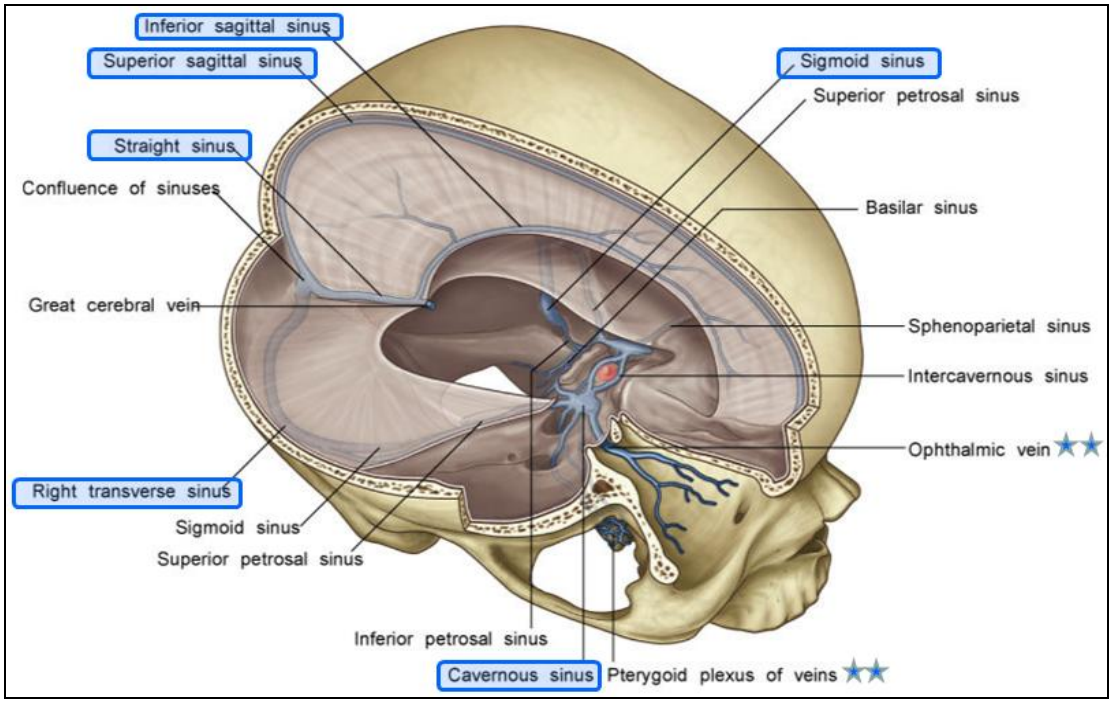
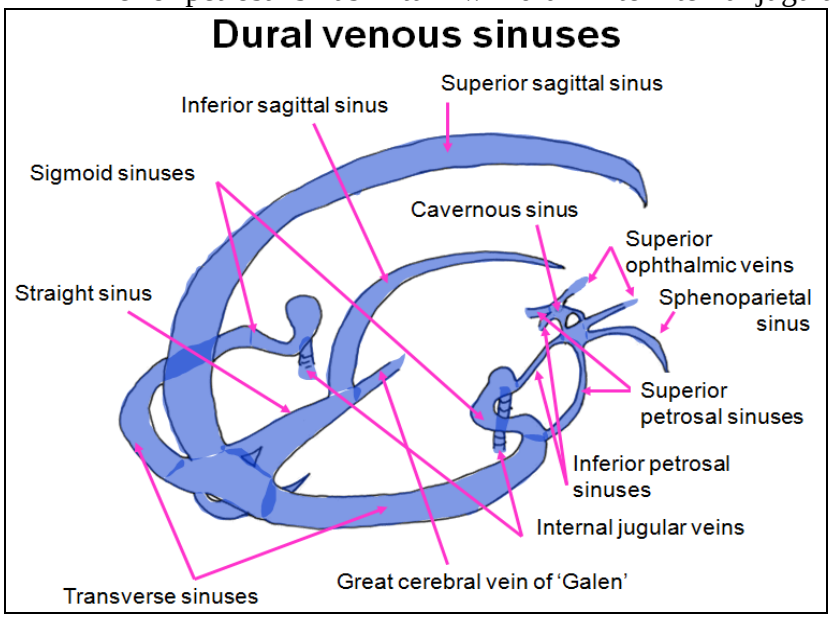
- **Meninges**: are the covers of the brain and spinal cord. They are composed of:
  - **Dura matter.**
  - **Arachenoid matter.**
  - **Pia matter.**
- **Dura matter:**
  - It is the tough outermost covering which is attached to the skull bone.
  - **It is composed of 2 layers:**
    - ✓ Periosteal layer of dura.
    - ✓ Meningeal layer of dura.
      Note: these 2 layers are fused together (except at sites where venous sinuses are present).
  - **Dura matter forms folds which are separating several parts of the brain:**
    - ✓ Falx cerebri:
      - ❖ Which is sickle-shaped and separating the two cerebral hemispheres.
      - ❖ It is starting from crista galli going to internal occipital protuberance.
      - ❖ It contains superior (at attached border) and inferior (at free border) sagittal sinuses. Note that the straight sinus is located at the junction between falx cerebri and tentorium cerebella and it is draining blood from inferior sagittal sinus.
    - ✓ Tentorium cerebelli:
      - ❖ It is separating the forebrain from hindbrain (cerebellum, pons & MO).
      - ❖ Receiving venous blood from falx cerebri sinuses and draining through right and left transverse sinuses → which in turn will drain to the S-shaped sigmoid sinuses and eventually to internal jugular vein in jugular foramen.
    - ✓ Diaphragma sellae: it is covering the pituitary gland and has a hole which permits the passage of pituitary stalk (infundibulum).
    - ✓ Falx cerebelli: it is separating the cerebellar hemispheres from each other.
  - **Inside the dural folds → there are dural venous sinuses.**

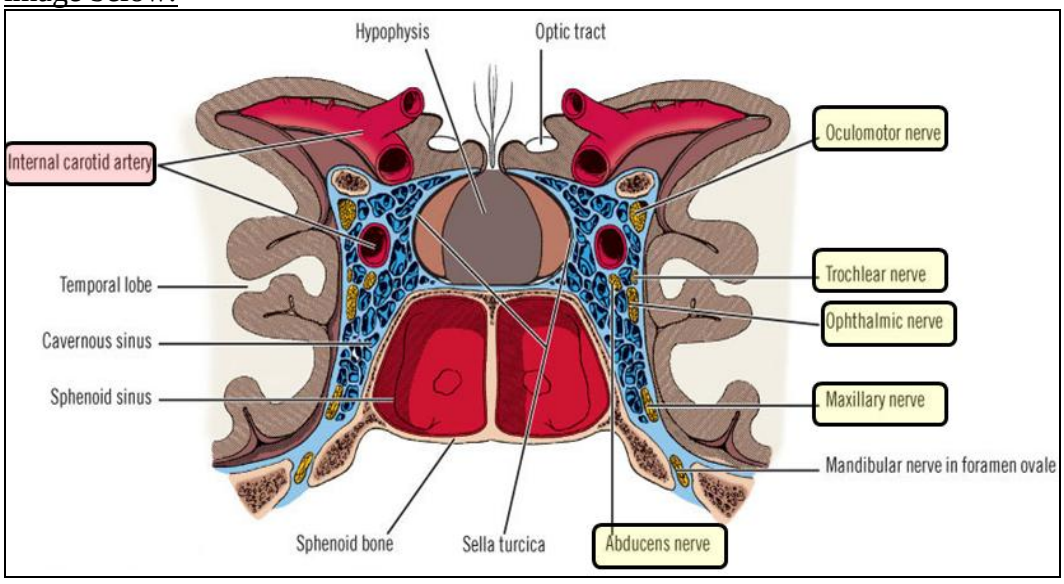


- **Innervation of dura:**
  - ✓ **In anterior cranial fossa + middle cranial fossa** → dura is innervated by ophthalmic and maxillary divisions of trigeminal nerve.
  - ✓ **In posterior cranial fossa** → dura is innervated by the vagus + C1,C2 & C3.

- **Arterial supply of dura:**
  - ✓ **It is supplied by meningeal vessels the most important one being middle meningeal artery (which is a branch of the maxillary artery** → that will enter the skull through foramen spinosum → and then runs in epidural space which is a potential space). Notice that a rupture in middle meningeal artery will result in epidural hematoma → and if surgery will be done → this will be through pterion (serving as a landmark).
- **Subdural space**: it is the potential space between dura matter and arachenoid matter. This space contains bridging veins which connect cerebral blood vessels with dural venous sinuses (notice that rupture of these veins will result in subdural hematoma which is mostly seen with shaken-baby syndrome).
- **Subarachenoid space**: it contains cerebral blood vessels and cerebrospinal fluid (CSF).
- **Cavernous sinus:**
  - ✓ Present on each side of sella turcica.
  - ✓ Receiving drainage from ophthalmic vein and pterygoid plexus of veins.
  - ✓ Intercavernous sinus is connecting the 2 sides of cavernous sinus.
  - ✓ Cavernous sinus will drain blood into superior and inferior petrosal sinuses:
    - ❖ Superior petrosal sinus in turn will drain into sigmoid sinus.
    - ❖ Inferior petrosal sinus in turn will drain into internal jugular vein.



  - ✓ Memorize the internal structures of cavernous sinus which are highlighted in the image below:



- **Ventricular system:**
  - **CSF**: it acts as a cushion to protect the brain and decrease it weight from 1500g (in dry air) to 50g only!.
  - **Lateral ventricles:**
    - ✓ They are mainly present in frontal and parietal lobes.
    - ✓ Lateral ventricle is composed of 3 horns:
      - ❖ An anterior one which is extending to the frontal lobe.
      - ❖ A posterior one which is extending to occipital lobe.
      - ❖ An inferior one which is extending to temporal lobe.
  - **3rd ventricle is in relation with the thalamus and hypothalamus.**
  - **CSF will be produced by choroid plexuses (which are mainly present in lateral and 4th ventricles and composed of specialized epithelial cells called ependyma). Then, this fluid will move from lateral ventricle to 3rd ventricle through foramen of MONRO. From 3rd ventricle, CSF will enter cerebral aqueduct which is present in the midbrain and from there it will move to the 4th ventricle. CSF will exit the 4th ventricle and enter subarachenoid space through foramena LUSCHKA and MEGENDIE.**
    - ✓ Note: blood capillaries in ependyma of choroid plexus are fenestrated (so CSF can leak from them).
    - ✓ CSF daily production: 400-500 ml/day.
  - CSF absorption: occurring in arachenoid granulations/villi which are present in superior sagittal sinus
  - **Blood-brain barrier**: it is composed of continuous blood capillaries (non-fenestrated), foot processes of astrocytes and tight junctions + pericytes.
  - **Blood-CSF barrier**: it composed of fenestrated blood capillaries. Tight junctions are present in ependymal cells themselves.