Beyin yapıları

- Protected by:
- Skull
- Liquid: meninges, CSF
- Blood-brain barrier:
  - tight controls over what enters the brain from the blood
  - due to tighter junctions and…?!
The Ventricular System of the Human Brain

- Right Lateral Ventricle
- Left Lateral Ventricle
- Central Part of Left Lateral Ventricle
- Third Ventricle
- Cerebral Aqueduct
- Choroid Plexus
- Fourth Ventricle
- Central Canal

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CNS - covered by dura. Integrates internal & external sensory input to produce motor or glandular output.
Ventricles

Isometric View

Anterior View

Lateral View
• Dura is tough & collagenous & blends with the periosteum of the skull
• Cobwebby arachnoid lies deep to the subdural space
• Space between arachnoid & pia is the subarachnoid space through which flows cerebrospinal fluid
• Pia is vascular & is adjacent to the glia limitans formed by astrocyte foot processes
Dura Mater

- Superior sagittal sinus
- Straight sinus
- Tentorium cerebelli
- Crista galli of the ethmoid bone
- Cavernous sinus
- Internal carotid artery
- Falx cerebri
- Falx cerebelli
Connective tissue meninges envelope the cord & brain.
Dura mater
Arachnoid mater
Pia mater
Pia & arachnoid together are called the leptomeninges. The dura is called the pachymeninx.
Meninksler (s. meninx)

MSS’in dış yüzünde konnektif dokudan oluşmuş üç memran bulunur: dura mater, arachnoid mater, and pia mater

Fonksiyonları:

MSS’ni sarar ve onu korur
Kan damarlarını korur ve venous sinusleri enclose
SSS içerir
Kafatası içerisinde partitions oluşturur.
Meninges
Dura Mater

Meninksler, 2 fibröz CT İtabakadan oluşmuştur. Bu tabakalar birbirlerinden beynin belirli bölgelerinde ayrılarak Dural sinusleri oluştururlar. Bu sinüsler de beyninden venöz kanı toplarlar.

3 dural septa beynin aşırı hareketlerini sınırlar
Falx cerebri – longitudinal fissur’ün içlerine dips dural kıvrım
- Falx cerebelli – serebellum’un vermisi boyunca uzanır
- Tentorium cerebelli – transvers fissure içine uzanan horizontal kıvrımdır
Arachnoid Mater

Dura mater'den subdural aralık ile ayrılır (Dar seröz boşluk)

Beneath the arachnoid geniş subarachnoid space bulunur ve burası SSS ile doludur, büyük kan damarlarını içerir

Arachnoid villi protrude superiorly ve SSS venöz kana absorbe edilmesinİsağlar
Pia Mater

En derinde yer alır – ince ve hassastır beyne yapışık olarak tüm kivrilmalarını takip eder
Serebrospinal Sıvı (SSS)

Watery, similar in composition to blood plasma, but contains less protein and different ion concentrations than plasma

Forms a liquid cushion that gives buoyancy to the CNS organs, prevents the brain from crushing under its own weight

Protects the CNS from blows and other trauma

Nourishes the brain and may carry chemical signals from one part of the brain to another
Choroid Plexus

Clusters of interwoven capillaries in each ventricle between the pia mater and a layer of ependymal cells.

Iyon pompaları ile SSS iyon konsantrasyonlarını değiştirir.
Artıkların atılımını sağlayarak SSS’ın temizlenmesine yardımcı olur.
Circulation of CSF

Superior sagittal sinus
Superior cerebral vein
Choroid plexus
Cerebrum covered with pia mater
Septum pellucidum
Corpus callosum
Interventricular foramen
Third ventricle
Pituitary gland

Arachnoid villus
Subarachnoid space
Arachnoid mater
Meningeal dura mater
Periosteal dura mater
Great cerebral vein
Tentorium cerebelli
Straight sinus
Confluence of sinuses
Cerebellum
Choroid plexus
Cerebral vessels that supply choroid plexus
Central canal of spinal cord
Spinal dura mater (dural sheath)
Inferior end of spinal cord
Filum terminale (inferior end of pia mater)
Blood-Brain Barrier

Protective mechanism that helps maintain a stable environment for the brain

Bloodborne substances in brain capillaries are separated from neurons by:

- Continuous endothelium of capillary walls
- Relatively thick basal lamina
- Bulbous feet of astrocytes

Least permeable capillaries in the body due to the nature of the tight junctions between endothelial cells
Blood-Brain Barrier: Functions

Selective barrier that allows nutrients to pass freely
Is ineffective against substances that can diffuse through plasma membranes (fats, gases, alcohol)
Absent in some areas (vomiting center and the hypothalamus), allowing these areas to monitor the chemical composition of the blood
Cerebrospinal fluid (CSF)
CSF

- Clear & Salty (NaCl 0.9%)
- Constant environment
- Nutrients and waste products
- Protection
Blood Brain Barrier = BBB

- Capillary endothelium (tight junctions)
  - morphology
  - disrupted in malignant tumours

- Choroid plexus epithelium
  - production site CSF

- Arachnoid villi
  - Absorption CSF
CSF data

• Production:
  – CSF ultrafiltration of plasma, active excretion Na/K pump

• Amount production:
  – 20 ml/hr = 500 ml/24hr

• Circulating Volume:
  – 150 ml

• Replacement:
  – 3 - 4 x per 24 hrs
Ventricles I-IV
Plexus Choroideus & Foramen of Monroe
Cerebrospinal fluid

arachnoid villi
Are extensions of the subarachnoid space which project into the...

superior sagittal sinus

This space is found between the two layers of the dura. It is filled with venous blood.

CSF passes through the arachnoid villi and is mixes with the venous blood of the sinus and is returned to circulation. The sinus eventually drains into the jugular veins and then to the heart.
Circulation of CSF
Cerebrospinal fluid

Function

shock absorber

The CSF surrounds the brain and the cord; it creates a watery cushion to absorb the normal shocks of everyday life.

nutrients delivery

Glucose, oxygen, some amino acids are carried in CSF and delivered to neural tissues.

removal of wastes

Carbon dioxide and waste products of normal metabolism and cell breakdown are removed by CSF.
hydrocephalus

Or “water on the brain”.

If there is an over production of CSF or if CSF is not drained properly, then fluid pressure within the ventricles of the brain can increase substantially.

The increased pressure will compress neural tissue and this will lead to brain damage and, in some extreme cases, death.

Causes of hydrocephalus may include blockage of the cerebral aqueduct, in which case the CSF accumulates in the lateral and forth ventricles.

A hydrocephalic shunt may have to implanted to relieve the pressure.
Blood supply of brain

The brain requires a constant and steady supply of blood (with oxygen and glucose.) It receives about 15% of the total cardiac output.

**Interruption**

Even a short interruption can cause the loss of function; a drop in BP can lead to dizziness and blackouts.

**Unconsciousness**

If the supply is blocked for longer than 5-10 seconds unconsciousness will follow.

permanent injury
...can occur if there is lack of blood for longer than a few minutes (5 minutes). This will result in massive brain injury and/or death.

**Blood brain barrier (BBB)**

The BBB is a selective barrier which prevents the certain materials from passing into the sensitive cerebral tissues.

selective barrier to ions
Slightly permeable to Na+, K+, Cl-.
Very permeable to oxygen, carbon dioxide, water, alcohol, and most anesthetics.
Not permeable to blood proteins and non-lipid organic molecules.
Coverings

cranial meninges
Similar to the spinal meninges.

dura mater
The cranial version has two layers
   outer- periosteal layer
   ...adheres to the cranium
   inner- meningeal layer
   ...sits next to the subdural space and the arachnoid.

Between the two layers is a dural sinus which contains venous blood.
Coverings

Arachnoid

Pia mater

These layers are similar to their spinal versions.
Cerebrospinal fluid

arachnoid villi

Are extensions of the subarachnoid space which project into the ...

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CSF Diagnostics

- **Information:**
  - Intracranial Pressure (ICP)
    - normal 5-15 cm liquor
    - pressure change: Queckenstedt
  - Composition CSF
    - protein tumour/bleeding
    - sugar infection
    - ery’s bleeding (SAB)
    - leuco’s infection
    - Gamma glob MS
  - Micro-organisms
CSF diagnostics

- **Safety:**
  - Coning
  - Check optic nerve Papils

- **Methods:**
  - Ventriicle punction
    - burr hole: External drainage
    - via fontanel: neonates
  - Lumbar punction (LP)
    - underneath level of myelum
    - at level of cauda equina (L2-S1)
Hydrocephalus

• A syndrome, or sign, resulting from disturbances in the dynamics of cerebrospinal fluid (CSF), which may be caused by several diseases.
Hydrocephalus
Hydrocephalus: etiology

- Too much production CSF:
  - rare: plexuspapilloma

- Insufficient resorption CSF:
  - frequent: meningitis

- Circulation disturbance = Obstruction:
  - frequent: tumour

- Combination:
  - probable: bleeding?
Patofizyoloji

- **CSF is formed by two mechanisms:**
  - Secretion by the choroid plexus,
  - Lymphatic-like drainage by the extracellular fluid in brain.

CSF circulates thru ventricular system and is absorbed within subarachnoid spaces by unknown mechanism.
Diagnostics Hydrocephalus
VP shunt

- Used in neonates and young infants
- Greater allowance for excess tubing; which minimizes number of revisions needed as child grows
VP/VA-Shunt
Endoscopical III ventriculocisterno stomy
**Therapy Hydrocephalus: depends on etiology**

- **Obstructive:**
  - Endoscopic III ventriculo-cisternostomy
  - Relief of obstruction
  - Shunt

- **Disturbed Resorption:**
  - Shunt
    - VP-shunt
    - VA-shunt
    - LP-shunt
SPINA BIFIDA

- Neural Tube defektleri kongenital anomalilerinen büyük gurubu oluşturur.

- Failure of neural tube to close produces defects of either entire neural tube or small areas.
SPINA BIFIDA