

# TRAUMA OVERVIEW

**Rami Addasi, MD, MRCS**

General Surgery and Surgical Oncology Consultant

Assistant Professor Faculty of Medicine

The University of Jordan

# EPIDEMIOLOGY

- Trauma is a leading cause of mortality globally
- Injuries from accidental trauma worldwide leave over 45 million people each year with moderate to severe disability.
- Half of traumatic deaths result from central nervous system (CNS) injury
- Patients with traumatic injuries have a significantly lower likelihood of mortality or morbidity (10.4 versus 13.8 percent ) when treated at a designated trauma center

# EPIDEMIOLOGY

- Older age, obesity, and major comorbidities are associated with worse outcomes.
- The most common preventable causes of mortality from trauma are hemorrhage, multiple organ dysfunction syndrome, and cardiopulmonary arrest.
- The most common preventable causes of morbidity are unintended extubation, technical surgical failures, missed injuries, and intravascular catheter-related complications.

# EPIDEMIOLOGY

- Relatively few patients die after the first 24 hours following injury.
- The majority of deaths occur either at the scene or within the first four hours after the patient reaches a trauma center.
- The "golden hour" concept, which emphasized the increased risk of death and the need for rapid intervention during the first hour of care following major trauma, was described in early trauma studies and has been promulgated in textbooks and instructional courses.

## Blunt trauma mechanisms and associated injuries

Mechanism of injury	Additional considerations	Potential associated injuries
<b>Motor vehicle collisions</b>		
Head-on collision		Facial injuries Lower extremity injuries Aortic injuries
Rear-end collision		Hyperextension injuries of cervical spine Cervical spine fractures Central cord syndrome
Lateral (T-bone) collision		Thoracic injuries Abdominal injuries: spleen, liver Pelvic injuries Clavicle, humerus, rib fractures
Rollover	Greater chance of ejection Significant mechanism of injury	Crush injuries Compression fractures of spine
Ejected from vehicle	Likely unrestrained Significant mortality	Spinal injuries
Windshield damage	Likely unrestrained	Closed head injuries, coup and countercoup injuries Facial fractures Skull fractures Cervical spine fractures

Steering wheel damage	Likely unrestrained	Thoracic injuries <ul style="list-style-type: none"> <li>▪ Sternal and rib fractures, flail chest</li> <li>▪ Cardiac contusion</li> <li>▪ Aortic injuries</li> <li>▪ Hemo/pneumothoraces</li> </ul>
Dashboard involvement/damage		Pelvic and acetabular injuries Dislocated hip
Restraint/seat belt use		
Proper three-point restraint	Decreased morbidity	Sternal and rib fractures, pulmonary contusions
Lap belt only		Chance fractures, abdominal injuries, head and facial injuries/fractures
Shoulder belt only		Cervical spine injuries/fractures, "submarine" out of restraint devices (possible ejection)
Airbag deployment	Front-end collisions Less severe head/upper torso injuries Not effective for lateral impacts More severe injuries in children (improper front seat placement)	Upper extremity soft tissue injuries/fractures Lower extremity injuries/fractures

<b>Pedestrian versus automobile</b>		
Low speed (braking automobile)		Tibia and fibula fractures, knee injuries
High speed		Waddle's triad - tibia/fibula or femur fractures, truncal injuries, craniofacial injuries "Thrown" pedestrians at risk for multisystem injuries
<b>Bicycle</b>		
Automobile related		Closed head injuries "Handlebar" injuries <ul style="list-style-type: none"> <li>▪ Spleen/liver lacerations</li> <li>▪ Additional intra-abdominal injuries</li> <li>▪ Consider penetrating injuries</li> </ul>
Nonautomobile related		Extremity injuries "Handlebar" injuries
<b>Falls</b>	LD <sub>50</sub> 36 - 60 feet (11 - 18 meters)	
Vertical impact		Calcaneal and lower extremity fractures Pelvic fractures Closed head injuries Cervical spine fractures Renal and renal vascular injuries
Horizontal impact		Craniofacial fractures Hand and wrist fractures Abdominal and thoracic visceral injuries Aortic injuries

# PREPARATION

- **Pre-arrival preparation**
- Emergency medical services (EMS) should notify the receiving hospital that a trauma patient is en route.
- **The information provided by EMS includes:**
  - Patient age and sex
  - Mechanism of injury
  - Vital signs
  - Apparent injuries

# PREPARATION

- Universal precautions against blood and fluid borne diseases.
- Gloves
- Gowns
- Masks
- Eye protection

# PRIMARY EVALUATION AND MANAGEMENT

- **Airway** assessment and protection (maintain cervical spine stabilization when appropriate)
- **Breathing** and ventilation assessment (maintain adequate oxygenation)
- **Circulation** assessment (control hemorrhage and maintain adequate end-organ perfusion)
- **Disability** assessment (perform basic neurologic evaluation)
- **Exposure**, with environmental control (undress patient and search everywhere for possible injury, while preventing hypothermia)

# Airway

- Airway obstruction is a major cause of preventable death among trauma patients
- Airway evaluation and management remain the critical first steps in the treatment of any severely injured patient

# **Airway assessment in a conscious patient**

- **Begin by asking the patient a simple question**
- **Observe the face, neck, and chest for signs of respiratory difficulty**
  - including tachypnea
  - accessory or asymmetric muscle use
  - abnormal patterns of respiration
  - stridor

# Airway assessment in a conscious patient

- **Inspect the oropharyngeal cavity**
  - Disruption
  - Injuries to the teeth or tongue
  - Blood
  - Vomitus
  - Pooling secretions
- **Inspect and palpate the anterior neck**
  - Lacerations
  - Hemorrhage
  - Crepitus
  - Swelling
  - or other signs of injury.

# In the unconscious patient

- The airway must be protected immediately
  - Foreign body
  - Vomitus
  - Displaced tongue

# Securing Airway

- Interventions may include maneuvers to open and maintain the airway.
- **Manual in-line stabilization of the cervical spine should be performed simultaneously.**
- **Airway adjuncts**
  - Oropharyngeal
  - Nasopharyngeal airways
  - Suctioning
  - Bag-valve mask device and high-flow oxygen.

# Intubation

- Many trauma patients require intubation for immediate airway protection
- Improves oxygenation, thereby helping to meet increased physiologic demands
- Allows for testing and procedures to be performed more easily and with less patient discomfort.

# Breathing and ventilation

- Assess the adequacy of oxygenation and ventilation
- Chest trauma accounts for 20 to 25 percent of trauma-related deaths
- Tension pneumothorax
- Massive hemothorax
- Cardiac tamponade

# Circulation

- Palpating central pulses
- It is important to obtain manual blood pressure measurements in trauma patients with systolic blood pressures below 90 mmHg
- Two large-bore (16 gauge or larger) intravenous (IV) catheters are placed, most often in the antecubital fossa of each arm, and blood is drawn for testing, particularly for blood typing and crossmatch
- Life-threatening hemorrhage must be controlled
- Initial evaluation and management of shock in adult trauma

# Control of the source of bleeding

- Direct pressure is the primary and preferred means for controlling external hemorrhage.
- While clamping bleeding vessels under direct visualization is acceptable when necessary
- Blind clamping should **NOT** be performed.
- Scalp lacerations can bleed profusely and are often overlooked if significant thoracic or abdominal injuries are present. Scalp lacerations can be managed with clips or by closing the wound with running stitches
- Use of a tourniquet is acceptable to stop hemorrhage in cases of amputation or severe extremity injury when other measures have not successfully controlled bleeding.
- Tourniquets must be released periodically (eg, every 45 minutes) to avoid prolonged ischemia and possible tissue loss.

## Differential diagnosis of shock in trauma

### **I. Low CVP**

#### A. Hypovolemia

##### 1. Hemorrhage

###### a. External (compressible)

i. Lacerations

ii. Contusions

iii. Fractures (partly compressible)

###### b. Internal (noncompressible)

i. Intrathoracic

ii. Intraabdominal

iii. Retroperitoneal (partly compressible)

###### c. Fractures (partly compressible)

##### 2. Third spacing (eg, burns)

#### B. Neurogenic (high cervical cord injury)

### **II. High CVP**

#### A. Pericardial tamponade

#### B. Tension pneumothorax

#### C. Myocardial contusion

### **III. Other diagnoses to consider**

#### A. Pharmacologic or toxicologic agents

#### B. Myocardial infarction (severe)

#### C. Diaphragmatic rupture with herniation

#### D. Fat or air embolism

# Disability and neurologic evaluation

- Focused neurologic examination
- Patient's level of consciousness using the Glasgow Coma Scale (GCS) score
- Maintain spinal immobilization for all patients with the potential for spinal cord injury

## Glasgow Coma Scale (GCS)

	Score
<b>Eye opening</b>	
Spontaneous	4
Response to verbal command	3
Response to pain	2
No eye opening	1
<b>Best verbal response</b>	
Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1
<b>Best motor response</b>	
Obeys commands	6
Localizing response to pain	5
Withdrawal response to pain	4
Flexion to pain	3
Extension to pain	2
No motor response	1
<b>Total</b>	

# Exposure and environmental control

- Be certain that the trauma patient is completely undressed and that his or her entire body is examined for signs of injury during the primary survey
- Hypothermia should be prevented if possible and treated immediately once identified
- Make liberal use of warm blankets and active external warming devices, warm IV fluids and blood

# Diagnostic studies

- **Portable radiographs**
- **Ultrasound (FAST exam)**
- **Emergency computed tomography (CT)**
- **Diagnostic peritoneal tap or lavage**
- **Electrocardiogram**
- **Laboratory tests**

# SECONDARY EVALUATION

- Definitive management of a hemodynamically unstable trauma patient must not be delayed to perform a more detailed secondary evaluation. Such patients are taken directly to the operating room (OR) or angiography suite, or transferred to a major trauma center.
- A careful, head-to-toe secondary assessment (ie, secondary survey) is performed in all trauma patients determined to be stable upon completion of the primary survey

# SECONDARY EVALUATION

- The secondary survey includes a
- Detailed history
- Thorough but efficient physical examination
- Targeted diagnostic studies

# History

- Mechanism-related information to be obtained from prehospital personnel includes
  - **Blunt trauma**
    - Seat belt use
    - Steering wheel deformation
    - Airbag deployment
    - Direction of impact
    - Damage to the automobile (especially intrusion into the passenger compartment)
    - Distance ejected from the vehicle
    - Height of fall
    - Body part landed upon

# History

- **Penetrating trauma**
- Type of firearm
- Distance from firearm
- Number of gunshots heard
- Type of blade
- Length of blade

# Physical examination

- **The goal of the secondary survey is to identify injuries**
- Head and face
- Neck
- Chest
- Abdomen
- Rectum and genitourinary
- Musculoskeletal
- Neurologic
- Skin