Acute Assessment of the Polytrauma Patient
A Systems Approach

Jamie Dyson PT
Orlando Health

Got I.C.E.?

National Trauma Statistics
Trauma kills more people between the ages of 1 and 44 than any disease or illness. Nearly 100,000 people of all ages die from trauma each year, roughly half of them in automobile crashes. But it is our children and young adults who are most affected: according to the National Center for Health Statistics, trauma (unintentional injuries plus homicides)
• 43% of all deaths from age 1 to 4
• 48% of all deaths in ages 5 to 14
• 62% of all deaths in ages 15 to 24
Trauma Facts and Figures

- Trauma is the leading cause of death in the first four decades of life
- More years of work life lost than cancer and heart disease combined
- 150,000 Deaths annually
- Accounts for > 25% all ED visits
- 1/8 of all hospital beds nationally

Disability

- Permanent disability dwarfs mortality 3:1
- 2 people killed, 350 injured severely enough to have a disabling injury every 10 minutes (7.8 million in costs)

Injuries

- 60 million injuries annually
- 50% require medical care (30 million)
- 3.6 million require hospitalization
- 9 million cause disability
- 300,000 permanent disability

ABBREVIATED INJURY SCALE (AIS)

The Abbreviated Injury Scale (AIS) is an anatomical scoring system. It provides a reasonably accurate ranking of the severity of injury. The AIS is monitored by a scaling committee of the Association for the Advancement of Automotive Medicine.

Injuries are ranked on a scale of 1 to 6, with 1 being minor, 5 severe, and 6 a nonsurvivable injury. This represents the 'threat to life' associated with an injury and is not meant to represent a comprehensive measure of severity.

<table>
<thead>
<tr>
<th>Injury</th>
<th>AIS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>Serious</td>
</tr>
<tr>
<td>4</td>
<td>Severe</td>
</tr>
<tr>
<td>5</td>
<td>Critical</td>
</tr>
<tr>
<td>6</td>
<td>Unsurvivable</td>
</tr>
</tbody>
</table>
INJURY SEVERITY SCORE (ISS) & NEW INJURY SEVERITY SCORE (NISS)

The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an AIS and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External). Only the highest AIS score in each body region is used. The 3 most severely injured body regions have their score squared and added together to produce the ISS score.

<table>
<thead>
<tr>
<th>Region</th>
<th>Injury</th>
<th>Description</th>
<th>AIS</th>
<th>Square Top Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head &amp; Neck</td>
<td>Cerebral Contusion</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Face</td>
<td>No Injury</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td>Flail Chest</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td>Small Intestine Intussusception</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Extremity</td>
<td>Fractured femur</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>External</td>
<td>No Injury</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Injury Severity Score: 50

“A trauma service should provide for the rehabilitation of its patients, with the goal of returning to society an individual who functions at the highest possible level consistent with his or her injuries. Early rehabilitation minimizes the risk of secondary complications that may interfere with or limit functional recovery. Members of the trauma service should also work with colleagues to prepare the patient and family physically, psychosocially, and emotionally for the transition to rehabilitation and ultimately for return to the community.”

The trauma medical director or trauma program manager shall ensure that trauma patients meeting the criteria established above have an evaluation by any or all of the following (as appropriate to the patient’s injury) within 7 days of inpatient admission:

1. Attending trauma surgeon, neurosurgeon, neurologist, or orthopedic surgeon.
3. Nursing personnel may include the following:
   a. Trauma program manager or designee.
   b. Clinical nurse specialist.
   c. Rehabilitation nurse.
4. Occupational therapist.
5. Physiatrist or medical director of the rehabilitation services department.
6. Physical therapist.
7. Speech therapist.

Florida Department of Health - Trauma Center Standards

Organized Critical care medicine

- improved patient care
- decreased resource utilization
- fewer complications
- decreased mortality
- lower costs
Models of ICU Care

- "Open" ICU Model
- "Closed" ICU Model
- "Semiclosed" ICU Model

Open ICU Model

- Most Common
- Any MD can oversee patient care
- MDs have responsibilities outside of ICU
- MD may not be readily available for emergencies
- Patient care guidelines and protocols are absent
- Duplication of services
- Increased cost of care
- Mostly used in smaller hospitals with limited or no house officers.
Closed ICU Model

- Primary MD yields care of the patient to an intensivist while in the ICU
- All orders cleared by the ICU service
- The primary MD resumes care once patient discharge from ICU

Closed ICU Model

- Patient guidelines and protocols are commonplace
- Lower ICU mortality rates
- Preferred by caregivers as MD is readily available
- Increased interactions with patients and families

Closed ICU Model

- May increase physician conflict as patient’s primary physician cannot provide patient care.
SemiClosed ICU Model

- An intensivist manages problems as they arise and serves as a gatekeeper for the allocation of resources
- Primary MD remains in close contact with the patient and shares decision making (DNR)
- Guidelines and protocols are commonplace

SemiClosed ICU Model

- Intensivist manages care in the ICU and is immediately available for arising problems
- Generalist provides continuity of care throughout continuum
- ICU staff become final common path for orders and procedures
- Preferred by ICU staff

The Team

- Physical Therapist
- Occupational Therapist
- Speech Pathologist
- Nurses
- ClinicalTechs
- Respiratory Therapists
The Team
- Pharmacists
- Social Workers
- Case Manager
- Dietitians
- Radiology
- Chaplains

Physical Therapy in the ICU
- A
- B
- C
- D

Physical Therapy in the ICU
- Airway/ C-spine
- B
- C
- D
Airway/ C-spine

- Is there a patent airway?
- Is the C-spine cleared?

Airway

- Artificial Airways
  - Oral Intubation
  - Nasal Intubation
  - Tracheostomy

Oral Intubation
Nasal Intubation

Tracheostomy

Physical Therapy in the ICU
- Airway
- Breathing
- C
- D
Breathing

- What is the rate?
  - Normal 12-18 breaths per minute

Breathing

- Do they require supplemental oxygen?
  - Nasal Cannula
  - Mask
  - How much oxygen?

Breathing

- Breathing pattern
  - Accessory muscle use
  - Pattern
Physical Therapy in the ICU
- Airway
- Breathing
- Circulation
- D

Circulation
- What is the heart rate?
  - Infant 120-150 BPM
  - Child 80-110 BPM
  - Adult 60-100 BPM

- Is there an abnormal heart beat?
  - Arrhythmia
  - Heart block
Circulation

- Any bleeding?
  - External- pressure
  - Internal- SLAK

Circulation

- S
- L
- A
- K

Circulation

- Spleen
- Liver
- Aorta
- Kidney
Circulation

- Any interruption in blood flow?
  - Compression- compartment syndrome
  - Emboli

Physical Therapy in the ICU

- Airway
- Breathing
- Circulation
- Disability

Physical Therapy in the ICU

- Cardiac System
- Pulmonary System
- Neurology
- Orthopedics
- Thoracic Surgery
- Vascular Surgery
Critical Checks

Clinical Problem: Early Mobilization in Critical Care Units

**Purpose:** To avoid the effects of prolonged bed rest without compromising the patient's clinical condition

**Assessment:**
- PT screen upon admission (as order needed) and PT consultation if needed
- Integumentary, cardiothoracic trauma
- Neck cleared or checked, clear
- MD activity order
- C-spine cleared, or deemed stable, c-collar (Refer to C-spine critical check)
- Deep vein thrombosis, lower extremity long bones
- Intubation which could compromise stability on muscle spasm, open abdomen
- ICP monitor in place, able to tolerate the semi-recumbent down position
- Cardiopulmonary stability

**Cardiothoracic Trauma**

- Cardiac monitor
- Oxygen saturation
- Respiratory rate
- Neurologic status

**Documentation:**
- Document activity performed
- Document level of tolerance to activity and assessment during activity
- Document if has an abdominal binder and use, when appropriate
- Documentation if any abdominal binder used and when appropriate
- Neurologic assessment if any
- Cardiac monitor and oxygen saturation

**Respiratory:**
- Respiratory rate
- Oxygen saturation
- Cardiac monitor

**Respiratory:**
- Respiratory rate
- Oxygen saturation
- Cardiac monitor

**Documentation:**
- Document activity performed
- Document level of tolerance to activity and assessment during activity
- Document if has an abdominal binder and use, when appropriate
- Documentation if any abdominal binder used and when appropriate
- Neurologic assessment if any
- Cardiac monitor and oxygen saturation

**Respiratory:**
- Respiratory rate
- Oxygen saturation
- Cardiac monitor

**Respiratory:**
- Respiratory rate
- Oxygen saturation
- Cardiac monitor

**Documentation:**
- Document activity performed
- Document level of tolerance to activity and assessment during activity
- Document if has an abdominal binder and use, when appropriate
- Documentation if any abdominal binder used and when appropriate
- Neurologic assessment if any
- Cardiac monitor and oxygen saturation

**Respiratory:**
- Respiratory rate
- Oxygen saturation
- Cardiac monitor
**Cardiothoracic Injuries**

- Chest Wall
- Pulmonary injury
- Airway injury
- Cardiac injury
- Vessel injury
- Other

---

**Chest Wall**

- Contusions/ Hematomas
- Rib Fx
- Flail Chest
- Sternal Fx

---

**Pulmonary Injury**

- Pulmonary Contusion
- Pulmonary Laceration
- Pneumothorax
- Hemothorax
- Hemopneumothorax

---
Airway Injury

- Tracheal Tear
- Bronchial Tear
Cardiac Injury

- Pericardial Tamponade
- Myocardial Contusion
- Cardiac Laceration
Vessel Injury

- Aortic Arch
- Thoracic Aortic Injury

Other

- Esophageal Injury
- Diaphragm Injury

Wide Mediastinum
Abdominal Trauma

- Organ Injury
- Vascular Injury
- Compartment Syndrome

Can be caused by both blunt and penetrating trauma (evisceration)
Organ Injury
Solid Vs Hollow Organs

• Liver - most common and most vulnerable -> exsanguination
• Spleen - 2nd most common
• Pancreas
• Kidneys - bloody urine - urinoma
• Bowel - usually penetrating trauma
• Stomach - penetrating trauma

---

Liver

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>AIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma Subcapsular, &lt;10% surface area</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration Capsular tear, &lt;1cm parenchymal depth</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma Subcapsular, 10-50% surface area or expanding. Ruptured subcapsular or parenchymal haematoma</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration &gt;3cm parenchymal depth</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma Subcapsular, &gt;50% surface area or expanding. Ruptured subcapsular or parenchymal haematoma</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laceration &gt;3cm parenchymal depth</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration Parenchymal disruption involving 25-75% of hepatic lobe or 1-3 Coinaud’s segments in a single lobe</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Laceration Parenchymal disruption involving &gt;75% of hepatic lobe or &gt;3 Coinaud’s segments within a single lobe</td>
<td>5</td>
</tr>
<tr>
<td>VI</td>
<td>Vascular Hepatic Avulsion</td>
<td>6</td>
</tr>
</tbody>
</table>

---

Vascular Injury

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Non-named SMA or SMV branches</td>
</tr>
<tr>
<td>II</td>
<td>Primary named branches of mesenteric artery or vein</td>
</tr>
<tr>
<td>III</td>
<td>Other named small arterial or venous structures requiring ligation</td>
</tr>
<tr>
<td>IV</td>
<td>Other named small arterial or venous structures requiring ligation</td>
</tr>
<tr>
<td>V</td>
<td>Other named small arterial or venous structures requiring ligation</td>
</tr>
</tbody>
</table>
Abdominal Compartment Syndrome

- Normal Abdominal Pressure <5 mmHg
- >20 usually requires surgical intervention
- If not treated in a timely manner can lead to other disabilities.

Neurological Trauma
Neurological Assessment

Central Nervous System - Brain and Spinal Cord

Peripheral Nervous System

Cerebral Cortex

Ventral View (From inferior)

The outermost layer of the cerebral hemisphere which is composed of gray matter. Cortices are asymmetrical. Both hemispheres are able to analyze sensory data, perform memory functions, learn new information, form thoughts and make decisions.

Left Hemisphere


Right Hemisphere

Holistic Functioning: processing multi-sensory input simultaneously to provide "holistic" picture of one's environment. Visual spatial skills. Holistic functions such as dancing and gymnastics are coordinated by the right hemisphere. Memory is stored in auditory, visual and spatial modalities.
Frontal Lobe

Prefrontal area: The ability to concentrate and attend, elaboration of thought. The "Gatekeeper": judgment, inhibition. Personality and emotional traits.

Motor Cortex (Brodmann's): voluntary motor activity.

Premotor Cortex: storage of motor patterns and voluntary activities.

Language: motor speech

- Impairment of recent memory, inattentiveness, inability to concentrate, behavior disorders, difficulty in learning new information. Lack of inhibition (inappropriate social and/or sexual behavior). Emotional lability. "Flattened" affect.
- Contralateral plegia, paresis.
- Expressive/motor aphasia.

Parietal Lobe

Processing of sensory input, sensory discrimination.

Body orientation.

Primary/secondary somatic area.

- Inability to discriminate between sensory stimuli.
- Inability to locate and recognize parts of the body (Neglect).
- Severe injury: inability to recognize self.
- Disorientation of environment space.
- Inability to write.

Occipital Lobe

Primary visual reception area.

Primary visual association area: Allows for visual interpretation.

- Primary Visual Cortex: loss of vision opposite field.
- Visual Association Cortex: loss of ability to recognize object seen in opposite field of vision, "flashes of light", "stars".
Temporal Lobe

Auditory receptive area and association areas.
Expressed behavior.
Language: Receptive speech.
Memory: Information retrieval.

- Hearing deficits.
- Agitation, irritability, childish behavior.
- Receptive/sensory aphasia.

Basal Ganglia

Part of extrapyramidal system: regulation of automatic movement.

- Movement disorders: chorea, tremors at rest and with initiation of movement, abnormal increase in muscle tone, difficulty initiating movement.
- Parkinson's.
Extra-Axial Bleeds

• Epidural Hematoma (EDH)
• Subdural Hematoma
• Subarachnoid Hemorrhage

Epidural Hematoma

• Between the skull and the dura
• Middle Meningeal Artery
• Lucid progressing to unconsciousness
• Biconvex on CT

Subdural Hematoma

• Between the dura and the arachnoid layer
• Venous
• Gradual increasing headache and confusion
• Crescent Shaped
Subarachnoid Hemorrhage

- Between the arachnoid layer and the pia mater
- Arterial or venous
- Severe Headache "thunderclap"
- Deteriorating level of consciousness

Intra-Axial Hemorrhages

- Intraparenchymal Hemorrhage
- Intraventricular Hemorrhage

Intraparenchymal Hemorrhage

- Hematoma which expands inside the brain.
- Pushes aside adjacent brain tissue and compresses it.
- Also called cerebral contusion
Intraventricular Hemorrhage

- Bleeding inside the ventricles
- Middle or posterior communicating artery

Diffuse Axonal Injury

- Shearing of axons
- High velocity
- Negative CT scan

Anoxic Brain Injury

- Airway
- Breathing
- Perfusion
Spinal Cord Injury

ASIA Impairment Scale
A. Complete- No motor or sensory function is preserved in sacral segments S4- S5
B. Incomplete- Sensory but not motor function is preserved below the neurological level and extends through the sacral segments S4-S5
C. Incomplete- Motor function is preserved below the neurological level and the majority of key muscles below the neurological level have a muscle grade less than 3
D. Incomplete- Motor function is preserved below the neurological level, and the majority of key muscles below the neurological level have a muscle grade greater than or equal to 3.
E. Normal- Motor and sensory function is normal

Central Cord

Greater motor impairment in upper compared to lower extremities, and variable degree of sensory loss below the level of injury

Brown-Sequard

Characterized by a motor loss and numbness to touch and vibration on the same side of the spinal injury and loss of pain and temperature sensation on the opposite side.
Anterior Cord

Characterized by loss of motor function below the level of injury, loss of sensations carried by the anterior columns of the spinal cord (pain and temperature), and preservation of sensations carried by the posterior columns (fine touch and proprioception).

Motor Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Motor Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-T1</td>
<td>Neck Extensors</td>
</tr>
<tr>
<td>C3,4,5</td>
<td>Diaphragm</td>
</tr>
<tr>
<td>C5,6</td>
<td>Deltoids and biceps</td>
</tr>
<tr>
<td>C6,7,8</td>
<td>Extends elbow, extends wrist, pronates wrist</td>
</tr>
<tr>
<td>C7,8, T1</td>
<td>Flex wrist</td>
</tr>
<tr>
<td>T1-6</td>
<td>Hand intrinsic</td>
</tr>
<tr>
<td>T7-L1</td>
<td>Intercostals and trunk muscles</td>
</tr>
<tr>
<td>L1-4</td>
<td>Hip flexion</td>
</tr>
<tr>
<td>L2-4</td>
<td>Adduction of leg</td>
</tr>
<tr>
<td>L4,5 S1</td>
<td>Abduction of leg</td>
</tr>
<tr>
<td>L4,5 S1,2</td>
<td>Hip extension - gluts</td>
</tr>
<tr>
<td>L4,5 S1</td>
<td>Knee extension - quads</td>
</tr>
<tr>
<td>L4,5 S1</td>
<td>Knee flexion - hamstrings</td>
</tr>
<tr>
<td>L4,5 S1</td>
<td>Dorsiflex foot</td>
</tr>
<tr>
<td>L4,5 S1</td>
<td>Extension of toes</td>
</tr>
<tr>
<td>L5 S1,2</td>
<td>Plantar flexion of foot, flexion of toes</td>
</tr>
</tbody>
</table>

Outcomes

<table>
<thead>
<tr>
<th>Level</th>
<th>Weight shifting</th>
<th>Bed Mobility</th>
<th>Transfers</th>
<th>Locomotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-T1</td>
<td>Dependent</td>
<td>Dependent</td>
<td>Dependent</td>
<td>Dependent</td>
</tr>
<tr>
<td>C3,4,5</td>
<td>Independent</td>
<td>Independent</td>
<td>Dependent</td>
<td>Dependent</td>
</tr>
<tr>
<td>C4</td>
<td>Independent</td>
<td>Independent</td>
<td>Dependent</td>
<td>Dependent</td>
</tr>
<tr>
<td>C5-8</td>
<td>Independent</td>
<td>Independent</td>
<td>Independent</td>
<td>Dependent</td>
</tr>
</tbody>
</table>

Independence may be inhibited by age, patient weight, associated injuries and motivation.
Peripheral Nervous System

Assessment

- Glasgow Coma Scale
- Cranial Nerves
- Upper vs Lower Motor Neuron

GLASGOW COMA SCORE

| Best Eye Response (4) | 1. No eye opening
|                      | 2. Eye opening to pain
|                      | 3. Eye opening to verbal command
|                      | 4. Eyes open spontaneously
| 13 or higher correlates with a mild brain injury |

| Best Verbal Response (5) | 1. No verbal response
|                          | 2. Incomprehensible sounds
|                          | 3. Inappropriate words
|                          | 4. Confused
|                          | 5. Orientated
| 9 to 12 is a moderate injury |

| Best Motor Response (6) | 1. No motor response
|                       | 2. Extension to pain
|                       | 3. Flexion to pain
|                       | 4. Withdrawal from pain
|                       | 5. Localising pain
|                       | 6. Obeys Commands
| 8 or less a severe brain injury |
Cranial Nerves

### Upper vs Lower Motor Neuron Lesions

**Upper Motor Neuron Lesion**
- (+) Babinski sign
- (+) Superficial abdominal reflex
- (-) Cremasteric reflex
- Loss of fine skilled voluntary movements
- Severe paralysis
- Spasticity or hypertonicity
- Exaggerated DTR and clonus
- Clasp-knife reaction
- Pronator drift
- Decorticate vs. decerebrate posture
- Spinal shock

**Lower Motor Neuron Lesion**
- Flaccid paralysis
- Atrophy
- Absent reflexes
- Muscular fasciculation
- Muscular contracture
- Reaction degeneration
- Dysphagia
- Dysarthria

Burn Trauma
Anatomy of the Skin

Function of the Skin

- Protection from infection and injury
- Prevention of loss of body fluids
- Regulation of body temperature
- Sensory contact with environment.

Classification of Burns
1st. degree burns - (Superficial)

- Involves the epidermis
- Red, Painful, Dry
- Usually heals on own in a week
Classification of Burns

2nd degree burns - (partial thickness)

- Epidermis into dermis
- Red, Blisters, Weeping
- Heels in 3-4 weeks and may scar
Classification of Burns

3rd degree burns - (full thickness)

- Full layers of epidermis and dermis
- Can penetrate underlying fat, muscle, nerve, tendon, and bone.
- Presents as brown or black with underlying white tissue
- Dry and little or no pain

Extent of Burns

Rule of Nines
**Extent of Burns**

A BURN CHART

**Types of Burns**

**Thermal**
- Flames
- Steam
- Scalds
- Heat Source

**Types of Burns**

**Thermal**
- Frost Bite
- Exposure to Freon
Types of Burns

Chemical

- Acid
- Alkaline
- Organic Compounds
- Hydrofluoric Acid
- Tar

Damage tissue through liquefaction necrosis and protein denaturation.

Types of Burns

Chemical

Alkaline

- oven cleaners
- drain cleaners
- fertilizers
- heavy industrial cleaners
- cement

Acids damage tissue by coagulation necrosis and protein precipitation which limits depth.

Types of Burns

Chemical

Acid

- Hydrochloric Acid - bathroom cleaners
- Oxalic Acid - rust removers
- Muriatic Acid - pools
Types of Burns
Chemical
Organic Compounds

- Phenols - disinfectants
- Petroleum

Organic compounds cause tissue damage due to their fat solvent action. Once absorbed they can cause toxic effects on the liver and kidneys.

Types of Burns
Chemical
Hydrofluoric Acid

- Etch Glass
- Teflon
- Clean Semiconductors

Cause immediate pain to area exposed due to tissue necrosis. Can lead to death from hypocalcemia as the fluoride binds free calcium in the bloodstream.

Types of Burns
Chemical
Tar

Tar is considered a chemical burn although it is actually a thermal burn.
Types of Burns

Electrical

- Current
- Arc
- Flash
- Lightning

Types of Burns

Electrical

Current

A/C current - current alternates back and forth from the source to contact points. Will have contact burns but no true entrance and exit wound.

D/C current will have definitive entrance and exit wound.

Types of Burns

Electrical

Arc

Ionization of air particles between two conductors. Heat generated from and arc can reach 4000 degrees C.
Types of Burns

Electrical

Flash

A flash can result from a power source resulting in thermal burn.

---

Types of Burns

Electrical

Lightning

Injury results from direct strike or side flash.

1:280,000 chance of being struck

---

Orthopedic Trauma
Orthopedic Trauma

- Fractures
- Amputations
- Compartment Syndrome

Ligamentous Injuries

- Can be missed during primary assessment
- May not present themselves until GCS Improves

Fractures

Open vs Closed

- Complete fracture: A fracture in which bone fragments separate completely.
- Oblique fracture: A fracture that is diagonal to a bone's long axis.
- Spiral fracture: A fracture where at least one part of the bone has been twisted.
- Comminuted fracture: A fracture where the bone has broken into a number of pieces.
- Compacted fracture: A fracture caused when bone fragments are driven into each other.

The type of fracture will effect weight bearing.
Pelvic Fractures

- Sacral
- Acetabular
- Anterior

Sacral Fractures

Zone I
Fracture across sacral ala can cause L5 nerve root impingement; about 6% of these patients will have neurological injuries.

Zone II
Fracture thru neuroforamina can cause unilateral sacral anesthesia; fracture involving the neuroforamina require operative debridement of fracture fragments prior to reduction and fixation (thru posterior approach).

Zone III
Fracture thru body of sacrum can cause highest incidence of injury to cauda equina and result in neurogenic bladder; about 56% of these patients will show neurological injuries.

Acetabular Fractures

Anterior wall fracture involves central portion of anterior column & iliopectineal line - associated injury: anterior hip dislocation

Anterior column extends from symphysis pubis & obturator foramen thru acetabulum to ASIS and up through the lesser sciatic foramen - frequently fractured thru posterior hip

- Fractures of the anterior column may compromise any portion of the column
- Fracture line extends from the middle of the pubic rami to any point between theischium above the level of the acetabulum

Transverse fractures extend across both the anterior and posterior columns; fracture divides the innominate bone into superior segment containing acetabular roof and intact ilium, & inferior segment consisting of single ischiopubic fragment.
Acetabular Fractures

- **Posterior Wall**: most common type of acetabular fracture (up to 50%)
  - Posterior wall fractures involve the posterior articular surfaces, often with retroacetabular surface and sometimes entire surface.
  - May be seen in MVA from posteriorly directed dashboard impact.
  - Spine with > 40-50% involvement of posterior wall or with posterior subluxation will be unstable and will require ORIF.

  Posterior column extends from obturator foramen thru posterior aspect of the acetabular dome and then obliquely thru the greater sciatic notch.
  - Fracture of posterior rim & posterior column arise from MVA, most likely as result of dashboard impact.

Anterior Pelvic Injury

- Anterior injury may be thru symphysis or thru pubic rami unilaterally or bilaterally.

  Symphysis disruption may also occur with pubic rami fractures.

  Diastasis > 1 cm represents pubic instability.

  Diastasis of > 2.5 cm represents ligamentous damage.

Openbook Pelvic Fracture

- Complete SI joint disruption with disrupted anterior and posterior ligaments.
Traumatic Amputation

Traumatic amputations usually result directly from factory, farm, or power tool accidents or from motor vehicle accidents. Natural disasters, war, and terrorist attacks can also cause traumatic amputations.

Often, the patient will have a better outcome from having a well-fitting, functional prosthesis than a nonfunctional replanted limb.

Don’t let an amputation distract from other more life-threatening injuries.
Compartment Syndrome

There are classically 5 "Rs" associated with compartment syndrome - Pain out of proportion to what is expected, Parthenosis, Pallor, Paralysis and Pulsations.

References

References


www.abdominalcompartmentsyndrome.org


Wheeless' Textbook of Orthopaedics


American Burn Association- Advanced Burn life Support- Instructor manual. Paul E. Marik What Defines an Intensive Care Unit?: Implications for Organizational Structure ICU Director, May 2010; vol. 1, 3: pp. 175-180