

# MENINGES AND VENOUS SINUSES

A working knowledge of certain parts of the intracranial compartment is essential for the trauma surgeon. The attachments of the dura influence natural progression of space occupying traumatic collections, explain neurosurgical approaches, and influence CSF leak management

## Meninges

1. Tough outer layer - **Dura mater**
2. Delicate middle layer - **Arachnoid mater**
3. Inner layer firmly adherent to brain - **Pia mater**

## Dura Mater

### OUTER PERIOSTEAL LAYER

- firmly attached to skull
- periosteum
- continuous with periosteum outside skull at foramina

### INNER MENINGEAL LAYER

- close to arachnoid mater
- continuous with dura of spinal cord

The Dura mater needs special consideration as it forms TWO different specialised structures

1. Dural partitions - project inwards and stabilise brain
2. Intracranial venous sinuses

## **Dural Partitions**

These project into the cranial cavity and subdivide it.

### **1. Falx Cerebri**

- crescent shaped
- between two cerebral hemispheres
- anteriorly attached to crista galli and frontal crest
- posteriorly attaches to the tentorium cerebelli

### **2. Tentorium cerebelli**

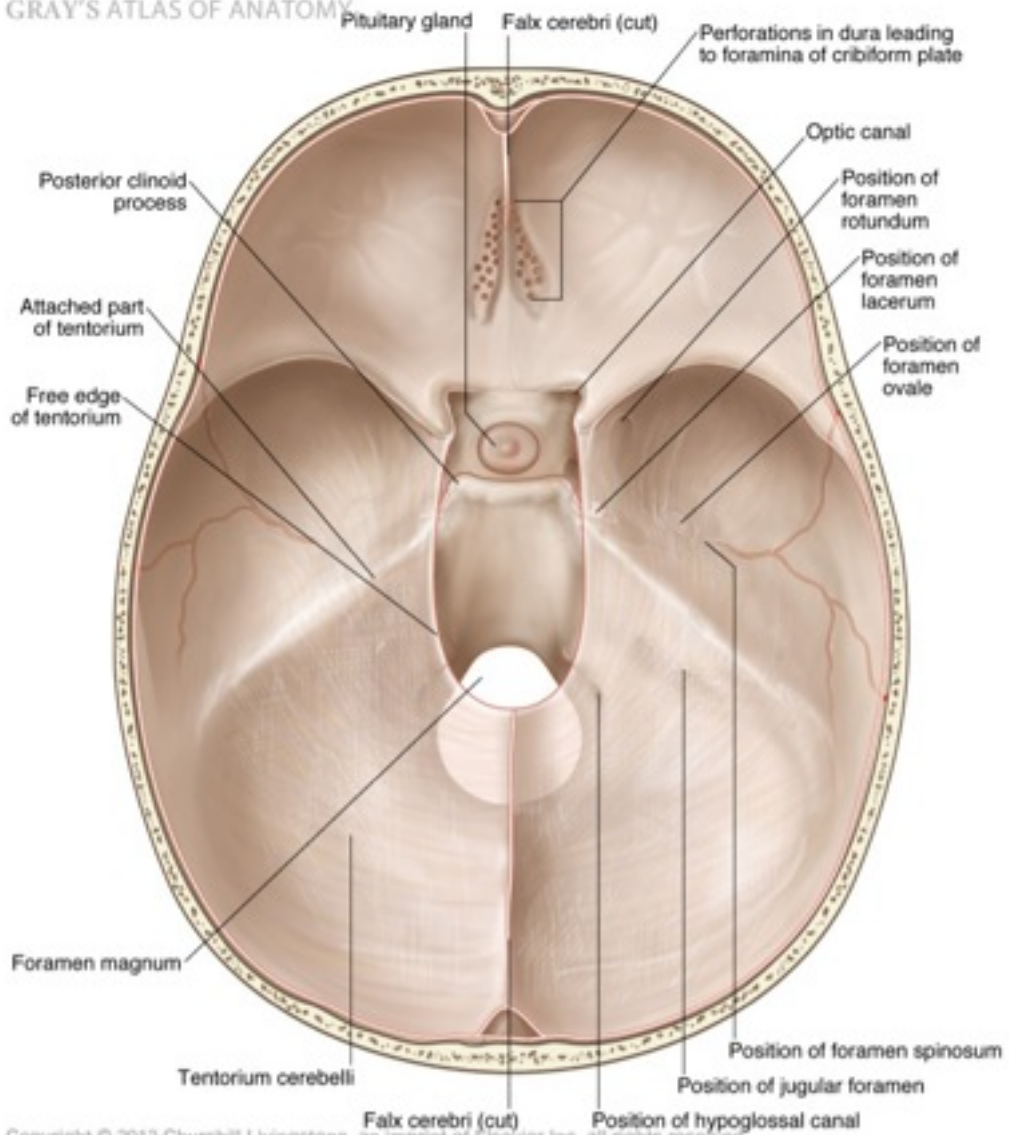
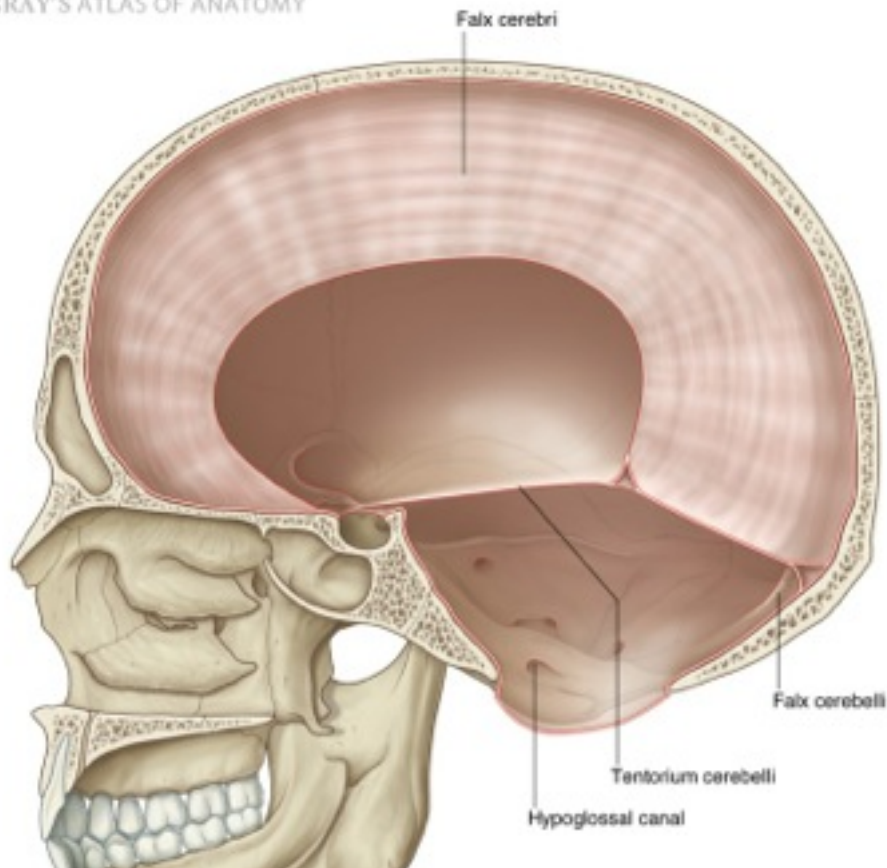
- horizontal projection separating the cerebellum from the posterior part of cerebral hemisphere
- attaches to occipital bone
- superior part of petrous temporal bone
- ends anteriorly at anterior and posterior clinoid process
- anterior and medial borders are free forming the tentorial notch

### **3. Falx cerebelli**

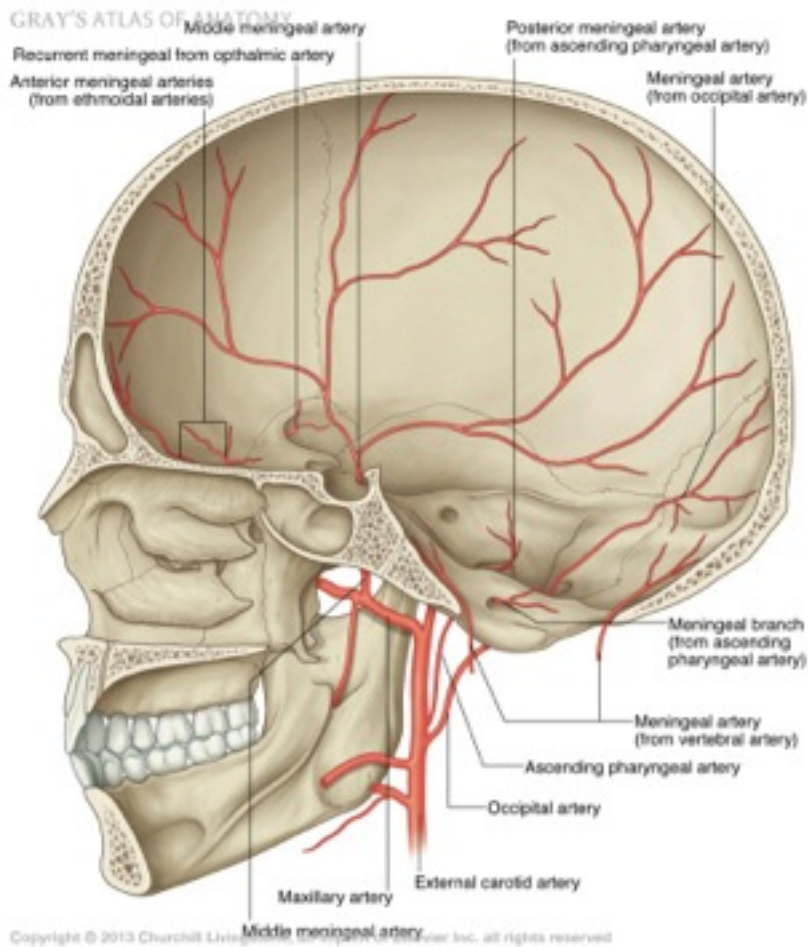
- small midline
- between cerebellar hemispheres
- above to tentorium cerebelli
- inferiorly to occipital bone

### **4. Diaphragma sellae**

- small horizontal shelf
- covers hypophyseal fossa in sella turcica
- small opening in centre where the infundibulum of the pituitary passes



## Arterial supply



- vessels travel in the outer layer of dura
- arteries as shown in the diagram
- of particular significance is the middle meningeal artery - a branch of the first part of the maxillary artery
- enters through foramen spinosum dividing into anterior and posterior branches
- anterior branch passes vertically across pteryion
- posterior branch passes posterosuperiorly to the posterior cranial fossa

- accessory meningeal enters through foramen ovale
- posterior meningeal - terminal branch of ascending pharyngeal through jugular foramen
- branches from occipital artery
- branches from vertebral artery

Nerve supply - all branches of trigeminal - vagus - and C 1-3

## Arachnoid and Pia

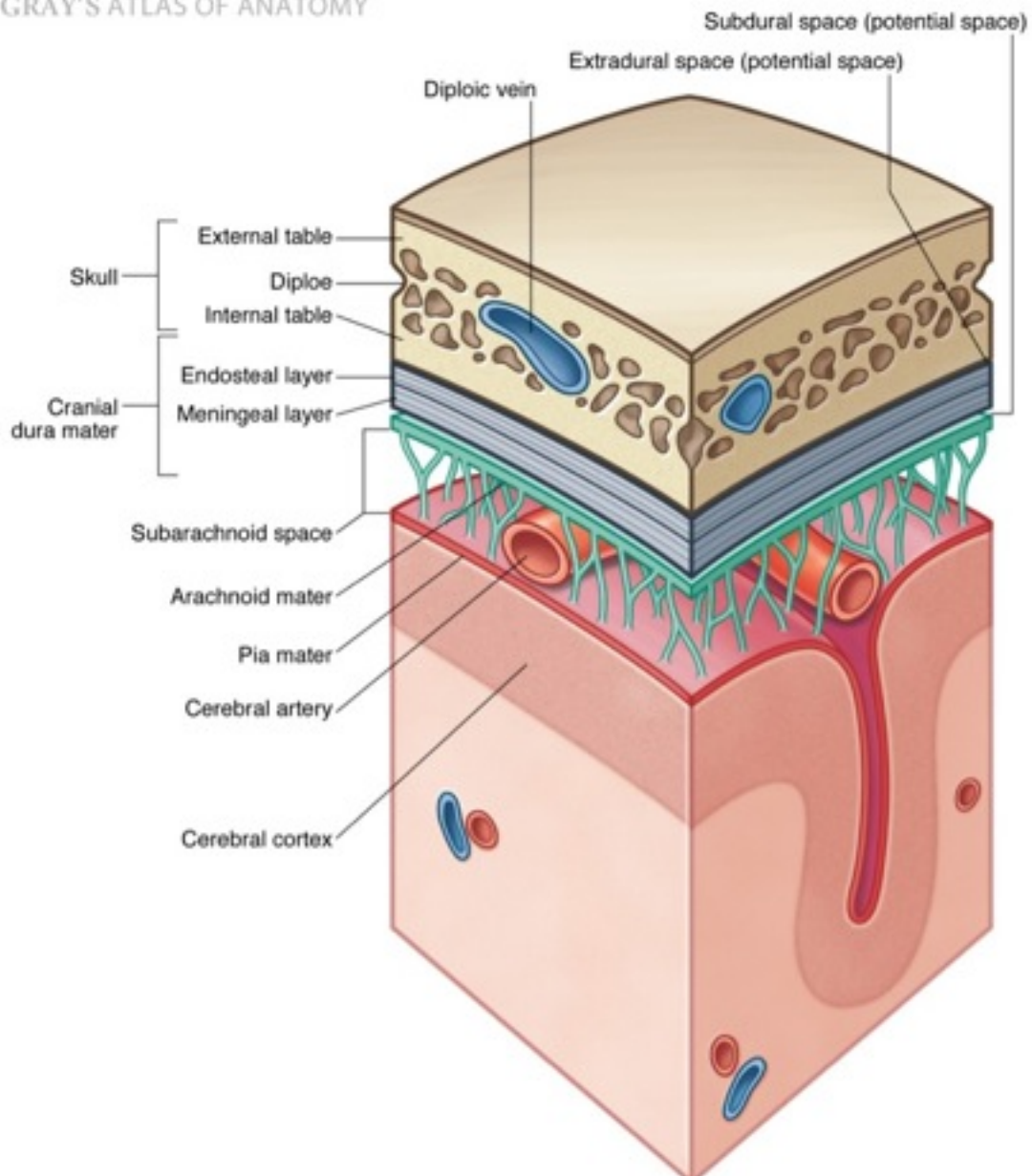
The province of the neurosurgeon

- arachnoid thin, adherent to dura, sends spider branches to pia

- Pia - thin and delicate - covers entire brain

## Spaces

GRAY'S ATLAS OF ANATOMY



### **Extra dural space**

- potential space
- common causation is rupture of an artery
- typically the middle meningeal

### **Subdural space**

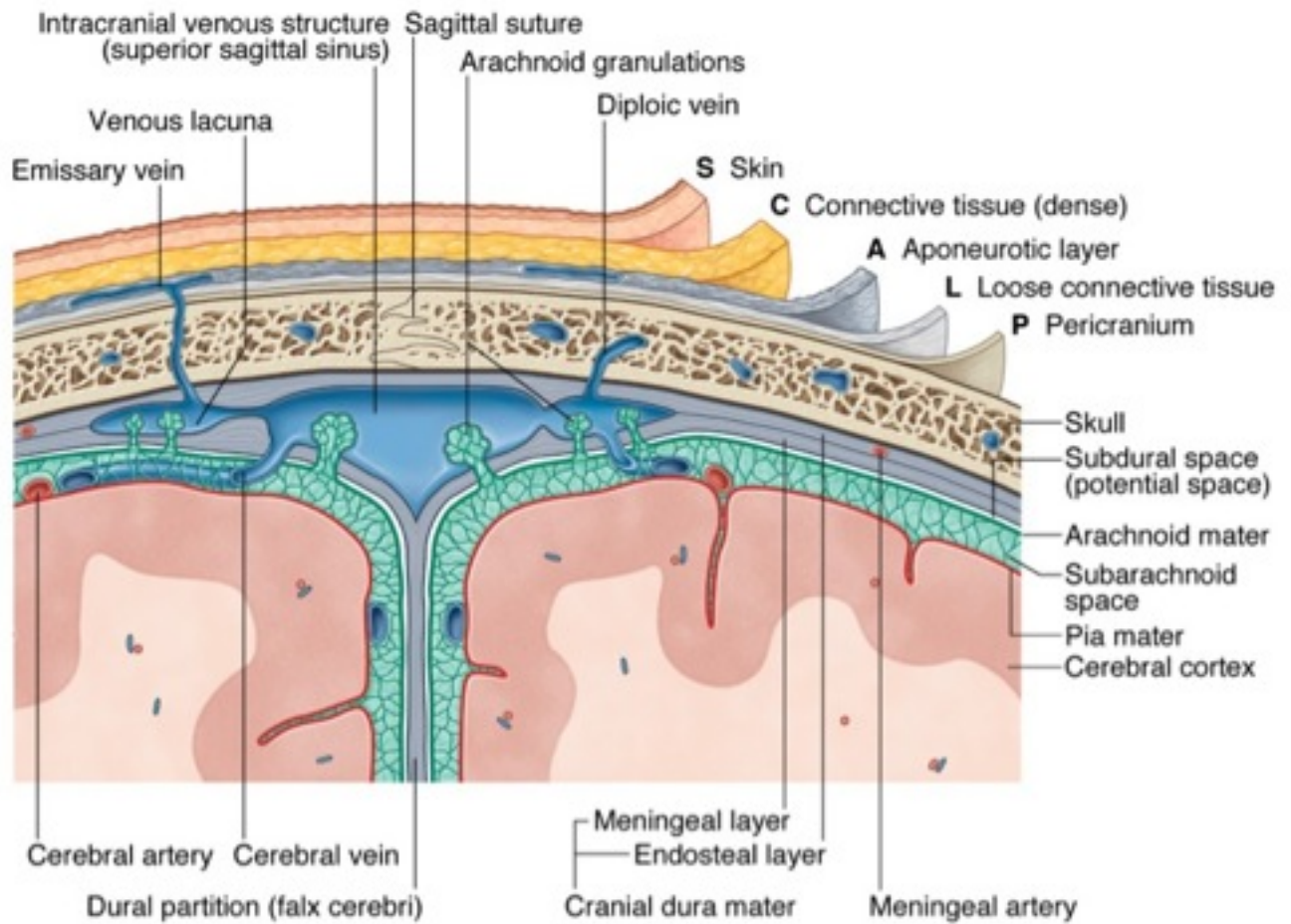
- these are caused by torn venous sinuses

### **Subarachnoid**

- this is the only natural meningeal space
- because the arachnoid hugs the dura mater
- the pia hugs the brain
- this space surrounds the brain and spinal cord
- enlarges into expanded area (subarachnoid cisterns)

### **CSF**

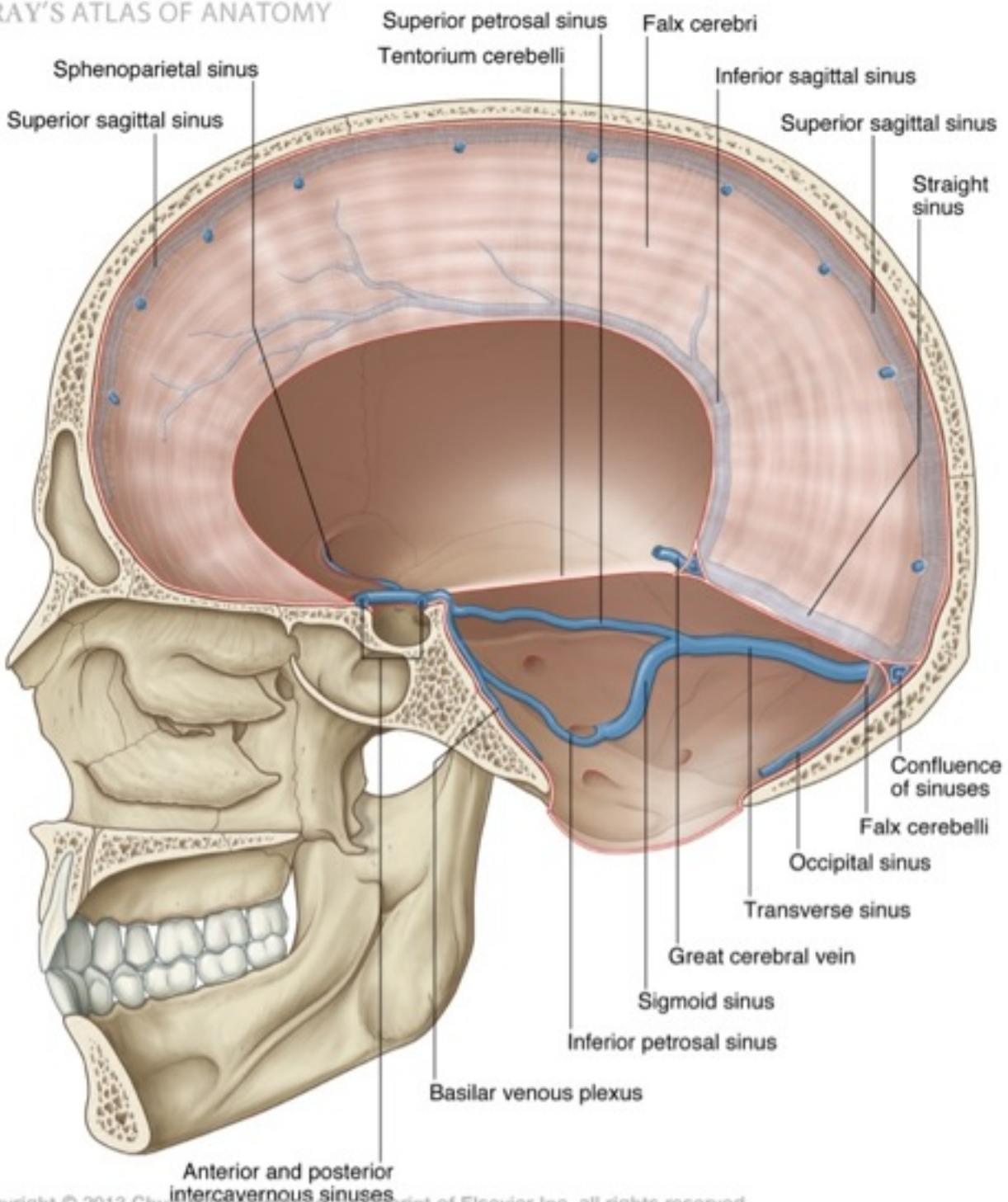
- Formed in the choroid plexus in the ventricles
- clear colourless
- returns to venous system through arachnoid villi in arachnoid granulations into the sagittal sinus



## Venous drainage and venous sinuses

- begins internally as small veins going to larger veins
- ultimately drain into dural venous sinuses
- drain to internal jugular vein
- also feeding in are diploic veins (from the diploea)
- also emissary veins from outside the cranial cavity

GRAY'S ATLAS OF ANATOMY







**Table 3** Dural venous sinuses

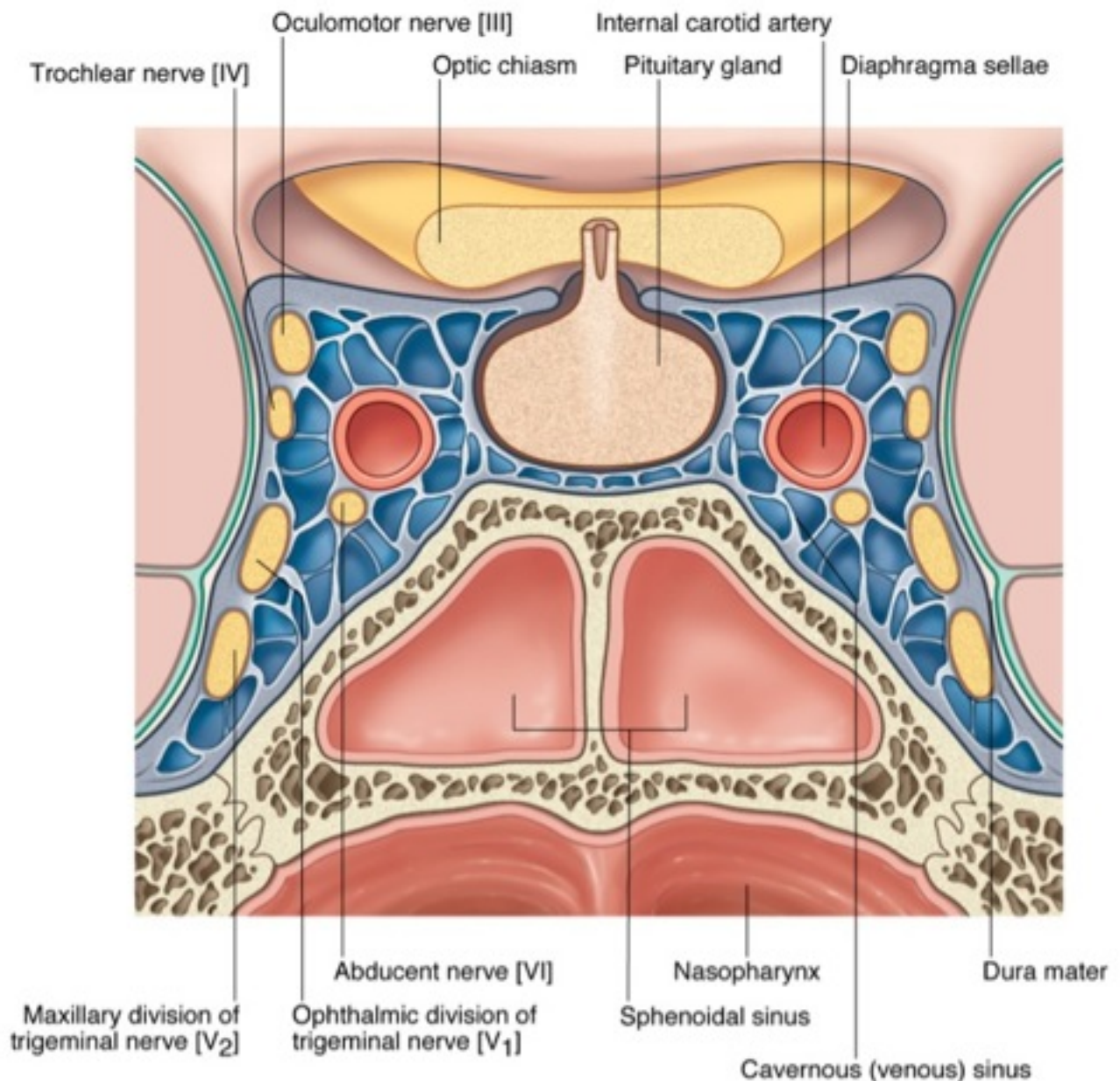
Dural sinus	Location	Receives
Superior sagittal	Superior border of falx cerebri	Superior cerebral, diploic, and emissary veins and CSF
Inferior sagittal	Inferior margin of falx cerebri	A few cerebral veins and veins from the falx cerebri
Straight	Junction of falx cerebri and tentorium cerebelli	Inferior sagittal sinus, great cerebral vein, posterior cerebral veins, superior cerebellar veins, and veins from the falx cerebri
Occipital	In falx cerebelli against occipital bone	Communicates inferiorly with vertebral plexus of veins
Confluence of sinuses	Dilated space at the internal occipital protuberance	Superior sagittal, straight, and occipital sinuses
Transverse (right and left)	Horizontal extensions from the confluence of sinuses along the posterior and lateral attachments of the tentorium cerebelli	Drainage from confluence of sinuses (right—transverse and usually superior sagittal sinuses; left—transverse and usually straight sinuses); also superior petrosal sinus, and inferior cerebral, cerebellar, diploic, and emissary veins
Sigmoid (right and left)	Continuation of transverse sinuses to internal jugular vein; groove of parietal, temporal, and occipital bones	Transverse sinuses, and cerebral, cerebellar, diploic, and emissary veins
Cavernous (paired)	Lateral aspect of body of sphenoid	Cerebral and ophthalmic veins, sphenoparietal sinuses, and emissary veins from pterygoid plexus of veins
Intercavernous	Crossing sella turcica	Interconnect cavernous sinuses
Sphenoparietal (paired)	Inferior surface of lesser wings of sphenoid	Diploic and meningeal veins
Superior petrosal (paired)	Superior margin of petrous part of temporal bone	Cavernous sinus, and cerebral and cerebellar veins
Inferior petrosal (paired)	Groove between petrous part of temporal bone and occipital bone ending in internal jugular vein	Cavernous sinus, cerebellar veins, and veins from the internal ear and brainstem
Basilar	Clivus, just posterior to sella turcica of sphenoid	Connect bilateral inferior petrosal sinuses and communicate with vertebral plexus of veins



## Cavernous Sinus

- sits against lateral aspect of body of sphenoid
- great clinical concern because of what passes through them
- receives from :-
  - cerebral veins
  - ophthalmic veins
  - emissary veins from pterygoid plexus

GRAY'S ATLAS OF ANATOMY



**contents** - passing through

- internal carotid artery
- gray sympathetic rami
- abducent nerve

**contents** - lateral wall superior to inferior

- oculomotor nerve
- trochlear nerve
- ophthalmic nerve
- maxillary nerve

**Superior sagittal sinus**

- very much at risk in a frontal craniotomy
- explain why medial posterior cut is the last one to make
- in superior border of flax cerebra
- begins at foramen cecum
- ends posteriorly in the confluence of sinuses
- receives emissary vein from nose
- receives local veins
- extends laterally in the lateral lacunae
- arachnoid granulations
- bends right to enter the right transverse sinus