INJURIES TO THE HEAD

• Traffic accidents
• Assaults
• Falls
SCALP
SCALP INJURIES

• May or may not associated with skull fracture

• Intracranial infections
  – Diploic veins
    • Meningeal veins /sinuses and veins of peicranium
  – Emissary veins
    • Thrombophlebitis
    • Parasagittal , lateral, cavernous sinus
CAUSES OF SCALP INJURIES

• Fall
• Accidents
• Assault
  – Blunt weapon
  – Sharp weapon
  – Sharp with heavy cutting edge
Abrasions

• **Brush abrasions**
  – Less common
  – Protective effect of hairs

• **Impact abrasions**
  perpendicular force
Bruising of the scalp

• Difficult to detect
  – Marked swelling
  – Blood present beneath aponeurosis or pericranium

• Head injuries in infants
  – Close attachment of pericranium with suture line Swollen, thickened, jelly like infiltration of tissue fluid
Laceration of the scalp

• Bleed profusely even after death
• Avulsion of large area of scalp exposing aponeurosis or skull
  – hairs entangled in machinery
  – Rotating vehicle tyres
• Reproduce the pattern of-inflicting object though random splitting is common
  – Hammer/heavy tools
• Associated with depressed fracture
Difference between incised and lacerated wounds

• Bruised margins
• Head hairs crossing the wound
• Facials strands, hair bulbs, small nerves and vessels in the depth of wound
  – Blunt Rod split the skin/underlying tissue in a sharply demarcated fashion
Injuries from fall

Usually injured occipital protuberance, forehead/parieto temporal area

- Injuries on the vertex
  - Suspicious of assault
  - Unusual to fall on the top of the head
- Ragged split
  - Linear, stellate or irregular
- Transverse laceration
  Ridge/ pavement/
  Maybe undercut/partly detached from the underlying bone
  Flap of scalp is loosened from the skull
Black eye /spectacle /raccoon

- Periorbital hematomas
- Direct violence
  - Associated with abrasion laceration of the eyebrow, nose or other part of the face
- Gravitational seepage
  - And injury to front of scalp or above the eyebrow
- Percolation of blood
  - Fracture of anterior cranial fossa of skull

- Fall on the face does not cause this injury
• **CLOSED HEAD INJURIES**
  – If Dura remain intact (whether skull is fractured or not)
• **OPEN HEAD INJURY**
  If Dura is lacerated or torn (open to possible infection)
• Observation
• Should be x-rayed
• High incidence of post traumatic epilepsy
• Spicules of bone penetrated the meninges
skull

• Parallel tables of compact bone
  – Suture line close by interdigitation
  – Osseous fusion during adult life
– Thin parts reinforced by stronger buttresses
  • Petrous temporal
  • Greater wing of sphenoid
  • Sagittal ridge
  • Occipital protuberance
  • Glabella

• Vulnerable thin area
  – Parieto temporal
  – Lateral frontal
  – Lateral occipital
SKULL

• Not resilient
  – Tends to fracture easily
  – K.E=mv^2/2G
  – Size of area bearing weight
  – Extent to which tissue absorb momentum of striking object
  – Movement of the part that is struck
Mechanism of skull fracture

• Fracture due to local deformation
  • Momentary distortion
  • Area under the point bend inward
  • Compensatory bulging
  • Infant skull more flexible more deformed

• Fracture due to general deformation
  • Compressed like elastic sphere
  • Compression on the concavity
  • Tension force on convexity

• Primary, secondary, tertiary stress areas
The skull is more susceptible to traction forces than compression, so that convexities tend to fracture during the distortion.
Mechanism of head injury
FRACTURE OF SKULL

• Direct  violence
  • Indirect
    – Fracture of vault of skull
    – Fracture of base of skull
DIRECT FRACTURES

• Direct
  – Obstetric forceps
  – Crushed under wheels of a vehicle
  – Struck by moving objects
INDIRECT FRACTURES

• Fall form height on feet/buttocks
• Pressure transmitted from below (explosion)
• Blow on the chin
  – Transmitted from mandible to the skull
  – Separation of sutures in young persons
Fracture of vault of the skull

- Assault/fall/transportation injuries
  - Target of choice in majority of assaults
  - When victim knocked to the ground
TYPES OF SKULL FRACTURES

- Linear fracture /fissured fracture
- Diastasis fracture /sutural fracture
- Pond fracture /indented fracture
- Mosaic/spider web fracture
- Depressed fracture
- Penetrating fracture
- Elevated fracture
- Gutter fracture
FISSURED FRACTURE

• Straight/curved fracture line
  – Temporal, frontal, parietal and occipital plates
• Child abuse
• Linear fracture of parietal bone may reach sagittal suture and continue across opposite plate
• Continuation
  – Direct
  – Stepped
DIASTASIS

• Children/young adults
  – Sagittal suture (two parietal bones)
  – Metopic suture can reopen under mechanical stress
POND FRACTURE
DEPRESSED FRACTURE

• Heavy weapon with small striking surface
  – Shape indicate type of weapon (signature fracture)
Comminuted fracture

• Broken into two or more pieces
  – Complication of depressed fracture

• Stellate appearance
  – When there is no displacement

• Mosaic/spider web fracture
  – Fissure radiating from it
  – Actual depression is absent
GUTTER FRACTURE

• Part of thickness of skull bone is removed
  – Glancing bullet wound
  – May be present without loss of bone
PENETRATING FRACTURE

• Clean cut opening due to penetrating weapon
  – Dagger /bullet
ELEVATED FRACTURE

• Moderately heavy sharp edge weapon
• Indicate relative position of victim and assailant
FRACTURE OF BASE OF SKULL

- Fracture of anterior cranial fossa
  - Direct blow
  - Indirect blow
FRACTURE OF MIDDLE CRANIAL FOSSA

• Direct
  – Behind the ears
  – Escape of blood/CSF
  – Mastoid hemorrhage
    • Battle’s sign
• Motor cyclist fracture /hinge fracture
  – Basal linear fracture middle fossa
  – Following petrous temporal or greater wing of sphenoid bone into pituitary fossa
  – Separate base of skull into two halves
Fracture of posterior cranial fossa

- Direct impact
  - Striking the back of head on the ground
- Escape of blood/CSF in the tissues of the back
RING FRACTURE

• Posterior fossa around foramen magnum
  – Fall from height on the feet
    • Impact is transmitted up the cervical spine
    • Severe blow on vertex
    • Heavy blow under occiput/chin
• Puppe’s rule
  • Two or more fractures occurs from successive impact
    – In case of blow resulting from fall
    – Fracture line due to the fall are arrested by those produced by the blow
Puppe’s rule
Complications of fracture of skull

- Injury to the brain
- Hemorrhage
- Traumatic epilepsy
- Infections
  - Direct spread through compound fracture
  - Fracture of cribriform plate anterior fossa
ANTE MORTEM AND POSTMORTEM INJURIES

- Impossible to determine in absence of soft tissues
- Artifactual damage (recovery, exhumation)
- Scanning electron microscope
  - Micro fracture and collagen
COUP INJURY

• Immediately subjacent to the area of impact
• Smaller area greater coup injury
  – Contusion and hemorrhage
CONTRE COUP INJURY

• Opposite blow
• Contralateral side of the area of impact
• Moving head decelerate suddenly by hitting hard surface
  – Occur only when head is free to move
  – Intermediate contre coup lesions
    • Moving head impacts at the vertex
INJURIES TO CRANIAL CONTENT

• **Acceleration/deceleration injuries**
  – Diffuse neuronal injuries
  – Diffuse axonal injuries

• **Impact injuries**
  – Cerebral concussion
  – Cerebral contusion
  – Cerebral laceration
  – Intracranial hemorrhage
DIFFUSE NEURONAL INJURIES (DNI)

– Sudden acceleration /deceleration injuries
  • Intracellular disturbance
  • Conduction defects at synaptic junction
– Deceleration impact is relatively prolonged
  • Sagittal head motion cause mild/moderate
  • Coronal/rotational cause severe DNI
• Diffuse axonal injuries
  – Motion of the head cause injury to the brain
  – Stretching of axons
  – damage to the blood vessels
  – Repeated jolts
  – (cumulative axonal damage –punch drunk syndrome )
CEREBRAL CONCUSSION

• Diffuse neuronal injury
  • Physiological disturbance of brain function
  • Sudden loss of consciousness and spontaneous recovery
  • At autopsy
  • Histology
EFFECTS OF CONCUSSION

- Cerebral irritation
- Post concussional syndrome
- Retrograde amnesia
- Post traumatic automatism
CEREBRAL CONTUSIONS

• Ruptured blood vessels (frontal /temporal)
  – Wedge shape lesions
    • Streak like hemorrhages /focal destruction of tissues
    • Enlarge with time
    • Blood cyst
CEREBRAL LACERATIONS

• Penetrating wounds
  • Gunshot injuries/depressed
  • Closed head injuries with rotational strain
  • Jagged areas of the skull

• Rupture of Pia mater
  • Porencephalic cysts(filled with CSF)
  • Presence of blood pigment
CEREBRAL EDEMA

• Common cause of raised intracranial pressure
• Diffuse neuronal injuries
• Concussion
  • Dura stretched
  • Brain bulges through incisions
  • Gyri pale and flattened
  • Sulci are obliterated
  • Cut surface of brain appear pale
  • Ventricles reduced in size
  • Herniation of hippocampal gyrus
  • Coning of cerebral tonsils in adults