**Advanced Trauma Life Support**

**Background**

- **Team members and their roles**
  - Emergency medicine consultant/registrar - lead
  - Emergency medicine doctor - primary survey
  - Anaesthetist - airway
  - Orthopaedic doctor - manage pelvis and other bone injuries
  - General surgery doctor - manage spleen/gut/chest
  - Intensive care doctor - decide upon ICU admission
  - Emergency medicine nurses x 2 - one for patient care (observations etc) and one for code red
  - Health care assistant - help with getting things etc
  - Operating department practitioner - organise theatre if required

- **Trauma handover** – **ATMIST**
  - Age
  - Time everything happens
  - Mechanism
  - Injuries
  - Signs – observations, capillary refill
  - Treatment so far – e.g. triple immobilised, pelvic binder, oxygen, tranexamic acid

- **Prioritising injuries in polytrauma**
  1. Life-threatening bleeding wounds e.g. splenic rupture, pelvic/thoracic injury
  2. Limb threatening injuries e.g. vascular injury, extensive limb bleeding requiring tourniquet to control blood loss
  3. Fractures, dislocations and wounds at risk of complications (e.g. infection, neurovascular damage, bleeding)
  4. Stable fractures and other non-urgent injuries are managed later and may even be best left until swelling has resolved

**Preparation and triage**

- Advance planning
- Gather equipment e.g. goggles, gloves, gowns, shoe covers, masks
- Call trauma team

**Primary survey – ** **C ABCDE**

**Catastrophic haemorrhage**

- Sources: external (usually from neck) or pericardial
- Management
  - Emergency thoracotomy for penetrating chest trauma causing cardiac arrest
  - Pressure over bleeding points
  - Warmed blood transfusion

**Airway maintenance with C-spine protection**

- Look for causes of airway compromise: maxilla fracture (bleeds ++, ask to bite down to assess), laryngeal fracture (hanging), burns/inhalation, neck haematoma, GCS less than or equal to 8, neuromuscular paralysis, vomiting, stridor
- Management
  - Airway manoeuvres e.g. jaw thrust
  - Artificial airway e.g. nasopharyngeal/oropharyngeal, intubation, surgical cricothyroidotomy (see artificial airways notes)
  - Remove foreign bodies
  - Suction
  - Triple immobilisation for C-spine until cleared by cervical spine X-rays and/or CT scan
    1. Hard collar
    2. Blocks or sandbags
    3. Tape over chin and forehead

**Breathing**

- Assessment
  - Saturations, respiratory rate
  - Look (cyanosis, respiratory effort, neck vein distention, bruises)
  - Feel (surgical emphysema, tenderness over ribs)
  - Expansion (haemothorax, pneumothorax, flail segment)
  - Percuss (haemothorax, pneumothorax)
**Shock differentiation**

**Haemorrhagic**
Cardiogenic: blunt cardiac trauma, tamponade, air embolus, MI

**Tension pneumothorax**
Neurogenic (↓BP + ↓HR)

**Septic**

**Classes of shock**

**Class 1**
15% blood loss
Normal observations

**Class 2**
15-30% blood loss
HR >100, normal BP, RR 20-30

**Class 3**
30-40% blood loss
HR >120, decreased BP, RR 30-40

**Class 4**
>40% blood loss
HR >140, decreased BP, RR >35

**Code red protocol**
Give pack 1 first, then pack 2 if needed, then alternate until haemorrhage controlled

Pack 1 = 6U blood, 4U FFP
Pack 2 = 6U blood, 4U FFP, 1U platelets, 2U cryoprecipitate

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**Management**

- Chest drain for haemothorax/pneumothorax
- High flow oxygen

**Listen** (haemothorax, pneumothorax)

**Management**

- Chest drain for haemothorax/pneumothorax
- High flow oxygen

**Circulation**

**Assessment**

- Heart rate, blood pressure
- Peripheral pulse (requires systolic pressure of 80mmHg)
- Heart sounds
- Lactate (>5 significant)
- Look for bleeding - "blood on floor (external) and 4 more", working down:
  1. Chest ➔ FAST scan, examination, CXR
  2. Abdomen ➔ FAST scan, examination (e.g. bruising)
  3. Pelvis ➔ Pelvic X-ray or CT scan
  4. Long bones ➔ X-rays, examination

  *i.e. examine now and, after resuscitation, get FAST scan + CXR + pelvic X-ray OR trauma CT (includes head, spine, chest, abdo, pelvis)*

**Management**

- Place 2 wide-bore IV cannulae and take blood (including G&S, FBC, clotting screen, fibrinogen)
- Aim for permissive hypotension
- Shock: Hartmanns 1-2L bolus (or 20ml/kg for child). Subsequent fluids depend on response
  - no response: give 0 negative blood
  - transient response: give more fluids (crystalloid or gelofusine) and type-specific blood
- Massive haemorrhage (ie. SBP<90, poor response to fluid resus, suspected haemorrhage): activate ‘code red’ transfusion protocol, give tranexamic acid, keep patient warm
- Ensure all transfused blood/fluids are warmed and patient is kept warm
- Leave pelvic binder on until pelvis cleared
- Traction for long bone fractures
- Combat application tourniquet only if compression fails to control limb blood loss

**Disability**

**Assessment**

- Glasgow coma score
- Limb movements
- Pupils reactivity

**Management**

- CT head if indicated (done after resuscitation)

**Everything else**

- Try not to expose (need to conserve heat) unless absolutely necessary e.g. stab check, can’t get CT scan

**Resuscitation**

- Oxygenation and ventilation
- Management of shock and bleeding
- Management of life threatening injuries

**Adjuncts to primary survey and resuscitation**

- X-rays:
  - Broken bones
  - C-spine
  - Chest, pelvis
  - OR trauma CT (head, spine, chest, abdo, pelvis)
- FAST scan
- CT head if indicated
- Urinary catheter
- Monitoring: ABG, end-tidal CO₂, ECG, observations

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Secondary survey
Takes place only after primary survey and resuscitation is established and there is demonstration of normalisation of vital functions

- History – **AMPLE**
  - Allergies
  - Medication
  - Past medical history/Pregnancy
  - Last meal
  - Events/Environment related to injury

- **Top-to-toe exam** – plot all injuries on a drawing – **SEE TABLE BELOW**

<table>
<thead>
<tr>
<th>Secondary Survey – Top-to-toe examination</th>
<th>Area</th>
<th>Possible injuries</th>
<th>Assessment</th>
<th>Possible further investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NERVOUS SYSTEM &amp; PROTECTION</strong></td>
<td>Skull</td>
<td>• Skull fracture</td>
<td>• P: Inspect</td>
<td>• CT head</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Scalp injury</td>
<td>• P: Palpate skull</td>
<td></td>
</tr>
<tr>
<td></td>
<td>'Brain</td>
<td>• Head injury</td>
<td>• P: GCS</td>
<td>• CT head</td>
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<tr>
<td></td>
<td></td>
<td>• Vertebral fracture</td>
<td>• P: Inspect for deformity</td>
<td>• Spine X-ray</td>
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<tr>
<td></td>
<td></td>
<td>• Vertebral instability</td>
<td>• P: Spinal process tenderness</td>
<td>• CT spine</td>
</tr>
<tr>
<td></td>
<td>'Spinal cord</td>
<td>• Cord injury</td>
<td>• P: Motor exam</td>
<td>• MRI X-ray</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Peripheral nerve injury</td>
<td>• P: Sensory exam</td>
<td>• CT spine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pain/motor response</td>
<td>• P: Auscultation</td>
<td></td>
</tr>
<tr>
<td><strong>FACE &amp; NECK</strong></td>
<td>Maxillofacial</td>
<td>• Skin/soft tissue injury</td>
<td>• P: Inspect for deformities</td>
<td>• Facial bone X-ray</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teeth/mouth injury</td>
<td>• P: Malocclusion</td>
<td>• CT of facial bones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•  Facial bones fractures</td>
<td>• P: Palpate for crepitus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neck</td>
<td>• Laryngeal injury</td>
<td>• P: Inspection</td>
<td>• Angiography</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Vascular injury</td>
<td>• P: Palpation</td>
<td>• Endoscopy/laryngoscopy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Esophageal injury</td>
<td>• P: Auscultation for bruit</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Surgical emphysema</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MAJOR CAVITIES</strong></td>
<td>Thorax</td>
<td>• Thoracic wall injury</td>
<td>• P: Inspect for bruising, deformity, paradoxical chest wall movement</td>
<td>• CXR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pneumothorax/haemothorax</td>
<td>• P: Chest wall tenderness/crepitus</td>
<td>• CT chest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pulmonary contusion</td>
<td>• P: Auscultation for reduced breath sounds and muffled heart sounds</td>
<td>• Angiography</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Thoracic aortic damage</td>
<td>• P: Palpation for t enderness</td>
<td>• Bronchoscopy</td>
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<td></td>
<td></td>
<td>• Surgical emphysema</td>
<td>• P: Auscultation</td>
<td>• Ultrasound thorax</td>
</tr>
<tr>
<td></td>
<td>Abdomen</td>
<td>• Abdominal wall injury</td>
<td>• P: Inspection</td>
<td>• Ultrasound abdomen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Retroperitoneal damage</td>
<td>• P: Palpation for tenderness</td>
<td>• CT abdomen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Organ injury e.g. splenic rupture/lacerations</td>
<td>• P: Auscultation</td>
<td>• Angiography</td>
</tr>
<tr>
<td></td>
<td>Pelvis</td>
<td>• Pelvic fractures</td>
<td>• P: Palpate bony pelvis and myphysis pubis widening</td>
<td>• Pelvic X-ray</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Genitourinary injuries</td>
<td>• P: Determine pelvic stability</td>
<td>• CT KUB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual inspection for swelling/bruising/malalignment</td>
<td>• P: Inspect perineum/rectum/vagina</td>
<td></td>
</tr>
<tr>
<td><strong>LIMBS</strong></td>
<td>Limbs</td>
<td>• Soft tissue injuries</td>
<td>• P: X-rays</td>
<td>• Doppler ultrasound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fractures</td>
<td>• P: Compartment pressures</td>
<td>• Compartment pressures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Joint injuries</td>
<td>• P: Angiography</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Neurovascular damage</td>
<td>• P: Analgesia</td>
<td></td>
</tr>
</tbody>
</table>

**Adjuncts to secondary survey**
- Trauma CT scan (head, chest, abdomen, spine)
- Further X-rays e.g. extremities, spine
- Ultrasound
- Other procedures required e.g. endoscopy/bronchoscopy, angiography, contrast urography

**Post resuscitation monitoring and re-evaluation**
- Regular observations
- Bloods
- Urine output monitoring (aim >0.5ml/kg/h)
- Others: ABG, cardiac monitoring
- Analgesia

**Definitive care**
- Treat/transfer

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