COVERINGS OF THE CENTRAL NERVOUS SYSTEM

essa cranii media

Fossa granii from

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Introduction

- The CNS is supported and protected by bone and membranous coverings.
- The brain is located within the cranial cavity of the skull and the spinal cord lies in the vertebral, or spinal, canal within the vertebral column, or spine.
- the brain and spinal cord are invested by three concentric membranous envelopes (dura mater, arachnoid mater and pia mater).



Middle meningeal a. -

Anterior meningeal a. (from anterior ethmoidal a.)





SKULL

• The bones of the skull and the meninges provide protection for the brain.

- The brain lies on the floor of the cranial cavity which consists of three fossae :
 - Anterior cranial fossa
 - Middle cranial fossa
 - Posterior cranial fossa

Anterior Cranial Fossa

- Formed by the frontal, ethmoid and sphenoid bones.
- Contains the frontal lobes of the cerebral hemispheres.
- forms the roof of the orbit and is closely associated with the frontal air sinus.
- The cribiriform plate admits the olfactory nerves to the cranial cavity and accommodated the olfactory bulbs.

Middle Cranial Fossa

• Formed by the sphenoid and temporal bones.

- Contains the temporal lobes. In the midline, the hypophyseal fossa holds the pituitary gland.
- A number of foramina provide entry and exit for important blood vessels and cranial nerves :
- Optic canal (optic nerve, ophthalmic artery),
- Superior orbital fissure (oculomotor, trochlear, abducens and ophthalmic division of trigeminal nerves),
- Foramen rotundum (maxillary division of trigeminal nerves),
- Foramen ovale (mandibular division of trigeminal nerve),
- Foramen spinosum (middle meningeal artery).

Posterior Cranial Fossa

- Formed by the occipital and petrous temporal bones.
- The posterior cranial fossa accommodates the brain stem and cerebellum.
- A number of important structures pass through the foramina of the posterior fossa:
- Foramen magnum (medulla oblongata, vertebral arteries, spinal root of the accessory nerve),
- Hypoglossal canal (hypoglossal nerve),
- Jugular foramen (internal jugular vein, glossopharyngeal, vagus, and accessory nerves),
- Internal auditory meatus (facial and vestibulocochlear nerves).





Cranial Nerve	Foramen of skull
I (olfactory)	cribriform plate
ll (optic)	optic foramen
III (oculomotor)	superior orbital fissure
IV (trochlear)	superior orbital fissure
VI (opthalmic)	superior orbital fissure
V2 (maxillary)	foramen rotundum
V3 (mandibular)	foramen ovale
VI (abducens)	superior orbital fissure
VII (facial)	internal auditory meatus
VIII (vestibulocochlear)	internal auditory meatus
IX (glossopharyngeal)	jugular foramen
X (vagus)	jugular foramen
XI (spinal accessory)	jugular foramen
XII (hypoglossal)	hypoglossal foramen

Foramen cecum	Emissary vein to superior sagittal sinus
Nasal slit	Anterior ethmoidal artery, vein, and nerve
Foramina of cribriform plate	Olfactory nerve bundles
Posterior ethmoidal foramen	Posterior ethmoidal artery, vein, and nerve
Optic canal	-{ Optic nerve (II) Ophthalmic artery
Superior orbital fissure	Coulomotor nerve (III) Trochlear nerve (IV) Lacrimal, frontal, and nasociliary branches of ophthalmic nerve (V1) Abducent nerve (VI) Superior ophthalmic vein
Foramen rotundum	Maxillary nerve (V2)
Foramen ovale	- { Mandibular nerve (V3) Accessory meningeal artery Lesser petrosal nerve (occasionally)
Foramen spinosum	
Sphenoid emissary foramen (of	Vesalius) (inconstant)
Foramen lacerum	
Carotid canal for	- { Internal carotid artery Internal carotid nerve plexus
Hiatus for	Lesser petrosal nerve
Hiatus for	Greater petrosal nerve
Internal acoustic meatus	
External opening of vestibular aqueduct	Endolymphatic duct
Mastoid foramen (inconstant) -	Emissary vein (and occasional branch of occipital artery)
Jugular foramen	Sigmoid sinus Posterior meningeal artery
Condylar canal (inconstant)	
Hypoglossal canal	Hypoglossal nerve (XII)
Foramen magnum	
	The second





Nasopalatine nerve

Greater palatine nerve and vessels ----- Greater palatine foramen Lesser palatine nerve and vessels ----- Lesser palatine foramen Greater petrosal nerve ----- Foramen lacerum

Lesser petrosal nerve Mandibular nerve (V3) Accessory meningeal artery

Middle meningeal vessels } ----- Foramen spinosum Meningeal branch of mandibular nerve (V3)

Internal carotid artery) ----- Carotid canal

Chorda tympani of facial nerve (VII)----- Petrotympanic fissure-

Tympanic branch of glossopharyngeal nerve (IX)----- Tympanic canaliculus – Auricular branch of vagus nerve (X)----- Mastoid canaliculus –

Facial nerve (VII)----- Stylomastoid foramen-

Glossopharyngeal nerve (IX) Vagus nerve (X) Spinal roots of accessory nerves (XI) Internal jugular vein Inferior petrosal sinus

> Mastoid emissary vein Posterior meningeal artery

Hypoglossal nerve (XII)----- Hypoglossal canal

Vertebral arteries and venous plexus Spinal roots of accessory nerves (XI)

CRANIAL MENINGES

- the system of membranes which envelopes the central nervous system.
- The outermost membrane is the dura mater → *meninx fibrosa* or *pachymeninx*
- the middle layer is the arachnoid mater, and the innermost layer is the piamater.
- The arachnoid mater and pia mater → *leptomeninges*

Meningeal Layers

Bone .

Dura

Superior Sagittal Sinus

Dura

Frontal Lobe

Arachnoid

Occipital Lobe

wikipedia.org

Dura Mater Encephali

- The outermost meningeal membrane
- A tough, fibrous membrane that ensheathes the brain like a loose-fitting bag.
- In some regions, such as the floor of the cranial cavity and the midline of the cranial roof, the dura is tightly adherent to the interior surface of the skull, while elsewhere, such as the frontoparietal area, the two are separated by a narrow extradural space.
- It consists of two layers:
- 1. the periosteal layer which lies closest to the calvaria (stratum endosteale/periosteale),
- 2. the inner meningeal layer which lies closer to the brain (stratum meningeale).

BRAIN DURA MATER

wikipedia.org





Dura Mater Encephali (Cont....)

- The dura has areas of infolding which include :
- 1. Falx cerebri, lying between the two cerebral hemispheres,
- 2. **Tentorium cerebelli**, lying between the cerebellum and the occipital lobes of the cerebellum and encircling the midbrain,
- 3. **Falx cerebelli**, vertical infolding; lies inferior to the tentorium cerebelli, separating the cerebellar hemispheres,
- 4. **Diaphragma sellae**, smallest infolding; covers the pituitary gland and sella turcica.
- The dura contains a number of venous sinuses, which are important in the venous drainage of the brain
- Important sinuses lie within the falx cerebri, tentorium cerebelli and on the floor of the cranial cavity



Arachnoid Mater Encephali

- The middle element of the meninges is the arachnoid mater, so named because of its spider web-like appearance.
- A soft, translucent membrane that, like the dura mater, loosely envelops the brain.
- Both the dura and arachnoid surround the brain loosely.
- It is separated from the dura by a narrow subdural space, through which pass veins en route to he dural venous sinuses.

Pia Mater Encephali

The innermost meningeal layer

- Adheres to the surface of the brain, closely following its contours \rightarrow creates a subarachnoid space of variable depth.
- microspically thin, delicate and highly vascular membrane that is closely adherent to the surface of the brain, following all its concavities and convexities.
- Subarachnoid space (between the pia and arachnoid mater)
 Subarachnoid space contains :

filamentous network of connective tissue strands (trabeculae) and is traversed by numerous arteries. Veins.

Cerebrospinal fluid (CSF), which is secreted by the choroid plexus within the cerebral ventricles.



Subarachnoid Cisterns

- Since the arachnoid mater fits loosely round the brain while the pia closely follows its surface contours, the subarachnoid space is of greatly varying depth in different regions.
- Where significant depressions or fissures in the brain are spanned by the arachnoid mater, subarachnoid cisterns are formed.
- A number of subarachnoid cistern:
- I. Cerebellomedullary cistern (Cisterna magna),
- 2. Interpeduncular cistern (Cisterna interpeduncularis),
- 3. Chiasmatic cistern,

- 4. Pontine cistern (Prepontine cistern or cisterna pontis),
- 5. Ambient cistern (Cisterna ambiens),
- 6. Quadrigeminal cistern (of great cerebral brain),
- 7. Cistern of corpus callosum.

Choroid plexus of lateral ventricle (phantom)

Cistern of corpus callosum

Dura mater

Arachnoid

Superior sagittal sinus

Subarachnoid space

Arachnoid granulations

Interventricular foramen (of Monro)

Chiasmatic cistern-

Choroid plexus of 3rd ventricle/

Interpeduncular cistern /

Cerebral aqueduct (of Sylvius)

Prepontine cistern

Lateral aperture (foramen of Luschka)/

Choroid plexus of 4th ventricle/

Dura mater

Arachnoid

Subarachnoid space

Central canal of spinal cord-

Quadrigeminal cistern (of great cerebral vein)

(Posterior) cerebellomedullary cistern

Median aperture (foramen of Magendie)

f. Natters

Dural Venous Sinuses

- The dural mater is considered to be comprised of two layers. These are normally closely adherent to one another but, in certain locations, become separated to enclose blood-filled spaces, the dural venous sinuses.
- Venous blood from the brain flows into the sinuses through a series of venous channels and it turn the sinuses drain principally into the internal jugular vein, through which blood is returned to the general extracranial circulation.

Dural Venous Sinuses

- I.---Superior sagittal sinus
- 2. Inferior sagittal sinus
- 3. Straight sinus
- 4. Sphenoparietal sinus
- 5. Superior petrosal sinus
- 6. Inferior petrosal sinus
- 7. Cavernous sinus
- 8. Anteroir and posterior ntercavernous sinus
- 9. Sigmoid sinus
- 10. Transverse sinus
- 11. Occipital sinus
- Confluence of sinuses









Raised Intracranial Pressure

- A space-occupying lesion is an expanding focal lesion such as a tumour, haematoma or abcess.
- Since the cranial cavity is closed and unyielding, the brain is distorted and displaced downwards, towards the foramen magnum, as the intracranial pressure rises.
- The optic discs are swollen (papilloedema), sign of brain stem dysfunction are found, and coma and death supervene if the pressure is not relieved by neurosurgery (craniotomy).
- The patient complains of headache, vomiting, blurring of vision and drowsiness.

Intracerebral Tumour



Foraminal Syndromes

- The exit foramina of the skull represent sites of potential extrinsic compression of structures running through them, by disorders such as bony deformity and tumours of bone, meninges or blood vessels.
- Example :

Vernet syndrome or jugular foramen syndrome is involvement of the IX, X, and XI cranial nerves with the fracture or by multiple etiologies including trauma or tumor growth. Patients present with difficulty in phonation and aspiration and ipsilateral motor paralysis of the vocal cord, soft palate (curtain sign), superior pharyngeal constrictor, sternocleidomastoid, and trapezius.

• The spinal cord, lower brain stem and the tonsils of the cerebellum are compromised in the foramen magnum syndrome.

Head Trauma

- The skull may be fractured and depressed, tearing brain coverings and the brain itself .
- Displacement and torsion of the brain lead to contusion, tearing of the white matter and bleeding into the brain (intracerebral haematoma)
- Tearing of the middle meningeal artery causes bleeding into the extradural space (extradural haematome).
- Tearing of the veins stretching a cross the subdural space (emissaria vein) causes gradual seepage of blood, collecting to form a chronic subdural haematome with eventual coma.

extradural haematoma

subdural haematoma





Intracerebral haematoma



Meningitis

- Inflammation of the meninges may result from :
- 1. infection with viruses (e.g. lymphocytic choriomeningitis), bacteria (meningococcal and tuberculous meningitis) or other organism.
- 2. chemical reaction to injected contrast medium during neuroradiological procedures
- Signs → febrile and has neck stiffness on attempting to move the head.
- The patient complains of headache, photophobia and vomiting.