Initial management of acute trauma

Introduction

A trauma team should consist of two to four doctors, three to five nurses, a radiologist or radiographer and porters. Before the patient arrives the team leader should assign each member a specific role (including someone to document findings and organize investigations), gowns and gloves should be put on and equipment checked.

The patient is most vulnerable during the first hour ('golden hour') of resuscitation. It is important to use a systematic method of examination and treatment to ensure that life-threatening injuries are promptly identified and treated. The standard approach is based on Advanced Trauma Life Support methodology which consists of:

- Primary survey and resuscitation:
  - **A** Airway and cervical spine control
  - **B** Breathing and ventilation
  - **C** Circulation and haemorrhage control
  - **D** Disability: CNS dysfunction
  - **E** Exposure or Environmental control
- Secondary survey: 'head to toe'
- Definitive treatment
- Tertiary survey: this is carried out the next day to ensure nothing has been missed.

Because of the large range of possible pathologies and treatments, to avoid being didactic this article presents 'treatment options' to be considered in each section. This article is intended for the non-specialist as an introduction to the hospital management of acute trauma. The authors encourage all junior doctors who may manage trauma to attend an Advanced Trauma Life Support course.

Primary survey

Once the patient arrives, everyone should listen to the handover from the ambulance crew. The organized, systematic Advanced Trauma Life Support primary survey protocol should be used to identify and treat life-threatening injuries. If vital signs change, the primary survey should start again at the 'top', i.e. airway, and proceed down. In this way the team leader continuously re-evaluates his/her findings as a patient's condition may deteriorate or change rapidly.

If the patient is on a spinal board or scoop for immobilization, it must be removed using a 'scoop to ski' technique as prolonged use of this device can cause serious pressure ulcers.

Airway management with cervical spine control

The patient should receive high flow oxygen. An anaesthetist should assess and manage the airway: if the patient can talk, the airway is likely to be clear, the patient can breathe and has probably adequate cerebral perfusion. If the patient has a reduced conscious level he/she may not be able to maintain his/her airway. Soot in the airway, hoarseness, stridor, foreign bodies, blood and lacerations should alert you to impending airway problems.

Assume cervical spine injury and maintain the spine in neutral position (hard collar, taped with sand bags either side of the head) until proven otherwise clinically and radiologically. During intubation it is acceptable to remove the hard collar to aid jaw movement so long as someone performs 'manual in-line immobilization' of the head and neck.

Treatment options include:

- Oxygen administration
- Basic airway manoeuvres: chin lift and jaw thrust
- Oropharyngeal or nasopharyngeal airway, but be careful not to cause any bleeding
- Endotracheal intubation
- Provision of a surgical airway, i.e. cricothyroidotomy (surgical or needle).

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Breathing and ventilation

The chest must be examined by inspection, palpation, percussion and auscultation. Trachea position (central or displaced), neck vein distension, cyanosis, respiratory rate and pattern, breath sounds, oxygen saturation, visible wounds or flail chest, surgical emphysema and chest symmetry should be sought. Life-threatening chest injuries such as tension pneumothorax, open pneumothorax, cardiac tamponade, flail chest and massive haemothorax must be identified and rapidly treated.

Treatment options include:

- Endotracheal intubation and ventilation
- Needle decompression
- Placing a chest drain
- Pericardial drainage
- Thoracotomy
- Giving adequate analgesia.

Circulation and haemorrhage control

Two intravenous cannulae (grey, 16 G or bigger) should be inserted, and vital signs monitored (heart rate and oxygen saturation are continuously displayed and blood pressure every 2–5 minutes initially till the arterial line is secured). Tachycardia and/or hypotension after traumatic injury is assumed to be caused by significant (>30% blood volume) blood loss until proven otherwise. Stopping haemorrhage with rapid haemostatic techniques (e.g. compression, bandage, pelvic splint, fracture reduction, interventional angiography or laparotomy) is the first priority in the treatment of traumatic haemorrhagic shock, with concomitant fluid resuscitation (fluid and blood) to maintain perfusion and organ function.

One approach to in-hospital resuscitation for the treatment of trauma patients with haemorrhagic shock is the rapid infusion of 2 litres of crystalloid, However, many experts advocate giving less and observing the response, i.e. halt bleeding while maintaining adequate tissue perfusion – this is a controversial area, so make sure you follow your local hospital guidelines.

This may be followed by blood transfusion with blood (uncrossmatched blood, i.e. O negative, ABO type-specific or fully crossmatched depending on urgency and availability) if there is evidence of ongoing hypovolaemia or anaemia. Fresh frozen plasma and cryoprecipitate should be considered early in massive haemorrhage.

The resuscitation endpoints (how to tell if you have given enough) that have been evaluated include restoration of blood pressure, heart rate and urine output, capillary refill, lactate, base deficit, mixed venous oxygen saturation and ventricular end-diastolic volume. Remember, patients can compensate for hypovolaemia (by vasoconstricting) and so delay the appearance of tachycardia and hypotension. Bleeding can occur externally or be from the thoracic, abdominal or pelvic cavities, long bones or spine. Diagnosis can be aided by ultrasound (e.g. 'FAST' scan: Focused Assessment with Sonography for Trauma), computed tomography, X-ray, angiography, diagnostic peritoneal lavage and blood tests (full blood count, urea and electrolytes and blood gases). *Table 1* lists some signs of hypovolaemia.

Treatment options include:

- Warm fluids (crystalloid or colloid)
- Warm blood and blood products (e.g. fresh frozen plasma)
- Arrest bleeding by direct local pressure
- Arrest bleeding by splinting pelvis
- Place a central line if inotropes or vasopressors are needed
- Insert a urinary catheter
- Surgery ('damage control' or definitive).

Table 1. Signs of hypovolaemia

System	Sign
Cardiovascular	Increased heart rate
	Increased capillary refill time
	Decreased blood pressure (late sign)
	Decreased pulse pressure
	Cool and clammy skin
Respiratory	Increased respiratory rate
Neurological	Confusion or agitation
	Decreased conscious level
Other	Decreased urine output

Disability: dysfunction of the CNS

A quick neurological assessment is an essential part of the primary survey. In general if the patient is talking appropriately he/she has a clear airway, adequate ventilation and intact cerebral function. Of course this can change, hence the need for repeating the primary survey should deterioration occur. The Glasgow Coma Scale can be used to give a reliable, repeatable and objective way of recording the conscious state of the patient (*Table 2*). Always try to make an assessment before intubation as sedation interferes with consciousness. Record the three values separately (e.g. E3V3M5) as well as their sum. The lowest possible Glasgow Coma Scale (the sum) is 3 (deep coma), while the highest is 15 (fully awake person). A drop of 2 in the Glasgow Coma Scale usually requires investigation, e.g. computed tomography of the head.

Treatment options include:

- Oxygen administration
- Intubation (to ensure normal arterial partial pressure of oxygen and carbon dioxide)
- Giving inotropes or vasopressors (to ensure adequate cerebral perfusion)
- Placing the patient head up to ensure venous drainage
- Emergency imaging of brain or spine
- Neurosurgery.

Exposure or environmental control

Fully undress the patient, allowing a thorough secondary survey. Avoid hypothermia which can have devastating consequences (coagulopathy, acidosis) by actively warming the patient. Check the blood sugar level.

Secondary survey

The secondary survey occurs after all life-threatening injuries from the primary survey have been identified and treated, and parallel initial investigations performed (*Table 3*). It aims to identify all the injuries sustained and involves a thorough head to toe examination including full neurological examination, examination of the spine, log rolling and performing a rectal examination. Take a complete

Table 2. Glasgow Coma Score

Best eye opening (E)	4 = Spontaneous
	3 = To voice
	2 = To pain
	1 = None
Best verbal response (V)	5 = Normal conversation
	4 = Disoriented conversation
	3 = Words, but not coherent
	2 = No words, only sounds
	1 = None
Best motor response (M)	6 = Normal
	5 = Localizes to pain
	4 = Withdraws to pain
	3 = Decorticate posture
	2 = Decerebrate
	1 = None

Table 3. Initial investigations for the secondary survey

Full blood count, urea and electrolytes, glucose, cross match, blood gas
Chest and pelvis plain radiographs
Anterior posterior, lateral and odontoid peg view cervical spinal radiographs

history from the patient, paramedics, police or relatives. Key questions stem from the mnemonic AMPLE 'Allergies, Medication, Past medical history, Last meal (relevant for surgery), and Event and Environment related to injury'. As a result of the secondary survey further investigations may be needed.

Definitive care

Definitive care starts once the patient has been resuscitated and any life-threatening injury dealt with. It includes further surgical intervention, antibiotics, tetanus immunization and may involve transfer to a tertiary centre. Transferring a trauma patient is very risky and should involve the most appropriate doctor trained in transfer. Ideally a tertiary survey should be performed the next day to ensure nothing has been missed in the initial surveys (e.g. small but functionally important digital injuries). Patients with certain injuries may sometimes need transfer before the secondary survey or even during the primary survey, e.g. isolated head injury or polytrauma patients requiring cardiothoracic surgery.

Conclusions

Trauma is a leading cause of death and disability, especially among young people. A well-rehearsed and systematic Advanced Trauma Life Support approach to hospital resuscitation can save lives as well as limiting the consequences of the trauma. The primary survey should be repeated whenever an intervention has been made and if changes in the patient's clinical state occur, to avoid the 'triad of death' (hypothermia, acidosis and coagulopathy). Be aware of the golden first hour of trauma resuscitation: delays in treatment can kill. **BJHM**

Conflict of interest: none.

KEY POINTS

- Trauma is a major health problem and its incidence is increasing.
- The key to the management of trauma is to follow and implement the Advanced Trauma Life Support approach, which is well established, systematic and known to all health professionals.
- Trauma patients are best treated in trauma centres which have started to take shape in the UK.
- Trauma is an acute or sudden event which should be treated promptly by a coordinated multidisciplinary team.
- We may not be able to alter the initial insult but we are expected to prevent secondary insults.