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- For practitioners in private clinics/hospitals
- For staff in ER, OPDs, Wards
- For medical students, interns, house surgeons
- For students preparing for PG Entrance Exams

3rd Edition

K Sunil Ravinder Paul

JAYPEE

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Chapter 4 Trauma (Advanced Trauma Life Support)

4.1 POLYTRAUMA AND ADVANCED TRAUMA LIFE SUPPORT

Advanced trauma life support (ATLS) is the process of selecting or sorting patients in emergency room (ER) when mass causalities arrive from fire/bomb blast/building collapse/major or multiple accidents.

Aim: Nurse, senior surgeon, or ER specialist doctor will identify patients who will benefit most by treating them at the earliest.

Triage areas are color-coded:

Color	Injury	Urgency and significance
Red	Most critical injury	High priority. Needs immediate treatment or referral
Yellow	Less critical injury	Medium priority. Needs treatment within 1 hour
Green	No life or limb injury	Patient is moving or walking. Nonurgent. Treat within 3 hours
Black	Death or fatal injury	Dead

Advanced Trauma Life Support

Primary Survey and Secondary Survey

Trauma patients may have multiple injuries. The internationally recognized protocol called ATLS involves a team of different specialties working together quickly to assess and treat trauma patients. Specialties include emergency medicine, anesthetist, general surgeon, orthopedist, plastic surgeon, neurosurgeon, and other specialists.

First aid	• "Roadside" aid given by paramedics or on-site medical teams • Aim is to maintain life during extraction and evacuation of the patient
Primary survey	*Do this in golden hour, i.e., first hour of trauma* • *A*: Airway management and cervical-spine protection • *B*: Breathing and ventilation • *C*: Circulation—stop external bleeding by direct pressure and maintain blood pressure (BP) • *D*: Disability—neurologic assessment with Glasgow Coma Scale (GCS) • *E*: Exposure—undress patient to assess for other injuries. Prevent hypothermia • *DEFG*: "Do not Ever Forget Glucose." Measure blood sugar Important to: • Reassess repeatedly • Treat life-threatening conditions as soon as diagnosed • Leave penetrating wound and implements for formal surgical exploration
Secondary survey	• Thorough examination of back is performed, looking for obvious signs of injury (bruising, laceration, deformity) • Vertebrae are palpated for tenderness • Per rectal examination is performed and patient is asked to squeeze against a finger to rule out signs of spinal cord damage. Blood per rectum may be a sign of significant pelvic injury • Assess systematically from head to toe for injuries, lacerations, contusions, skin tears, or fractures of small bones • Document any other injuries, take history, examine patient from head to toe, document GCS, assess neck (clinical and radiology to include C7–T1) • Perform review of the patient's history. Allergy, Medications, Past medical history, Last meal, Events (AMPLE) of the incident

A = Airway management and cervical-spine immobilization

- Is the patient maintaining his/her own airway? If he/she is talking, it is safe to assume that the patient is maintaining his/her own airway
- Clear obstructions by hand and suction, and lift chin in obtunded patients
- Secure airway with oropharyngeal or nasopharyngeal airway
- *Endotracheal intubation or emergency tracheostomy indications*:
  - Inability to maintain airway patency (due to direct trauma to either neck, jaw, or face)
  - Inability to protect airway from aspiration (comatose patients)
  - Failure to ventilate (hypoxemia)
  - Failure to oxygenate
  - Anticipation of a deteriorating course that will eventually lead to respiratory failure

JAYPEE BROTHERS

B = Breathing

- *Expose patient's chest*:
  - Look for any obvious deformity or bruising over the chest. Is there any tenderness over the ribs?
  - Is breathing normal or "paradoxical?" Paradoxical breathing is chest caving in as the patient breathes in (normally, the thorax should swing out)
- If there is caving, the patient may have multiple rib fractures with a "flail segment"
- Is the chest normal to percussion? Normally, lungs are filled with air and should be resonant
- Dullness to percussion indicates a possible hemothorax or lung collapse
  - Administer supplemental oxygen
  - Monitor oxygen saturation with pulse oximetry
  - Temperature pulse respiration (TPR) recordings

C = Circulation

- Measure capillary refill, blood pressure and heart rate, apex beat, jugular venous pressure (JVP), heart sounds, and evidence of blood loss
- Think bleeding as "one on the floor and four more" parts of body
- "One on the floor" refers to any open wounds that are visibly bleeding. If this is the case, maintain direct and constant pressure over the bleed
- "Four more" parts refer to the four main body parts that trauma patients tend to bleed from—chest, abdomen, pelvis, and long bones (especially femur). These four parts/places need to be checked carefully
- Listen to chest for signs of hemopneumothorax. Muffling of heart sounds in blunt trauma to chest (e.g., driver's chest striking the steering wheel) and hemodynamic instability are signs of cardiac tamponade, which may require pericardiocentesis
- *Check abdomen for signs of bruising and palpate for tenderness*:
  - Spleen is the most injured organ in blunt trauma with potentially torrential blood loss. Abdomen can distend to accommodate a large quantity of blood. There can also be hollow viscus injury and mesenteric tears
  - Hepatic and renal trauma can also result in significant blood loss
  - Pelvis can be fractured in several ways, the most serious of which are "open book" and "vertical-shearing fractures." If there is clear deformity or potentially a pelvic fracture, pelvis should be "bound" by a pelvic binder. If not available, use bed sheets or towels. Bring and tie the great toes together, so that the open book injury becomes a closed book
  - Long bones, especially femur, can bleed significantly. Look for deformities and palpate long bones carefully
- Insert two large-bore IV lines (intraosseous fluids if IV access is not readily available, e.g., in children)
- Draw blood for cross-match, complete blood count (CBC), urea, and electrolytes
- Insert urinary catheter and monitor urine output
- Tachycardia may be due to pain but when coupled with hypotension, it is a worrying sign

D = Dysfunction of the CNS

- Assess GCS. GCS is a useful tool in assessing the patient's neurological status
- *Examine pupils*: Look for symmetry and note their reaction to light. Asymmetrical pupils may be the only signs of serious intracranial pathology
- *Gross motor and sensory function*: Abnormality in sensation or defect in movement may be due to spinal trauma

E = Exposure of extremities

Expose the patient fully (while avoiding hypothermia) and look for long bone injuries and major blood loss

DEFG:

"Do not Ever Forget Glucose," measure blood sugar

Pitfalls in Fluid Resuscitation in Trauma

Avoid overly aggressive fluid resuscitation in trauma	Patients who require additional volume beyond 1 or 2 L of crystalloid should receive packed red blood cells
Do not wait too long to initiate blood transfusion	Patients with hemodynamic instability, altered mental status, or significant bleeding should receive blood as soon as possible
Failure to transfuse more than just packed red cells	Use massive transfusion protocol when transfusing more than 4–6 units of packed red blood cells. When massive transfusion is used, use plasma, platelets, and packed red blood cells in the ratio of 1:1:1
Remember clotting agents and use as indicated	Tranexamic acid improves outcome if given within 3 hours of injury. It should be considered as an adjunct transfusion in a hemorrhaging patient
Resuscitate patient with fluids and blood rather than initiating vasopressors	Vasopressors without adequate fluid registration will lead only to further vasoconstriction and end-organ perfusion. Focus on controlling bleeding, crystalloids, and early transfusion
Recognize and manage alternative sources of shock in an injured patient	Although hypovolemic shock should always be suspected and treated first, other causes of shock such as cardiogenic shock, septic shock, or spinal cord injury may be present

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Investigations

A standard "trauma series" of investigations should be performed on trauma patients.

Blood and urine tests	CBC, urea and creatinine, electrolytes, liver function tests (LFT), amylase, clotting profile [bleeding time (BT), clotting time (CT), prothrombin time (PT), and platelets], blood group
Imaging	
C-spine (includes C7 and T1)	Look for vertebral alignment and fractures
Chest X-ray	Look for hemothorax, pneumothorax, and fractured ribs (fractures of the first and second ribs indicate significant force applied to thorax)
Pelvis	Look for pelvic and neck-of-femur fractures
Other X-rays	Of relevant parts of the body found to have injury on secondary survey
CT	CT imaging may be required for any part of the body such as head, cervical spine, chest, abdomen, and pelvis. Sometimes, whole-body CT is required in unconscious patients for head injury or faciomaxillary injury, especially for spinal cord problems
MRI	
ECG	All trauma patients should have an ECG. Look for ECG changes
Pulse oximetry	
Arterial blood gas (ABG)	ABG should be checked in hypoxic or hemodynamically compromised patients

Cardiac Arrest

Cardiac arrest (CA) can be defined as sudden loss or stop of heart function either instantaneously or following a range of symptoms ultimately leading to arrest of circulation. (Heart attack is a circulation problem.)

Classical features of CA are:
- Pulselessness
- Unresponsiveness
- *Abnormal breathing*: Either agonal/absent

Prompt recognition is important and early
High-quality CPR and early defibrillation remain the mainstay of CA resuscitation

Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation (CPR) includes basic life support (BLS) and advanced cardiac life support (ACLS).

The 2015 American Heart Association (AHA) revised the guidelines for CPR. It is now CAB, which stands for chest compressions, airway, and breathing (instead of ABC, which stands for airway, breathing, and circulation).

Basic life support (BLS): Any person can do this anywhere for adults, children, and infants (newborns are excluded)	*Cardiopulmonary resuscitation (criteria for high-quality CPR)* *C = Chest* compression Compression on the lower half of the patient's sternum 100 per minute. 2 inches deep for circulation. Allow chest to recoil each time. No pause should be greater than 10 seconds Early chest compression can immediately circulate oxygen that is still in the bloodstream. By changing the sequence, chest compressions are initiated sooner and the delay in ventilation should be minimal *A = Airway* patency Elevate the head, tilt to one side, lift the chin, do jaw thrust, remove any secretions or food from mouth *B = Breathing* With mask and Ambu bag, if available + Automated electrical defibrillator (AED) (biphasic lower current) Continue CPR for 2 minutes, and then use AED. It will detect arrhythmias and automatically give shock if only arrhythmia is present. Continue CPR and again use AED
Advanced cardiac life support (ACLS): Done in hospitals by expert staff or doctors	CPR (high quality) (refer above CAB) Drugs (adrenaline and other drugs) Defibrillation (biphasic lower voltage current) Invasive airway procedures (intubation and ventilation)

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