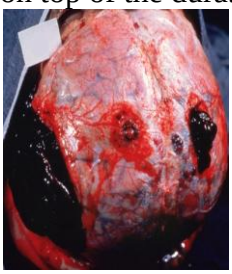
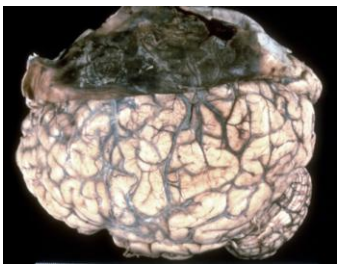
Unit VIII – Problem 3 – Pathology: Head Injury

- **The coverings of the brain are known as meninges and they are:**
  - **Pia mater**: it is the innermost layer.
  - **Dura matter**: it is the outermost layer. Note that blood supply in dura matter is from middle meningeal artery.
  - **Arachenoid**: is between pia mater and dura mater. Note that cerebrospinal fluid (CSF) is circulating in the subarachenoid space.
- **Types of head injuries:**
  - **Focal head injuries: and these include:**
    - ✓ Epidural hematoma:
      - ❖ Dura is the inner lining of the skull → and middle meningeal artery is located between the dura and skull → if it ruptures → epidural hematoma results.
      - ❖ This epidural hematoma will lead to edema and pressure on the underlying brain parenchyma (pushing the rest of the brain).
      - ❖ Both images are showing the brain, with the covering (dura) and hematoma on top of the dura.

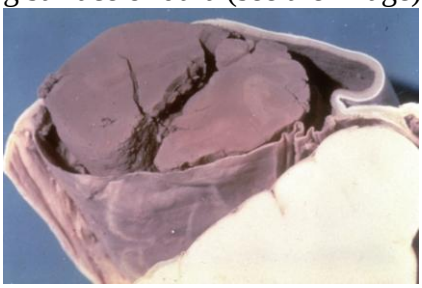


      - ❖ Durate hemorrhage: stretching and ischemia of perforating arteries of basilar artery in the pons → caused by the pushing effect of epidural hematoma.
      - ❖ Clinical course:
        - There is a variable period of consciousness.
        - The patient appears normal for several hours → lucid interval.
        - Increased intracranial pressure: with headache, vomiting, altered consciousness and papilledema.
        - Tentorial herniation: rapidly follows with oculomotor nerve palsy and pyramidal tract compression.
        - Compression of the brainstem follows resulting in changes in hear rate, blood pressure and respiration.
        - Coma and death rapidly ensue in untreated cases.
    - ✓ Subdural hematoma:
      - ❖ It is a collection of blood between the dura and arachenoid.
      - ❖ Caused by: rupture of bridging veins which are located below the dura. This is seen with brain atrophy, hydrocephalus, shaken-baby syndrome and falls.



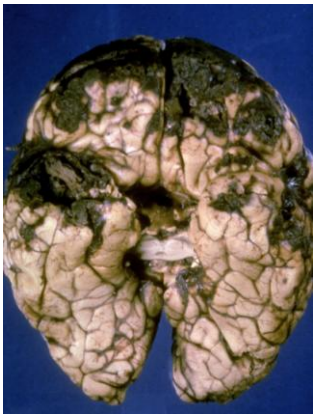
      - ❖ Brain damage is more severe and prognosis is worse than epidural hematoma.
      - ❖ It will also lead to edema and pressure on the underlying brain parenchyma (same as epidural hematoma).
      - ❖ Image showing the brain, with dura and arachenoid reflected to expose the subdural hematoma.
      - ❖ Types of subdural hematoma:
        - Acute: discovered within 2-3 days of its onset.
        - Sub-acute: discovered within 1-2 weeks of its onset.

- Chronic: in which hematoma is present for a long time. The hematoma will be enclosed by a membrane which is formed from the underlying surface of dura (see the image).



❖ Fate of subdural hematoma:
- Small hematomas: reabsorbed (taken by macrophages).
- Remain static or may enlarge.
- If it is chronic: a membrane will be formed around it (as mentioned earlier).

✓ Contusion:



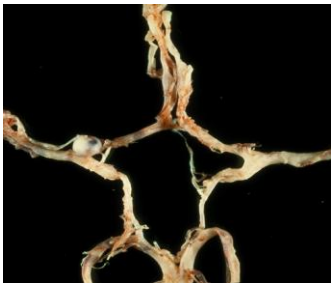
❖ Definition: bruises usually caused by a direct, strong blow to the head in which there is a rupture of intrinsic vessels.
❖ This is mainly seen with shaken-baby syndrome:
- If the contusion is at the side of injury → it is called coup contusion.
- If the contusion is at the opposite side of injury → it is called contrecoup contusion.

❖ Image showing small areas of hemorrhage on the surface of the brain (most commonly in orbital surfaces of frontal lobe and the tips of temporal lobes).

✓ Laceration:
❖ Definition: tears in brain tissue caused by a foreign object or pushed-in bone fragment from a skull fracture.
❖ Low velocity bullet wound will cause more damage to the brain than high velocity bullet wound.

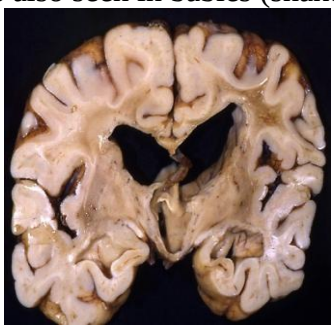
- **Diffuse head injuries:**

✓ Sub-arachenoid hemorrhage:
❖ Definition: there is injury to the circle of Willis or cerebral arteries.
❖ Causes:
- Congenital: in which there is arterio-venous malformation (10% of cases).
- Acquired: due to atherosclerosis which can lead to a rupture of an arterial aneurysm (berry aneurysm) in 2/3 of cases (see the image).

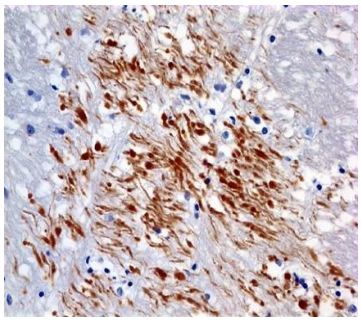


- Course: acute.
- Complications: raised intracranial pressure, vascular spasm, fibrosis and hydrocephalus.

- ✓ Diffuse axonal injury:
  - ❖ In which axons are disrupted from cell bodies at nodes of Ranvier.
  - ❖ This mostly occurs in old people in whom the brain is atrophied and any minor injury can lead to separation/rupture of axons (white mater) from cell bodies (grey mater).
  - ❖ It is also seen in babies (shaken-baby syndrome).



severe degeneration of white matter



axonal swelling detected by β-amyloid precursor protein immunostain

- ✓ Spinal cord injury:
  - ❖ Injury occurs by hyperflexion or hyperextension of the neck.
  - ❖ If it occurs in the cervical region: this will lead to quadriplegia.
  - ❖ If it occurs in the thoracic region: this will lead to paraplegia.
  - ❖ Avulsion of pons from medulla or medulla from cervical cord causes instant death.