

430 SURGERY TEAM



INTRODUCTION TO MECHANISMS OF TRAUMA AND TREATMENT PRIORITIES



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Green: Doctor's notes & explanation during the lecture.

Blue: Further explanation & team's notes.

Red: important notes.

Mechanisms and Patterns of Injury

BLUNT	PENETRATING
<p>Classified into:</p> <ol style="list-style-type: none">1. High energy transfer e.g. Car Accident2. Low energy transfer e.g. Fall from a bicycle <p>● Associated with multiple widely distributed injuries because the energy is transferred over a wider area during blunt trauma.</p> 	<p>Classified into:</p> <ol style="list-style-type: none">1. Stab wound2. Gunshot wound3. Shotgun <p>● Damage is localized to the path of the bullet or knife.</p> 

Pre Hospital Care:

The objective of pre hospital care is to prevent further injury, initiate resuscitation and transport the patient safely and rapidly to the most appropriate hospital.

- Airway control
 - Fluid resuscitation
- In pre hospital care assure safety of the patient by airway control Chin-lift: fingers under mandible, lift forward so chin is anterior with cervical spinal protection.
 - Resuscitation of the patient start by primary care survey ABC, Airway is the most important.

Transportation

- Ground Ambulance
- Helicopter

Initial Evaluation and Resuscitation of the Injured Patient

Primary Survey

- The goal of primary survey is to identify and treat conditions that constitute an immediate threat to life.
- **ATLS** provides a structured approach to the trauma patient with standard Algorithms of care.
- It emphasizes the “golden hour” concept that timely prioritized interventions are necessary to prevent death.
- The ATLS Course refers to the primary survey as assessment of the “**ABC**” (**A**irway with cervical spine protection, **B**reathing and **C**irculation).
- Although the concepts within primary survey are presented in a sequential fashion in reality they often proceed simultaneously.

(A) Airway Management with cervical spine protection

- Conscious patient who do not show tachypnea and have normal voice do not require early attention to the airway.
- Patients with penetrating neck injuries and an expanding hematoma, evidence of chemical or thermal injuries to the mouth, nares or hypopharynx, extensive subcutaneous air in the neck, complex maxillofacial trauma or airway bleeding, in these cases *elective intubation* should be performed. These patients may initially have a satisfactory airway but they may become obstructed if soft tissue swelling, hematoma formation, or edema progress.

Some patients need elective intubation those who have either chemical injuries or extensive subcutaneous air. Burned patient have edema which may cause swelling and obstruct the airway.

- Establishment of a definitive airway (i.e. **endotracheal intubation**) is indicated in patients with apnea, inability to protect the airway due to altered mental status, impending airway compromise due to inhalation injury, hematoma, facial bleeding, soft tissue swelling or aspiration, and inability to maintain oxygenation. *Altered mental status is the most common indication for intubation.*

Options for Endotracheal Intubation Include:

- 1) **Nasotracheal intubation:** It can be accomplished only in patients who are breathing spontaneously. The primary application for this technique in Emergency Department (ED) is in those patients requiring emergent airway support in whom chemical paralysis cannot be used.

in breathing patient without major facial trauma, but nobody use it anymore

- 2) **Orotracheal intubation:** It is the most common technique used to establish a definitive airway.

It's the most common technique because we can see the vocal cords, do capnography " is the monitoring of the concentration or partial pressure of carbon dioxide (CO₂) in the respiratory gases. Its main development has been as a monitoring tool for use during anesthesia and intensive care." , auscultation of the chest bilaterally if you hear the breath sounds on one side of the chest it means the obstruction is on the other side and usually it's the right bronchus and x-ray

- Because all patients are presumed to have cervical spine injuries, manual in-line cervical immobilization is essential.
- Correct endotracheal placement is verified with:
 - *Direct laryngoscopy*
 - *Capnography*
 - *Audibility of bilateral breath sounds*
 - *And finally Chest X-Ray*

3) Surgical Routes:

- **Cricothyroidotomy:** *Patients in whom attempts at intubation have failed or who are precluded from intubation due to extensive facial injuries.*
- **Emergent Tracheostomy:** *Is indicated in a patient with extensive laryngeal injury . It is the most common technique used to establish a definitive airway.*

- *Cricothyroidotomy for patients with extensive facial injuries*
- *and Emergent tracheostomy for extensive laryngeal injury*

(B) Breathing and Ventilation

- Once a secure airway is obtained, adequate oxygenation and ventilation must be assured. All injured patients should receive supplemental oxygen and be monitored by pulse oximetry.
- The following conditions constitute an immediate threat to life due to inadequate ventilation and should be recognized during the primary survey:

1) Tension pneumothorax

- accumulation of air in the plural cavity, causing respiratory distress → distended neck veins → hypotension → cardiovascular collapse
- treatment → needle → second intercostal space in the midclavicular line → tube → in the fifth intercostal space in the midaxillary line

Diagnosis: Respiratory distress and hypotension in combination with any of the following physical signs in patients with chest trauma.

- Tracheal deviation away from the affected side.
- Lack or decreased breath sounds on the affected side.

- Subcutaneous emphysema on the affected side.
- Distended neck veins due to impendence of superior vena cava, but the neck veins may be flat due to systemic hypovolemia.

In cases of tension pneumothorax: the parenchymal tear in the lung act as a one-way valve, with each inhalation allowing additional air to accumulate in the pleural space. The normally negative intrapleural pressure becomes positive which depresses the ipsilateral hemidiaphragm and shift the mediastinal structures into the contralateral chest. Subsequently the contralateral lung is compressed and the heart rotates about the superior and inferior vena cava, this decreases venous return and ultimately cardiac output which results in cardiovascular collapse.

Treatment:

- Immediate needle thoracostomy: decompression with a 14 gauge angiocatheter in the second intercostal space in the midclavicular line followed by
- Tube thoracostomy in the fifth intercostal space in the midaxillary line immediately in the emergency department before the chest radiograph.

2) Open pneumothorax (or sucking chest wound).

This occurs with full-thickness loss of the chest wall, permitting free communication between the pleural space and the atmosphere. This comprises ventilation due to equilibration of atmospheric and pleural pressures which prevents lung inflation and alveolar ventilation and result in hypoxia and hypercarbia

Treatment:

Closure of the chest wall defect and tube thoracostomy

3) Flail chest with underlying pulmonary contusion

- It occurs when three or more contiguous ribs are fractured in at least two locations
- Paradoxical movement of this free-floating segment of chest wall may be evident in patient with spontaneous ventilation due to the negative intrapleural pressure of inspiration.
- Rarely the additional work of breathing and chest wall pain caused by the flail segment is sufficient to compromise ventilation.
- Resultant hypoventilation and hypoxemia may require intubation and mechanical ventilation.

(C)Circulation with Hemorrhage Control

- 2 IV lines in 16 gauge through intercostal fossa with ringer lactate.
- Take blood for measurement because patient may need transfusion.
- Central line is contraindicated, but if he's a cardiac patient or elderly or stabilized we can use it .
- Put pressure 4 x 4 gauze with gloved hands in open wounds don't do sutures

- Blood pressure and pulse should be measured manually at least every 5 minutes in patient with significant blood loss until normal vital signs values are restored.
- Two peripheral catheters, 16 gauge or larger in adults.
- Fluid resuscitation.
- Blood should be drawn simultaneously and send for measurement of hematocrit level, as well as for typing and cross-matching for possible blood transfusion in patient with evidence of hypovolemia.
- If peripheral angiocatheter access is difficult, saphenous vein cutdown at the ankle provide excellent access
- Additional venous access through femoral or subclavian vein(can be used for CVP measurement).
- Intraosseous needle can be placed in the proximal tibia (preferred) or distal femur of an unfractured extremity for fluid resuscitation in patient under 6 years of age .
- External control of hemorrhage should be achieved promptly while circulating volume is restored. Manual compression of open wounds with ongoing bleeding should be done with a single 4 x 4 gauze and a gloved hand. Blind clamping of bleeding vessels should be avoided.

During the circulation section of the primary survey FOUR life-threatening injuries that must be identified.

1) Massive hemothorax

- Rapid accumulation of >1500 cc blood in chest cavity which requires immediate surgery.
- Hypovolemia & hypoxemia
- Neck veins may be: Flat: from hypovolemia ,Distended: intrathoracic blood
- Absent breath sounds, dull to percussion

Immediate treatment

- Tube thoracostomy to facilitate lung re-expansion
- Massive hemothorax (>1500 ml. blood) is an indication for operative intervention

2) Cardiac tamponade

- Usually from penetrating injuries
- fluid accumulates in the pericardial sac which prevents cardiac activity

Immediate treatment

- Pericardial drain under ultrasound guidance
- Followed by operative intervention

3) Massive hemoperitoneum with Hemodynamic Unstability

- Fluid resuscitation
- Immediate surgical intervention

4) Mechanically unstable pelvic fracture

- Pelvis fracture
- Immediate external fixation

THREE critical tools used to differentiate these in multisystem trauma patient are:

- Chest radiograph
- Pelvis radiograph
- Focused Abdominal Sonography for Trauma (FAST)

Shock Classification and Initial Fluid Resuscitation:

- Classic signs and symptoms of shock are : tachycardia, hypotension, tachypnea, mental status changes, diaphoresis and pallor.
- The quantity of acute blood loss correlates with physiologic abnormalities.
- Tachycardia is often the earliest sign of ongoing bleeding.
- Hypotension is not reliable early sign of Hypovolemia, because blood volume must decrease by >30% before hypotension occurs.
- Fluid resuscitation begins with a 2 L (Adult) or 20 ml/kg (child) IV bolus of isotonic crystalloid, typically Ringers's Lactate.
- For persistent hypotension, this is repeated once in an adult and twice in a child before red blood cells (RBCs) are administered.
- Urine output is a quantitative reliable indicator of organ perfusion. Adequate urine output is 0.5 ml/kg per hour in an adult, and 1 ml/kg per hour in child.
- Based on the initial response to fluid resuscitation, hypovolemic injured patients can be separated into three broad categories:
 - Responders
 - Transient responders
 - Non-responders

- The table is IMPORTANT , class 1 and 2 BP is good specially in young people
- Brain anoxia → Irritability → Loss of consciousness
- Tachycardia is the first sign of shock hypotension is the late sign
- 2 L for adults and 20 ml/kg for children ringer lactate is better than normal saline because it induces hyperchloremic acidosis " is a form of metabolic acidosis associated with a normal anion gap, a decrease in plasma bicarbonate concentration, and in an increase in plasma chloride concentration"

Signs and Symptoms of Advancing Stages of Hemorrhagic Shock				
	Class I	Class II	Class III	Class IV
Blood loss (ml)	Up to 750	750 – 1500	1500 – 2000	> 2000
Blood loss (% BV)	Up to 15%	15 – 30%	30 – 40%	>40 %
Pulse Rate	<100	>100	>120	>140
Blood Pressure (mmHg)			Decreased	Decreased
Pulse Pressure	Normal or Increased	Decreased	Decreased	Decreased
Respiratory Rate	14 – 20	20 – 30	30 – 40	> 35
Urine Output (ml/hr)	>3	20 – 30	5 – 15	Negligible
CN/Mental Status	Slightly anxious	Mildly anxious	Anxious and confused	Confused and Lethargic

Secondary Survey

- Once the immediate threats to life have been addressed, a thorough history is obtained and the patient is examined from top to toe to ensure that no wound, bruise or swelling is missed.
- The back and spine are examined with the patient “log-rolled”, looking specifically for localized tenderness, swelling, bruising or a “step”.
- The perineum is examined and a rectal examination is performed to evaluate for sphincter tone, presence of blood, rectal perforation, or high riding prostate, this is particularly critical in patients with suspected spinal cord injury, pelvic fracture, or transpelvic gunshot wounds.
- Vaginal examination with speculum should be performed in women with pelvic fractures to exclude an open fracture.
- In addition to physical examination the following should be done:
 - 1) Vital Signs Monitoring
 - 2) CVP Monitoring
 - 3) ECG Monitoring
 - 4) Nasogastric Tube Placement
 - Contraindicated in complex maxillofacial injury and should be passed orally
 - It evaluate the stomach content for blood which may suggest gastro- duodenal injury.
 - If it passed to the chest it may suggest diaphragmatic injury.

5) Foley Catheter Placement

- To monitor the urine output-Foley Catheter placement should be deferred after urological evaluation in patients with signs of urethral injury (Blood at the meatus, perineal or scrotal hematoma, or a high riding prostate).

6) Repeat FAST as needed

7) Laboratory Measurement

8) Radiographs

- Selective radiography and laboratory tests are done early after the primary survey.
- For patients with severe blunt trauma the following radiograph should be done:
 - 1) Lateral Cervical Spine X-Ray
 - 2) Chest X-Ray
 - 3) Pelvis X-Ray
- For patients with truncal gunshots wound, anteriorposterior and lateral radiographs of the chest and abdomen should be done with marking the entrance and exit sites with metallic clips or staples.
- In critically injured patient blood sample for :
 - 1) Type and Cross- Matching.
 - 2) Complete Blood Count
 - 3) Blood Chemistry
 - 4) Coagulation Studies
 - 5) Lactate Level
 - 6) Arterial Blood Gas Analysis

- Nasogastric is contraindicated if the patient have maxillofacial injury because it will go to the brain
- Foley catheter is contraindicated in urethral injury