X-rays most likely to guide resuscitation early on, especially in blunt trauma, include:

- CXR.
- Pelvic X-ray. (although It has been suggested that CT scans may be used in some stable patients.[14]
- Lateral cervical spine X-ray.

Other useful procedures include FAST (= focused assessment with sonography for trauma), eFAST (= extended focused assessment with sonography for trauma) and/or CT scanning to detect occult bleeding.[16] The National Institute for Health and Care Excellence (NICE) advocates FAST in patients who are haemodynamically unstable and not responding to volume resuscitation.[17]

Secondary survey

This begins after the 'ABCDE' of the primary survey, once resuscitation is underway and the patient is responding with normalisation of vital signs. The secondary survey is essentially a head-to-toe examination with completion of the history and reassessment of progress, vital signs, etc. It requires repeat physical examinations and may require further X-ray and laboratory tests. It comprises:

History

- **A** = **A**llergies.
- **M** = **M**edication currently used.
- **P** = **P**ast illnesses/**P**regnancy.
- **L** = **L**ast meal.
- **E** = **E**vents/**E**nvironment related to injury

Physical examination

This will repeat some examinations already undertaken in the primary survey and will be further informed by the progress of the resuscitation. It aims to identify serious injuries, occult bleeding, etc. A review of neurological status including GCS score is also undertaken. Back and spinal injuries are commonly missed and pelvic fractures cause large blood loss which is often underestimated.

Beware: burns (fluid requirements, inhalation injury); cold injury (continue resuscitation until rewarmed); high-voltage electricity injuries (extensive muscle injury likely to be concealed).

Additional considerations to secondary survey

A range of further diagnostic tests and procedures may be required after the secondary survey. These include CT scans , ultrasound investigations, contrast X-rays, angiography, bronchoscopy, oesophageal ultrasound, etc.

Definitive care

Choosing where care should continue most appropriately will depend on results of the primary and secondary surveys and knowledge of the facilities available to receive the patient. The closest appropriate facility should be chosen.

Records and legal considerations

Remember:

- Keep meticulous records (times for all entries, etc). Teamwork with timekeeping and recording of clinical measurements, and observations can be helpful. Some units have a member of the nursing staff whose sole role is to record and collate patient care information accurately.
- Consent for treatment is not always possible with lifesaving treatment and consent may have to be given later.
- Forensic evidence may be required in injuries caused by criminal activity.

Practice tips

Regular training in resuscitation by the whole practice team is recommended. Attention to a team approach is essential. Involvement in medical cover at schools, sports events, and car accidents (British Association for Immediate Care (BASICS)) requires higher-level training and regular refresher courses.

Further reading

- British Association for Immediate Care - BASICS
- Fractures (non-complex): assessment and management; NICE Guidelines (February 2016)
- Fractures (complex): assessment and management; NICE Guidelines (February 2016 - last updated November 2017)
- Major trauma: service delivery; NICE Guidelines (February 2016)
- Spahn DR, Bouillon B, Cerny V, et al; The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition. Crit Care. 2019 Mar 27;23(1):98. doi: 10.1186/s13054-019-2347-3.

References

1. Scherer LA, Chang MC, Meredith JW, et al; Videotape review leads to rapid and sustained learning. Am J Surg. 2003 Jun;185(6):516-20.
2. Mohammad A, Branicki F, Abu-Zidan FM; Educational and clinical impact of Advanced Trauma Life Support (ATLS) courses: a systematic review. World J Surg. 2014 Feb;38(2):322-9. doi: 10.1007/s00268-013-2294-0.
3. Bell RM, Krantz BE, Weigelt JA; ATLS: a foundation for trauma training. Ann Emerg Med. 1999 Aug;34(2):233-7.
4. Esposito TJ, Kuby A, Unfred C, et al; General surgeons and the Advanced Trauma Life Support course: is it time to refocus? J Trauma. 1995 Nov;39(5):929-33; discussion 933-4.
5. Henry S et al; ATLS at 40: Distinguished past, bright future, Bulletin of the American College of Surgeon, 2018.
6. Hogan MP, Boone DC; Trauma education and assessment. Injury. 2008 May 24.
7. Planas JH, Waseem M, Sigmon DF; Trauma Primary Survey
8. Hayden B, Plaat F, Cox C; Managing trauma in the pregnant woman. Br J Hosp Med (Lond). 2013 Jun;74(6):327-30.
9. Austin N, Krishnamoorthy V, Dagal A; Airway management in cervical spine injury. Int J Crit Illn Inj Sci. 2014 Jan;4(1):50-6. doi: 10.4103/2229-5151.128013.
10. Zileli M, Osorio-Fonseca E, Konovalov N, et al; Early Management of Cervical Spine Trauma: WFNS Spine Committee Recommendations. Neurospine. 2020 Dec;17(4):710-722. doi: 10.14245/ns.2040282.141. Epub 2020 Dec 31.
11. McCullough AL, Haycock JC, Forward DP, et al; Early management of the severely injured major trauma patient. Br J Anaesth. 2014 Aug;113(2):234-41. doi: 10.1093/bja/aeu235.
12. Reed RC, Bourn S; Prehospital emergency medicine - UK military experience. BJA Educ. 2018 Jun;18(6):185-190. doi: 10.1016/j.bjae.2018.03.003. Epub 2018 Mar 28.
13. The Trauma Audit and Research Network: Procedures manual England & Wales; TARN, January 2021
14. Soto JR, Zhou C, Hu D, et al; Skip and save: utility of pelvic x-rays in the initial evaluation of blunt trauma patients. Am J Surg. 2015 Dec;210(6):1076-9; discussion 1079-81. doi: 10.1016/j.amjsurg.2015.07.011. Epub 2015 Oct 22.
15. Kool DR, Blickman JG; Advanced Trauma Life Support. ABCDE from a radiological point of view. Emerg Radiol. 2007 Jul;14(3):135-41. Epub 2007 Jun 12.
16. Desai N, Harris T; Extended focused assessment with sonography in trauma. BJA Educ. 2018 Feb;18(2):57-62. doi: 10.1016/j.bjae.2017.10.003. Epub 2017 Nov 28.
17. Major trauma: assessment and initial management; NICE Guidelines (February 2016)

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