ATLS (Advanced Trauma Life Support) Shock and Trauma Lecture

General Principles:

- The concept:

Three underlying concepts of trauma management:

1. Treat the greatest threat to life first
2. The lack of a definite diagnosis should never impede the application of an indicated treatment
3. A detailed history is not essential to begin the evaluation of an acutely injured patient

- Specific principles govern the management of trauma patients in ED:

1. Organized team approach
2. Priorities
3. Rule out the most serious injury
4. Treatment before diagnosis
5. Thorough examination
6. Frequent reassessment
7. Monitoring

- In-hospital clinical process:
  - Systemic, organized approach to seriously injured patients is mandatory.

✧ Preparation
✧ Triage
✧ Primary survey (ABCDEs)
Resuscitation
Adjuncts to primary survey & resuscitation
✧ Secondary survey (Head to toe Evaluation)
Adjuncts to secondary survey
✧ Continued post resuscitation monitoring and reevaluation
✧ Definitive care

  - The primary and secondary surveys should be repeated frequently
  - In the actual clinical situation, many of these activities occur in parallel or simultaneously.

- **Organized Team Approach:**
  - ✧ Trauma Team Leader : Coordinate, control the resuscitation
    Assessing the patient, ordering needed procedures/ studies

Monitoring the patient's progress.

- ✧ Monitoring procedures by other physician team members.
- ✧ Nurses

- ➢ **Priorities In Management and Resuscitation**
  - ✧ Immediate / potential threats to life
  - ✧ 1. High-priority areas
    Airway/ breathing
    Shock/ external hemorrhage
    Impending cerebral hemorrhage
    Cervical spine

    2. Low-priority areas
    Neurologic
    Abdominal
    Cardiac
    Musculoskeletal
    Soft tissue injury

- ➢ **Rule out the Most Serious Injury**
  - ✧ Expect the worst possible injury
  - ✧ Mechanism of injury is important to predict injuries

- ➢ **Treatment Before Diagnosis**
  - ✧ Based on initial brief assessment
  - ✧ The more unstable the patient, the more it is essential to treat a life-threatening diagnosis before it is confirmed by investigative modalities (clinical diagnosis > confirmed diagnosis)

- ➢ **Thorough Examination**
  - ✧ When time and the patient's stability permits.
  - ✧ Unconscious/ alcohol intoxicated patients

- ➢ **Frequent Reassessment**
  - ✧ Dynamic process
  - ✧ Some injuries take time to manifest
  - ✧ Any sudden worsening in the physiologic status of the patients mandates a return to the "ABCDEs"

- **Monitoring**
  - Vital signs
  - Pulse oximetry
  - Glucocheck
  - In/out (fluids/urine output)
  - Lab: ABG, Lactate, CBC
  - CVP, Arterial line

In-hospital Trauma Management

- **PREPARATION**
  - Resuscitation area
  - Proper airway equipment
  - Warmed IV crystalline solutions
  - Monitoring capabilities
  - Summon extra medical assistance e.g. Trauma Code
  - Prompt response by lab and radiology personnel
  - Transfer route
  - Periodic review
  - Standard precautions

- **TRIAGE**
  - Based on the ABCDE priority

- **PRIMARY SURVEY**
  - **A**irway with Cervical spine protection
  - **B**reathing and ventilation
  - **C**irculation with hemorrhage control
  - **D**isability: Neurologic status
  - **E**xposure/ **E**nvironmental control

Airway Maintenance with Cervical Spine Protection

- **Q : What are the problems that lead to airway compromise ?**
- **Q : What are the indications for definite airway ?**

Indications for a Definite Airway (intubation)

Need for Airway Protection	Need for Ventilation
Unconscious GCS ≤ 8	Apnea Neuromuscular paralysis Unconscious
Severe maxillofacial fractures	Inadequate respiratory effort Tachypnea Hypoxia Hypercarbia Cyanosis
Risk for aspiration Bleeding Vomiting	Severe closed head injury with need for hyperventilation
Risk for obstruction	

- **Assessment:**
  - Ascertain patency
  - Rapidly assess for airway obstruction
  - Foreign bodies, facial / mandibular / tracheal / laryngeal fractures.
- **Management:**
  - Chin lift / jaw thrust maneuver (NO HEAD TILT!!!)
  - Clear the airway of FB
  - Insert an oro-tracheal / nasopharyngeal airway
  - Establish a definitive airway
    1. Oro-tracheal / naso-tracheal intubation (not to be used if ? basal skull fracture)
    2. Surgical cricothyroidotomy
  - Jet insufflation
- **Maintain the cervical spine** in a neutral position with manual immobilization as necessary when establishing an airway
- **Immobilization of the c-spine** with appropriate devices after establishing an airway.
- **Important Notes:**
  - Normal examination does not exclude a cervical spine injury
  - Assume a cervical spine injury in any patient with multisystem trauma, especially with an altered level of consciousness or a blunt injury above the clavicle
- **Pitfalls:**
  - Equipment failure
  - Failure to intubate = difficult airway → surgical airway
  - Unknown laryngeal fracture / incomplete airway transection.

Breathing and Ventilation

✧ **Q : What are the injuries that may acutely impair ventilation in the primary survey?**

Injuries that should be identified in the Primary survey:

1. Tension pneumothorax
2. Flail chest with pulmonary contusion
3. Massive hemothorax / Open pneumothorax
4. Cardiac tamponade

✧ **Assessment :**

Inspection / palpation /Auscultation / Percussion

- Expose the neck and chest
- Respiratory rate and depth
- Inspect and palpate: tracheal deviation ? symmetrical chest movement ? use of accessory muscles ? signs of injury ? subcutaneous emphysema ? crepitus ?
- Cyanosis ?
- Auscultate the chest
- Percussion : dullness? Hyper resonance?

✧ **Management :**

- Administer high concentrations of oxygen
- Ventilate with BVM (Bag-Valve-Mask)
- Alleviate tension pneumothorax : needle decompression / Place chest tube
- Indication for thoracotomy
- Seal an open pneumothorax
- Pulse oximeter

✧ **Important Notes :**

- Always check for right main bronchus intubation, chest X-rays should be performed

✧ **Pitfalls :**

- If the ventilation problem is produced by a pneumothorax, intubation could lead to deterioration and development of tension pneumothorax

Circulation with Hemorrhage Control

✧ **Q : What are the elements that provide the information about the hemodynamic status of the injured patients.**

These elements are:

1. Level of consciousness
2. Skin color
3. Pulse (quality, rate, regularity)

✧ Presence of a Carotid pulse SBP≥ 60 mmHg

Femoral pulse SBP≥ 70 mmHg

Radial pulse SBP≥ 80 mmHg

Dorsalis pulse SBP≥ 90 mmHg

✧ **External bleeding** is identified and controlled in the primary survey.

✧ **Operative intervention** for internal bleeding control and hypotensive patients.

✧ **Q : What are the injuries that may acutely impair circulation status ?**

These injuries are :

1. External/internal bleeding with hypovolemic shock
2. Massive hemothorax / Tension pneumothorax
3. Cardiac tamponade

✧ **Assessment:**

- Identify source of external hemorrhage
- Identify potential source(s) of internal hemorrhage /
- Pulse / skin color, capillary refill / Blood pressure

✧ **Management:**

- Apply direct pressure to external bleeding site.
- Internal hemorrhage ? Need for surgical intervention ?
- Establish large IV access (best 14G in both antecubital veins) / central line / IO
- Fluid resuscitation (2L initially) / blood replacement (after bolus fluids if no response)

✧ **<u>Important Notes</u>** :

- Hypotension following injury must be considered to be hypovolemic in origin until proved otherwise.

✧ **<u>Pitfalls</u> :**

- The elderly, children, athletes and others with chronic medical conditions do not respond to volume loss in similar manner

Disability

- **Assessment** :
  - **Level of consciousness** in the AVPU scale
    - **A**lert
    - **V**oice illicit response
    - **P**ain illicit response
    - **U**nresponsive
  - GCS
  - Pupils size, equality and reaction
- **Management** :
  - Intubation and allow mild hyperventilation
  - Administer IV mannitol (1.5-2.0g/kg)
  - Arrange for brain CT
- **Important notes :**
  - CT is contraindicated when the patient is hemodynamically unstable
  - A decrease in the level of consciousness maybe due to:
    a. Decreased cerebral oxygenation
    b. Decreased cerebral perfusion
    c. Direct cerebral injury
    d. Alcohol / drugs

    Always rule out hypoxemia and hypovolemia first.
  - Reevaluation
- **Pitfalls :**
  - Lucid interval of acute EDH, reevaluation is important.

Exposure / Environment Control

- Completely undressed the patient.
- Prevent hypothermia (warmed blankets, fluids & bear huggers)
- Injured patients may arrive in hypothermic condition
- Log-roll

- **RESUSCITATION**
  - ✧ To reverse immediately life-threatening situations and maximize patient survival

TREATMENT PRIORITY	NECCESSARY PROCEDURE
Airway	1. Jaw thrust/chin lift/ 2. Suction 3. Intubation 4. Cricothyroidotomy (with protection of C-spine)
Breathing/Ventilation/oxygenation	1. Chest needle decompression 2. Tube thorocostomy 3. Supplemental oxygen 4. Seal an open pneumothorax
Circulation/hemorrhage control	1. IV line/ central line 2. IO line/ Venous cut down 3. Fluid resuscitation/Blood transfusion 4. Thorocostomy for massive hemothorax 5. Pericardiocentesis for cardiac tamponade
Disability	1. Burr holes for trans-tentorial herniation (only by neurosurgeon) 2. IV mannitol
Exposure/**E**nvironment	1. Warmed crystalloid fluid 2. Warmed blankets 3. Temperature

- **ADJUNCTS TO PRIMARY SURVEY AND RESUSCITATION**
  - ✧ Electrocardiographic Monitoring.
  - ✧ Urinary Catheter
  - ✧ Gastric Catheter
  - ✧ Monitoring
    - ABG
    - Pulse oximeter
    - Blood pressure
  - ✧ X-rays
    - AP CXR
    - AP pelvis
    - C-spine
  - ✧ Diagnostic peritoneal lavage
  - ✧ Abdominal ultrasonography (FAST)

- **CONSIDER NEED FOR PATIENT TRANSFER**

- **SECONDARY SURVEY**
  - The secondary survey does not begin until:
    - the primary survey is completed,
    - resuscitation efforts are well established,
    - The patient is demonstrating normalization of vital functions.
  - Head-to-toe evaluation
  - Complete history and Physical Examination
  - Reassessment of all vital signs.
  - Complete Neurological Examination.
  - Indicated x-rays are obtained.
  - Special procedures
  - Tubes and fingers in every orifice

  - **History:**

    AMPLE history

    Allergies

    Medications currently used

    Past illness/ **P**regnancy

    Last meal

    Events/ **E**nvironment related to the injury

    Mechanism/blunt/penetrating/burns/cold/hazardous environment
  - **Pitfalls:**
    - Facial edema in patients with massive facial injury or patients in coma can preclude a complete eye examination.
    - Blunt injury to the neck may produce injuries in which clinical signs and symptoms develop late.(e.g. Injury to the intima of the carotid artery.)
    - The identification of cervical nerve root/brachial plexus injury may not be possible in the comatose patient.
    - Decubitus ulcer from immobilization on a rigid spine board/cervical collar.
    - Children often sustain significant injury to the intrathoracic structures without evidence of thoracic skeletal trauma.
    - A normal initial examination of the abdomen does not exclude a significant intraabdominal injury.
    - Patients with impaired sensorium secondary to alcohol/drugs are at risk.
    - Injury to the retroperitoneal organs may be difficult to identify.
    - Female urethral injury is difficult to detect.
    - Blood loss from pelvic fractures can be difficult to control and fatal hemorrhage may result (use pelvic binder to temporarily control the hemorrhage or embolization)
    - Fractures involving the bones of extremities are often not diagnosed.
    - Most of the diagnostic and therapeutic maneuvers increase ICP.

- **ADJUNCTS TO THE SECONDARY SURVEY**

  These specialized tests *should not be performed until the patient's hemodynamic status has been normalized* and the patient has been carefully examined.

  - ✧ Additional x-rays of the spine and extremities
  - ✧ CT of the head, chest, abdomen, and spine
  - ✧ Contrast urography
  - ✧ Angiography
  - ✧ Bronchoscopy
  - ✧ Esophagoscopy
  - ✧ Others

- **REEVALUATION**
  - ✧ The trauma patient must be reevaluated constantly to assure that new findings are not overlooked.
  - ✧ A high index of suspicion
  - ✧ Continuous monitoring of vital signs and urinary output is essential.
  - ✧ ABG/cardiac monitoring/ pulse oximetry
  - ✧ Pain relive- IV opiates/anxiolytics.

- **DEFINITIVE CARE**
  - ✧ Transfer to a trauma center or closest appropriate hospital.

➢ TRAUMATIC SHOCK

✧ Recognition of Shock :

- Early: Tachycardia and cutaneous vasoconstriction
- Normal heart rate varies with age, tachycardia is present when
  Infant: >160 BPM
  Preschool age child: >140 BPM
  School age to puberty: >120 BPM
  Adult: >100 BPM
- The elderly patient may not exhibit tachycardia because of the limited cardiac response to catecholamine stimulation / use of medications

✧ Differentiation of shock:

- **Hemorrhagic shock** → hypovolemic shock
- **Non-hemorrhagic shock:**
  a. Cardiogenic shock: Blunt cardiac injury, cardiac tamponade, air embolus, myocardial infarction.
  b. Tension pneumothorax
  c. Neurogenic shock
  d. Septic shock
  e. Spinal shock

✧ The normal blood volume of adult is 7 % of body weight. Whereas that of a child is 8-9% of body weight.

✧ **Estimated Fluid and Blood Losses: (For a 70-kg man)**

	Class I	**Class II**	**Class III**	**Class IV**
Blood Loss (ml)	Up to 750	750-1500	1500-2000	>2000
Blood Loss (% Blood Volume)	Up to 15 %	15-30 %	30-40 %	>40 %
Pulse Rate	<100	>100	>120	>140
Blood Pressure	Normal	Normal	Decreased	Decreased
Pulse Pressure (mmHg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory Rate	14-20	20-30	30-40	> 35
Urine Output (mL/hr)	>30	20-30	5-15	Negligible
CNS/Mental status	Slightly anxious	Mildly anxious	Anxious, Confused	Confused, lethargy
Fluid Repacement (3:1 rule)	Crystalloid	Crystalloid	Crystalloid and blood	Crystalloid and blood

- **Fluid Therapy:**
  - **Fluid bolus:** 1-2 liters for an adult and 20mL/kg for a pediatric patient
  - **3:1 rule**
  - **39 °C** (1 liter fluid, microwave, high power, 2 minutes)

- **Blood Replacement:**
  - PRBC/Whole blood
  - Cross-matched/type-specific/ type O blood (O-ve for female childbearing age the rest O+ve)
  - FFP
  - Platelets
  - Massive Transfusion Protocol 1:1:1 (PRBC:Platelets:FFP)

- CVP monitoring

Thoracic Trauma

- **PATHOPHYSIOLOGY**
  - **1. Hypoxia:** a. Hypovolemia (blood loss); b. Pulmonary ventilation / perfusion mismatch (contusion, hematoma, alveolar collapse); c. Changes in intrathoracic pressure relationships (tension pneumothorax, open pneumothorax)
  - **2. Hypercarbia:** a. Inadequate ventilation due to changes in intrathoracic pressure; b. Depressed level of consciousness
  - **3. Metabolic acidosis:** Hypoperfusion of the tissues (shock)

- **ASSESSMENT & MANAGEMENT:**
  - Must consist of:
    1. Primary survey
    2. Resuscitation of vital functions
    3. Detailed secondary survey
    4. Definitive care

- **PRIMARY SURVEY (Life-threatening injuries)**
  - **Airway:**
    - **Recognition of:** Stridor, change of voice quality, obvious trauma
    - **Major problems:**
      1. Foreign Body obstructions,
      2. Laryngeal injury,
      3. Posterior dislocation / fracture dislocation of the sternoclavicular joint.
    - **Management:** Establishing a patent airway/ ET intubation; closed reduction.

✧ **Breathing:**

- **Recognition of:** Neck vein distention, respiratory effort and quality changes, cyanosis
- **Major problems:**
  1. Tension pneumothorax:
     - Clinical diagnosis
     - Chest pain, air hunger, respiratory distress, tachycardia, hypotension, tracheal deviation, unilateral absence of breath sounds, neck vein distention, cyanosis. (V.S. cardiac tamponade)
     - Hyperresonant percussion.
     - Immediate decompression: Needle decompression/ chest tube.
  2. Open pneumothorax:
     - 2/3 of the diameter of the trachea – impaired effective ventilation
     - Sterile occlusive dressing, taped securely on 3 sides.
     - Chest tube (remote)
  3. Flail chest:
     - ≥ 2 ribs fractured in two or more places.
     - Severe disruption of normal chest wall movement.
     - Paradoxical movement of the chest wall.
     - Crepitus of ribs.
     - The major difficulty is underlying lung injury (pulmonary contusion)
     - Pain.
     - Adequate ventilation, humidified oxygen, fluid resuscitation.
     - The injured lung is sensitive to both underresuscitation of shock and fluid overload.
  4. Massive hemothorax:
     - Compromise respiratory efforts by compression, prevent adequate ventilation.

✧ **Circulation:**

- **Assessment:** Pulse quality, rate and regularity. BP, pulse pressure, observing and palpating the skin for color and temperature. Neck veins.
- **Important notes:** Neck veins may not be distended in the hypovolemic patient with cardiac tamponade, tension pneumothorax, or traumatic diaphragmatic injury.
- **Monitor with:** Cardiac monitor/pulse oximeter.
- **Major problems:**
  1. Massive hemothorax:
     - Rapid accumulation of > 1500 mL o blood in the chest cavity.
     - Hypoxia

- Neck veins may be flat secondary to hypovolemia
- Absence of breath sounds and/or dullness to percussion on one side of the chest
- Management: Restoration of blood volume and decompression of the chest cavity.
- Indication of thoracotomy: a. Immediately 1500 mL of blood evacuated. b. 200mL/hr for 2-4 hrs. c. Patient's physiology status. d. Persistent blood transfusion requirements.

2. Cardiac tamponade:
   - Beck's triad: venous pressure elevation, decline in arterial pressure, muffled heart sounds.
   - Pulsus paradoxicus.
   - Kussmaul's sign.
   - PEA
   - Echocardiogram.
   - Management: Pericardiocentesis.

- **RESUSCITATIVE THORACOTOMY**
  - Left anterior thoracotomy
  - The therapeutic maneuvers that can be effectively accomplished with a resuscitative thoracotomy are:
    - Evacuation of pericardial blood causing tamponade.
    - Direct control of exsanguinating intrathoracic hemorrhage
    - Open cardiac massage
    - Cross cramping of the descending aorta to slow blood loss below the diaphragm and increase perfusion to the brain and heart.

- **SECONDARY SURVEY:**
  - Further in-depth Physical Examination, Chest x-rays (PA), ABG, Monitoring.
  - Eight lethal injuries are considered:
    1. Simple pneumothorax
    2. Hemothorax
    3. Pulmonary contusion
    4. Tracheobronchial three injuries
    5. Blunt cardiac injuries
    6. Traumatic aortic disruption
    7. Traumatic diaphragmatic injury
    8. Mediastinal traversing wounds.

Simple Pneumothorax

- ✧ Breath sounds are decreased on the affected side. Percussion demonstrates hyper-resonance.
- ✧ CXR
- ✧ Chest tube insertion F/U CXR..
- ✧ Never use general anesthesia or positive pressure ventilation to patient who sustains traumatic pneumothorax until a chest tube is inserted.

Hemothorax

- ✧ Lung laceration/ intercostal vessel laceration/ Internal mammary artery Laceration.
- ✧ Chest tube
- ✧ Guide line of surgical exploration.

Pulmonary Contusion

- ✧ Respiratory failure.
- ✧ Patients with significant hypoxia should be intubated.
- ✧ Monitoring.

Tracheobronchial Tree Injury

- ✧ Hemoptysis, subcutaneous emphysema, tension pneumothorax with a mediastinal shift.
- ✧ Pneumothorax associated with a persistent large air leak after tube thoracostomy (large leak needing >2 chest tubes)
- ✧ Bronchoscopy
- ✧ Opposite main stem bronchial intubation.
- ✧ Intubation may be difficult operative intervention

Blunt Cardiac Injury

- ✧ Result in: Myocardial muscle contusion, cardiac chamber rupture, valvular disruption.
- ✧ Hypotension, ECG abnormalities, wall-motion abnormality
- ✧ ECG: PVCs, sinus tachycardia, Atrial fibrillation, RBBB, ST segment changes.
- ✧ Elevated CVP.
- ✧ Monitor.

Traumatic Aortic Disruption

- ✧ High index of suspicion
- ✧ Adjunctive radiological signs:
  - Widened mediastinum
  - Obliteration of the aortic knob
  - Deviation of the trachea to the right
  - Obliteration of the space between the pulmonary artery and the aorta

- Depression of the left main bronchus
- Deviation of the esophagus to the right
- Widened paratracheal stripe
- Widened paraspinal interfaces
- Presence of a pleural or apical cap
- Left hemothorax
- Fractures of the first or second rib or scapula.

✧ Angiography is the gold standard.

✧ OR critical.

Traumatic Diaphragmatic Injury

✧ More commonly diagnosed on the left side

✧ NG tube

✧ Upper GI series x-rays

✧ Direct repair.

Mediastinal Traversing Wounds

✧ Surgical consultation is mandatory.

✧ Hemodynamic abnormality: thoracic hemorrhage, tension pneumothorax, pericardial tamponade.

✧ Mediastinal emphysema: esophageal or tracheobronchial injury.

✧ Mediastinal hematoma: great vessel injury.

✧ Spinal cord.

✧ For stable patient.

- Angiography
- Water-soluble contrast esophagography
- Bronchoscopy
- CT
- Ultrasonography.

Others

✧ **Subcutaneous emphysema**

✧ **Traumatic Asphyxia**

- Compression of the SVC.
- Upper torso, facial and arm plethora.

✧ **Rib, Sternum, and Scapular fractures.**

✧ **Blunt esophageal Rupture**

Abdominal Trauma

- **Mechanism of Injury:**
  - **Blunt Trauma:**
    - Spleen, liver, retroperitoneal hematoma
  - **Penetrating Trauma:**
    - Stab: Liver, small bowel, diaphragm, colon
    - Gunshot: small bowel, colon, liver, abdominal vascular structures.

- **Assessment:**
  - **Hitory.**
  - **Physical Exam:**
    - **Inspection**
    - **Auscultation:**
      1. Bowel sounds
    - **Percussion**
      1. signs of peritonitis
      2. Tympanic/ diffuse dullness
    - **Palpation**
      1. Involuntary muscle guarding
    - **Evaluation of penetrating wounds:**
      Determine the depth
    - **Assessing pelvic stability:**
      Manual compression
    - **Penile, perineal and rectal examination:**
      1. Presence of urethral tear.
      2. Rectal exam: Blunt (sphincter tone, position of the prostate, pelvic bone fractures), Penetration (sphincter tone, gross blood from a perforation)
    - **Vaginal examination**
    - **Gluteal examination**

  - **Intubation:**
    - **Gastric tube:**
      - Relieve acute gastric dilatation.
      - Presence of blood
    - **Urinary catheter:**
      - Relieve urine retention
      - Monitoring urine output.
      - **Caution:** The inability to void, unstable pelvic fracture, blood in the meatus, a scrotal hematoma, perineal ecchymosis, high-riding prostate.

- **X-rays studies:**
  - **Blunt Trauma:**
    - Hemodynamically stable:
      Supine/upright abdominal x-rays
      Left lateral decubitus film
  - **Penetrating Trauma:**
    - Hemodynamically stable:
      Upright CXR.

- **Contrast Studies:**
  - **Urethrography**
  - **Cystogaphy**
  - **IV Pyelogram**
  - **GI series**
- **Special diagnostic studies in blunt trauma:**
  - **DPL**
  - **Ultrasonography E-FAST (Extended Focused Assessment by Sonography in Trauma)**
  - **Computed tomography**
- **Special diagnostic studies in penetrating trauma:**
  - **Lower chest wounds**
  - **Anterior abdominal**
  - **Flank/back**

- **Indications For Laparotomy**
  - **Based on abdominal evaluation**
    - **Blunt:** Positive DPL/ ultrasound
    - **Blunt:** Recurrent hypotension despite adequate resuscitation
    - **Peritonitis**
    - **Penetrating:** Hypotension
    - **Penetrating:** Bleeding from the stomach, rectum, GU tract.
    - **Gunshot wounds:** Traversing the peritoneal cavity
    - **Evisceration**
  - **Based on x-rays studies:**
    - Free air, retroperitoneal free air, rupture of the hemidiaphragm
    - CT demonstrates ruptured organ/ GI tract.

- **Special Problems**
  - **Blunt Trauma:**
    - **Diaphragm**
    - **Duodenum**
    - **Pancreas**
    - **Genitourinary**
    - **Small bowel**
  - **Pelvic Fractures:**
    - **Assessment:**
      - The flank, scrotum and perianal area should be inspected
      - Blood at the urethral meatus, swelling/bruising/laceration in the peritoneum, vagina, rectum, or buttock open pelvic facture
      - Palpation of a high-riding prostate gland.
      - Manual manipulation of the pelvis should be performed only once.