

# Secondary Survey

Ahmad ghoochani.MD  
Emergency Medicine Specialist  
Fellowship of Clinical Toxicology

- ▶ The secondary survey does not begin until the primary survey (ABCDE) is completed, resuscitative efforts are under way, and improvement of the patient's vital functions has been demonstrated.

- ▶ When additional personnel are available, part of the secondary survey may be conducted while the other personnel attend to the primary survey.
  - ▶ This method must in no way interfere with the performance of the primary survey, which is the highest priority.
- 

- ▶ The secondary survey is a head-to-toe evaluation of the trauma patient—that is, a complete history and physical examination, including reassessment of all vital signs.

- ▶ Each region of the body is completely examined.
  - ▶ The potential for missing an injury or failing to appreciate the significance of an injury is great, especially in an unresponsive or unstable patient.
- 

# History

- ▶ Every complete medical assessment includes a history of the mechanism of injury.
  - ▶ Often, such a history cannot be obtained from a patient who has sustained
  - ▶ trauma; therefore, prehospital personnel and family must furnish this information.
- 

# AMPLE

- ▶ •• Allergies
  - ▶ •• Medications currently used
  - ▶ •• Past illnesses/Pregnancy
  - ▶ •• Last meal
  - ▶ •• Events/Environment related to the injury
- 

- ▶ The patient's condition is greatly influenced by the mechanism of injury. Knowledge of the mechanism of injury can enhance understanding of the patient's
- ▶ physiologic state and provide clues to anticipated injuries.

## MECHANISM OF INJURY

## SUSPECTED INJURY PATTERNS

### BLUNT IN

**Frontal impact,  
automobile collision**

- Bent steering wheel
- Knee imprint,  
dashboard
- Bull's-eye fracture,  
windscreen

- Cervical spine fracture
- Anterior flail chest
- Myocardial contusion
- Pneumothorax
- Traumatic aortic disruption
- Fractured spleen or liver
- Posterior fracture/dislocation  
of hip and/or knee
- Head injury
- Facial fractures

**Side impact,  
automobile collision**

- Contralateral neck sprain
- Head injury
- Cervical spine fracture
- Lateral flail chest
- Pneumothorax
- Traumatic aortic disruption
- Diaphragmatic rupture
- Fractured spleen/liver and/or kidney, depending on side of impact
- Fractured pelvis or acetabulum

MECHANISM OF INJURY	SUSPECTED INJURY PATTERNS
<b>INJURY</b>	
<p><b>Rear impact, automobile collision</b></p>	<ul style="list-style-type: none"> <li>• Cervical spine injury</li> <li>• Head injury</li> <li>• Soft tissue injury to neck</li> </ul>
<p><b>Ejection from vehicle</b></p>	<ul style="list-style-type: none"> <li>• Ejection from the vehicle precludes meaningful prediction of injury patterns, but places patient at greater risk for virtually all injury mechanisms.</li> </ul>
<p><b>Motor vehicle impact with pedestrian</b></p>	<ul style="list-style-type: none"> <li>• Head injury</li> <li>• Traumatic aortic disruption</li> <li>• Abdominal visceral injuries</li> <li>• Fractured lower extremities/pelvis</li> </ul>
<p><b>Fall from height</b></p>	<ul style="list-style-type: none"> <li>• Head injury</li> <li>• Axial spine injury</li> <li>• Abdominal visceral injuries</li> <li>• Fractured pelvis or acetabulum</li> <li>• Bilateral lower extremity fractures (including calcaneal fractures)</li> </ul>

# PENETRATING INJURY

## Stab wounds

- Anterior chest
  - Cardiac tamponade if within "box"
  - Hemothorax
  - Pneumothorax
  - Hemopneumothorax
- Left thoraco-abdominal
  - Left diaphragm injury/spleen injury/hemopneumothorax
- Abdomen
  - Abdominal visceral injury possible if peritoneal penetration

# THERMAL INJURY

## Thermal burns

- Circumferential eschar on extremity or chest
- Occult trauma (mechanism of burn/means of escape)

## Electrical burns

- Cardiac arrhythmias
- Myonecrosis/compartment syndrome

## Inhalational burns

- Carbon monoxide poisoning
- Upper airway swelling
- Pulmonary edema

# Blunt trauma

- ▶ Blunt trauma often results from automobile collisions, falls, and other injuries related to transportation, recreation, and occupations. It can also result from interpersonal violence.

# automobile collisions

- ▶ seat-belt use,
  - ▶ steering wheel deformation,
  - ▶ presence and activation of air-bag devices,
  - ▶ direction of impact,
  - ▶ damage to the automobile in terms of major deformation or intrusion into the passenger compartment,
  - ▶ patient position in the vehicle.
- 

- ▶ Ejection from the vehicle greatly increases
- ▶ the possibility of major injury.

# Penetrating Trauma

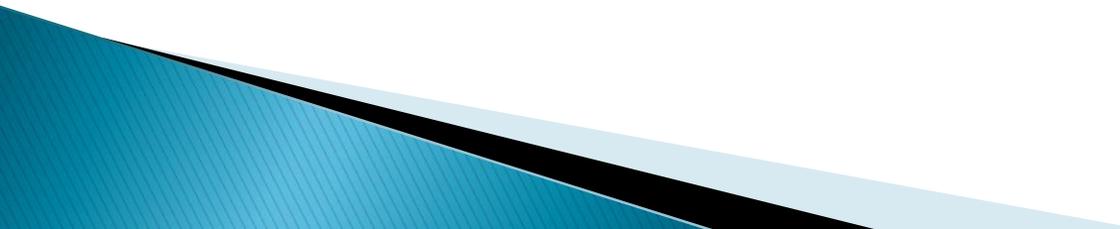
- ▶ The body region that was injured,
  - ▶ organs in the path of the penetrating object, and velocity of the missile.
  - ▶ Therefore, in gunshot victims,
  - ▶ the velocity, caliber,
  - ▶ presumed path of the bullet,
  - ▶ and distance from the weapon to the wound can provide important clues regarding the extent of injury.
- 

# Thermal Injury

- ▶ Burns are a significant type of trauma that can occur alone or in conjunction with blunt and/or penetrating trauma
- ▶ resulting from, for example, a burning automobile, explosion, falling debris, or a patient's attempt to escape a fire.

- ▶ Inhalation injury and carbon monoxide poisoning often complicate burn injuries. Information regarding the circumstances of the burn injury can increase the index of suspicion for inhalation injury or toxic exposure from combustion of plastics and chemicals.

# Hazardous Environment

- ▶ A history of exposure to chemicals, toxins, and radiation is important to obtain for two main reasons:
  - ▶ These agents can produce a variety of pulmonary, cardiac, and internal organ dysfunctions in injured patients,
  - ▶ They can present a hazard to healthcare providers.
- 

- ▶ the clinician's only means of preparation
  - ▶ for treating a patient with a history of exposure to a hazardous environment is to understand the general principles of management of such conditions and
  - ▶ establish immediate contact with a Regional Poison Control Center.
- 

# Physical Examination

- ▶ During the secondary survey, physical examination follows the sequence of head, maxillofacial structures, cervical spine and neck, chest, abdomen and pelvis, perineum/rectum/vagina, musculoskeletal system, and neurological system.

# Head

- ▶ The secondary survey begins with evaluating the head to identify all related neurologic injuries and any other
- ▶ significant injuries.
- ▶ The entire scalp and head should
- ▶ be examined for lacerations, contusions, and evidence of fractures.

- ▶ Visual acuity
  - ▶ Pupillary size
  - ▶ Hemorrhage of the conjunctiva and/or fundi
  - ▶ Penetrating injury
  - ▶ Contact lenses (remove before edema occurs)
  - ▶ Dislocation of the lens
  - ▶ Ocular entrapment
- 

- ▶ Clinicians can perform a quick visual acuity examination of both eyes by asking the patient to read printed material, such as a handheld Snellen chart or words on a piece of equipment.

- ▶ Ocular mobility should be evaluated to exclude entrapment of extraocular muscles due to orbital fractures.
- ▶ These procedures frequently identify ocular injuries that are not otherwise apparent

# Maxillofacial Structures

- ▶ Examination of the face should include palpation of all bony structures, assessment of occlusion, intraoral examination, and assessment of soft tissues.

- ▶ Maxillofacial trauma that is not associated with airway obstruction or major bleeding should be treated only after the patient is stabilized and life-threatening injuries have been managed.

- ▶ Patients with fractures of the midface may also have a fracture of the cribriform plate. For these patients, gastric intubation should be performed via the oral route.

# Cervical Spine and Neck

- ▶ Patients with maxillofacial or head trauma should be presumed to have a cervical spine injury (e.g., fracture and/or ligament injury), and cervical spine motion must be restricted.

- ▶ The absence of neurologic deficit does not exclude injury to the cervical spine.
  - ▶ and such injury should be presumed until evaluation of the cervical spine is completed.
- 

- ▶ Evaluation may include radiographic series and/or CT, which should be reviewed by a doctor experienced in detecting cervical spine fractures radiographically.
  - ▶ Radiographic evaluation can be avoided in patients who meet The National Emergency X-Radiography Utilization Study (NEXUS)
- 

- ▶ Examination of the neck includes inspection,
  - ▶ palpation, and auscultation.
  - ▶ Cervical spine tenderness,
  - ▶ subcutaneous emphysema,
  - ▶ tracheal deviation, and
  - ▶ laryngeal fracture can be discovered on a detailed examination.
- 

- ▶ The carotid arteries should be palpated and auscultated for bruits.
  - ▶ A common sign of potential injury is a seatbelt mark.
  - ▶ Most major cervical vascular injuries are the result of penetrating injury; however,
  - ▶ blunt force to the neck or traction injury from a shoulderharnes restraint can result in intimal disruption, dissection, and thrombosis.
- 

# seatbelt mark



- ▶ Blunt carotid injury can present with coma or without neurologic finding.
  - ▶ CT angiography, angiography, or duplex ultrasonography may be required to exclude the possibility of major cervical vascular injury when the mechanism of injury suggests this possibility.
- 

- ▶ Protection of a potentially unstable cervical spine injury is imperative for patients who are wearing any type of protective helmet, and extreme care must be taken when removing the helmet.



- ▶ Penetrating injuries to the neck can potentially injure several organ systems. Wounds that extend through the platysma should not be explored manually, probed
- ▶ with instruments, or treated by individuals in the ED who are not trained to manage such injuries.

- ▶ Surgical consultation for their evaluation and management is indicated.
  - ▶ The finding of active arterial bleeding,
  - ▶ an expanding hematoma, arterial bruit, or airway compromise usually requires operative evaluation.
- 

- ▶ Unexplained or isolated paralysis of an upper extremity should raise the suspicion of a cervical nerve root injury and should be accurately documented.

# Chest

- ▶ Visual evaluation of the chest, both anterior and posterior, can identify conditions such as open pneumothorax and large flail segments.
- ▶ A complete evaluation of the chest wall requires palpation of the entire chest cage, including the clavicles, ribs, and sternum

- ▶ Contusions and hematomas of the chest wall will alert the clinician to the possibility of occult injury.
  - ▶ Significant chest injury can manifest with pain, dyspnea, and hypoxia.
  - ▶ Evaluation includes inspection, palpation, auscultation and percussion, of the chest and a chest x-ray.
- 

- ▶ Auscultation is conducted high on the anterior chest wall for pneumothorax and
  - ▶ at the posterior bases for hemothorax. Although auscultatory findings can be difficult to evaluate in a noisy environment, they can be extremely helpful.
- 

- ▶ Distant heart sounds and decreased pulse pressure can indicate cardiac tamponade.
  - ▶ In addition, cardiac tamponade and tension pneumothorax are suggested by the presence of distended neck veins, although associated hypovolemia can minimize or eliminate this finding.
- 

- ▶ A chest x-ray or eFAST can confirm the
  - ▶ presence of a hemothorax or simple pneumothorax.
  - ▶ Rib fractures may be present, but they may not be visible on an x-ray.
  - ▶ A widened mediastinum and other radiographic signs can suggest an aortic rupture.
- 

# Abdomen and Pelvis

- ▶ Abdominal injuries must be identified and treated aggressively.
  - ▶ Identifying the specific injury is less important than determining whether operative intervention is required.
  - ▶ A normal initial examination of the abdomen does not exclude a significant
  - ▶ intraabdominal injury.
- 

- ▶ Close observation and frequent reevaluation of the abdomen, preferably by the same observer, are important in managing blunt abdominal trauma, because over time, the patient's abdominal findings can change.
  - ▶ Early involvement of a surgeon is essential.
- 

- ▶ Pelvic fractures can be suspected by the identification of ecchymosis over the iliac wings, pubis, labia, or scrotum.
  - ▶ Pain on palpation of the pelvic ring is an
  - ▶ important finding in alert patients. In addition, assessment of peripheral pulses can identify vascular injuries.
- 

- ▶ Patients with a history of unexplained hypotension,
  - ▶ neurologic injury, impaired sensorium secondary to alcohol and/or other drugs, and equivocal abdominal findings should be considered candidates for DPL,
  - ▶ abdominal ultrasonography, or, if hemodynamic findings are normal, CT of the abdomen.
- 

- ▶ Fractures of the pelvis or lower rib cage also can hinder accurate diagnostic examination of the abdomen,
  - ▶ because palpating the abdomen can elicit pain from these areas.
- 

# Perineum, Rectum, and Vagina

- ▶ The perineum should be examined for contusions, hematomas, lacerations, and urethral bleeding.
- ▶ rectal examination may be performed to assess for the presence of blood within the bowel lumen, integrity of the rectal wall, and quality of sphincter tone.

- ▶ Vaginal examination should be performed in patients who are at risk of vaginal injury. The clinician should assess for the presence of blood in the vaginal vault
- ▶ and vaginal lacerations.
- ▶ In addition, pregnancy tests should be performed on all females of childbearing age.

# Musculoskeletal System

- ▶ The extremities should be inspected for contusions and deformities. Palpation of the bones and examination for tenderness and abnormal movement aids in the
- ▶ identification of occult fractures.

- ▶ Impaired sensation and/or loss of voluntary muscle contraction strength can be caused by nerve injury or ischemia, including that due to compartment syndrome.

- ▶ The musculoskeletal examination is not
  - ▶ complete without an examination of the patient's back.
  - ▶ Unless the patient's back is examined,
  - ▶ significant injuries can be missed.
- 



# Neurological System

- ▶ A comprehensive neurologic examination includes motor and sensory evaluation of the extremities, as well as reevaluation of the patient's level of consciousness and pupillary size and response.

- ▶ Early consultation with a neurosurgeon is required for patients with head injury.
  - ▶ Monitor patients frequently for deterioration in level of consciousness and changes in the neurologic examination, as these findings can reflect worsening of an intracranial injury.
- 

- ▶ If a patient with a head injury deteriorates
  - ▶ neurologically, reassess oxygenation, the adequacy of ventilation and perfusion of the brain (i.e., the
  - ▶ ABCDEs). Intracranial surgical intervention or
  - ▶ measures for reducing intracranial pressure may be necessary.
- 

- ▶ The neurosurgeon will decide whether
  - ▶ conditions such as epidural and subdural hematomas
  - ▶ require evacuation, and whether depressed skull
  - ▶ fractures need operative intervention.
  - ▶ Thoracic and lumbar spine fractures and/or neurologic injuries must be considered based on physical findings and mechanism of injury.
- 

- ▶ Any evidence of loss of sensation, paralysis, or weakness suggests major injury to the spinal column or peripheral nervous system.
  - ▶ Neurologic deficits should be documented when identified, even when transfer to another facility or doctor for specialty care is necessary.
- 

- ▶ Protection of the spinal cord is required at all times until a spine injury is excluded. Early consultation with a neurosurgeon
- ▶ or orthopedic surgeon is necessary if a spinal injury is detected.

# Reevaluation

- ▶ Trauma patients must be reevaluated constantly to ensure that new findings are not overlooked and to discover any deterioration in previously noted findings.

# ADJUNCTS TO SECONDARY SURVEY

- ▶ Specialized diagnostic tests may be performed during the secondary survey to identify specific injuries.
  - ▶ These include additional x-ray examinations of
  - ▶ the spine and extremities; CT scans of the head,
  - ▶ chest, abdomen, and spine; contrast urography
  - ▶ and angiography; transesophageal ultrasound;
  - ▶ bronchoscopy; esophagoscopy; and other diagnostic procedures.
- 

- ▶ During the secondary survey, complete cervical and thoracolumbar spine imaging may be obtained
- ▶ if the patient's care is not compromised and the mechanism of injury suggests the possibility of spinal injury.

- ▶ Restriction of spinal motion should be maintained until spine injury has been excluded.
  - ▶ An AP chest film and additional films pertinent to the site(s) of suspected injury should be obtained.
- 

- ▶ These specialized tests should not be performed until the patient has been carefully examined and his or her hemodynamic status has been
- ▶ normalized.
- ▶

- ▶ Missed injuries can be minimized by
  - ▶ maintaining a high index of suspicion and providing continuous monitoring of the patient's status during performance of additional testing.
- 

# REEVALUATION

- ▶ Continuous monitoring of vital signs, oxygen saturation, and urinary output is essential.
  - ▶ For adult patients, maintenance of urinary output at 0.5 mL/kg/h is desirable. In pediatric patients who are older than
  - ▶ 1 year, an output of 1 mL/kg/h is typically adequate.
- 

- ▶ The relief of severe pain is an important part of treatment for trauma patients.
  - ▶ Many injuries, especially musculoskeletal injuries, produce pain and anxiety in conscious patients.
  - ▶ Effective analgesia usually requires the administration of opiates or anxiolytics
  - ▶ intravenously (intramuscular injections are to be avoided)..
- 

- ▶ These agents are used judiciously and in small
  - ▶ doses to achieve the desired level of patient comfort
  - ▶ and relief of anxiety while avoiding respiratory status
  - ▶ or mental depression, and hemodynamic changes.
- 

