**Trauma  
Dr. Gary Mumaugh and Dr. Bruce Simat**

**Overview of Traumatic Injury**

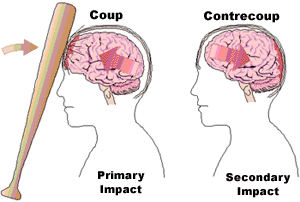
* Factors affecting wound production
  + Amount of energy
  + Duration of impact
  + Surface area
  + Tissue Characteristics

**Wound Classification**

* Wounds caused by mechanical forces
  + Abrasion: epidermis is scraped off, produced by friction, usually minor.
  + Contusion: a bruise—blood loss into tissue spaces, surface is unbroken.
* Hematoma: Focal pooling of blood within a tissue
* Coup injury: blow to brain causes contusion at site of impact.
* Countrecoup injury: contusion on opposite side of brain due to brain moving in skull.

**Brain Trauma**

* **Major head trauma**
  + A traumatic insult to the brain possibly producing physical, intellectual, emotional, social, and vocational changes
  + Transportation accidents
  + Falls
  + Sports-related event
  + Violence
* **Closed (blunt, nonmissile) trauma**
  + Head strikes hard surface or a rapidly moving object strikes the head
  + The dura remains intact and brain tissues are not exposed to the environment
  + Causes focal (local) or diffuse (general) brain injuries
* **Open (penetrating, missile) trauma**
  + Injury breaks the dura and exposes the cranial contents to the environment
  + Causes primarily focal (local) injuries
* **Coup injury**
  + Injury directly below the point of impact
* **Contrecoup**
  + Injury on the pole opposite the site of impact
* **Compound fractures**
* **Basilar skull fracture**



**Focal Brain Injury**

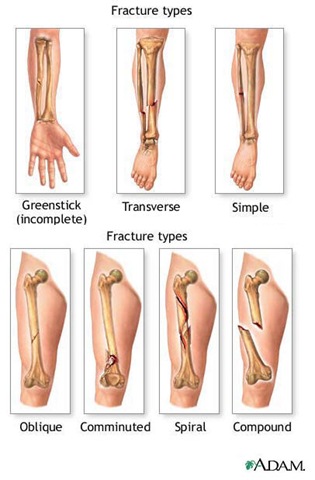
* Observable brain lesion
* Force of impact typically produces contusions
* Contusions can cause:
  + Extradural (epidural) hemorrhages or hematomas
  + Subdural hematomas
  + Intracerebral hematomas

**Wound Classification**

* Laceration: caused by tearing or splitting of skin or organ surface.
  + Different than an incisionwhich is a smooth slice
  + Configurations: straight, curved, stellate (star-shaped)
  + Rupture: deep laceration or when hollow organ’s wall tears completely through.
* Penetrating wounds: caused by sharp, long object, causing deep and narrow wound.
* Serious blood loss
* Vital organs may be reached, causing severe hemorrhage or extensive peritonitis.

**Bone Fracture**

* Many different types, depending on the forces that are applied to the bone.
* Types of Bone Fractures
  + Compound (open) – bone ends penetrate the skin
* Simple (closed) – bone ends do not penetrate the skin
* Greenstick – incomplete fracture where one side of the bone breaks and the other side bends; common in children
* Comminuted – bone fragments into three or more pieces; common in the elderly
* Compression – bone is crushed; common in porous bones



**Craniocerebral Trauma**

* Primary brain injury: initial trauma causing injury, like a blow to the skull.
* Secondary brain injury: caused by complication of primary injury: infarction, loss of function, epilepsy, etc.
* Types of brain injury:
  + Concussion: period of lost or altered consciousness that follows a brain injury and period of paralysis of nervous function.
  + Coup and Contrecoup Injuries
  + Basal Skull Fracture: when hit hard, the area that is directly hit withstands the pressure, but the opposite side fractures.
  + Closed head injuries: meningeal and vascular protection of brain intact.
  + Open head injuries: protection is broken in some way.

**Hematomas:**

* Extradural hematoma: artery is blood source.
* Subdural hematoma: bridging vein is usually the blood source.
* Acute: develops over 24-48 hours.
* Subacute: develops in 48 hours to two weeks.
* Chronic: slow leak, initial trauma was minor.

**Spinal Cord Trauma**

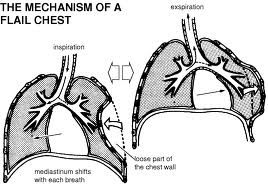
* Most commonly occurs due to vertebral injuries
  + Simple fracture, compressed fracture, and comminuted fracture and dislocation
* Traumatic injury of vertebral and neural tissues as a result of compressing, pulling, or shearing forces
* Spinal cord trauma: caused by hyperextension, crushing, dislocation.
  + Spinal shock: loss of function below site of injury
  + Most common locations: cervical (1, 2, 4-7), and T1-L2 lumbar vertebrae
  + Locations reflect most mobile portions of vertebral column and the locations where the spinal cord occupies most of the vertebral canal
* Spinal shock
  + Normal activity of the spinal cord ceases at and below the level of injury. Sites lack continuous nervous discharges from the brain.
  + Complete loss of reflex function (skeletal, bladder, bowel, sexual function, thermal control, and autonomic control) below level of lesion

**Spinal Cord Trauma**

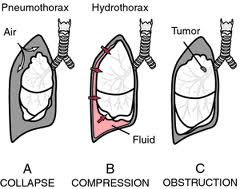
* Paraplegia
* Quadriplegia
* Autonomic hyperreflexia (dysreflexia)
  + Autonomic dysreflexia means an over-activity of the Autonomic Nervous System.
* It can occur when an irritating stimulus is introduced to the body below the level of spinal cord injury, such as an overfull bladder.
* The stimulus sends nerve impulses to the spinal cord, where they travel upward until they are blocked by the Lesion at the level of injury.
* Since the impulses cannot reach the brain, a Reflex is activated that increases activity of the sympathetic portion of autonomic nervous system

**Thoracic Trauma**

* Flail Chest: three or more adjacent ribs are fractured and section can move independently.
  + Can result in hypoxemia and hypercapnia due to hypoventilation.
* Closed pneumothorax: fractured ribs puncture lung and allow air into pleural space, but chest wall is not open to atmospheric air.
* Open pneumothorax: atmospheric air enters pleural space directly through opening.

**Thoracic Trauma**

* Tension pneumothorax: chest wound closes during expiration, causing increased pressure in one pleural cavity.
  + This forces the collapsed lung, heart, and other structures into the other pleural cavity.
* Hemothorax: blood in the pleural space.
* Ruptures in the diaphragm can cause herniation, usually on the left side.
* Cardiac wounds often involve laceration of the aorta or vena cavae.



**Abdominal Trauma**

* Nonpenetrating trauma can cause contusion, laceration, or rupture of abdominal viscera.
* The spleen is the most often damaged organ in cases of blunt trauma.
* Penetrating wounds increase risk of abdominal infection.
* Evisceration: large wall defect allows abdominal organs to escape from abdomen.

**Trauma in Athletics**

* Stress fracture: overuse injury, load is not enough to cause acute fracture, but exceed that level that the bone can absorb without damage.
* Ligaments: partial or complete tears of ligaments due to excessive stresses.
  + Avulsion fracture: ligament is intact but pulls off a section of bone at its attachment site.
* Joints: injuries involve forces which separate bones in a joint.
  + Sprain (bone return to position)
  + Dislocation (bones remain displaced)
* Tendons: long healing time due to poor vascularization.
* Muscles:
  + Distraction ruptures: caused by high contractile loads or excessive stretching.
  + Compression ruptures: caused by direct impact which forces muscle against bone

**Burn Trauma**

* Burns caused by thermal energy applied to skin at a rate greater than it can be dissipated.
* Factors affecting skin’s ability to absorb and dissipate heat:
  + Thickness
  + Blood supply
  + Water content
  + Pigmentation
  + Presence of hair and other surface matter (dirt, cosmetics, etc.)
* Classification
  + First-degree burn: damages epidermis only, no significant necrosis. (Sunburn)
  + Second-degree burn: destruction of epidermis and part of dermis, causes blisters.
  + Third-degree burn: damage to epidermis, dermis, and underlying tissue, skin grafting usually needed
* Alternate classification system:
  + Partial-thickness burn: epidermis and some of dermis damage (second-degree).
  + Full-thickness burn: epidermis and whole dermis damage (third-degree).
* Consequences of severe burns:
  + Shock
  + Infection
  + Deformity