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.
- **Arachnoid**: is between pia mater and dura mater. Note that cerebrospinal fluid (CSF) is circulating in the subarachnoid 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 arachnoid.
    - 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 arachnoid 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-arachnoid 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).

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.