Meninges, Ventricles and CSF

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Meninges
- Role to support brain, SC, and its blood vessels
- 3 layers
  - periosteum (peri, close, osteum, bone)
  - dura mater (“tough mother” protects and supports the brain and SC; follows the bone contours)
  - arachnoid (like spider web; connects the dura to the pia, contains CSF and suspends blood vessels)
  - pia (“tender” a fine membrane fused to the arachnoid, follows the brain contours, often referred to together as the “pia-arachnoid”)

Dura
- sometimes referred to as the “pachymeninx” (thick, c.f. pachyderm)
- In the vertebrae a tube containing the spinal cord
- fused to periosteum in the cranium
- epidural and subdural are only potential spaces in the cranium
- dural reflections are important for support and clinically for displacement by “space occupying lesions” (cancer, blood clot from a bleed etc.)

Arachnoid Villus

does NOT follow all the contours of the brain
Follows the skull

Dural reflections
- falx cerebri (falx = sickle)
- tentorium cerebelli (tent over the cerebellum!)
  - (Doctors may say in their notes that a patient’s problems are “supra-tentorial”, particularly after an iatrogenic episode….look that up in a dictionary)
  - revise the gross anatomy of the interior of the skull

Dural innervation
- innervated by the V, X, C1 and spinal nerves, very sensitive to stretch
- migraine and other “pulsatile” headaches may be due to localised stretching of the dura over blood vessels.
- dural sinus pain is often referred to the temple

Venous Sinuses
- often asymmetric
- only place where dura “splits” intradurally
- sagittal
- straight
- sigmoid
- transverse

Pia-arachnoid
- sometimes referred to as the “leptomeninges” (lepto=thin)
- mesodermal
- vascular (arteries and veins have a “sleeve” of pia)
- follow the brain contours exactly
- denticulate ligaments supporting the SC come from the pia to the dura
- may be the “blood brain” barrier

Ventricles and Cisterns
 Internal and External Spaces

“Cisterns”
- subarachnoid cisterns form where pia follows brain and arachnoid remains attached to the dura thus areas where dura does not follow the brain form “cisterns” full of CSF
- cerebellomedullary cistern (cisternae magna)
- pontine
- interpeduncular
- optic chiasm
- lamina terminalis
- superior cistern (of great vein of Galen)
- lateral fissure
- lumbar cistern of SC L2 - S2 (important for epidural anaesthesia)
Epidural anaesthesia & lumbar puncture

Choroid Plexus produces CSF
- Supportive role
- Why so constant? A metabolic role too?
- A route for neuroactive hormones to spread?
- A “sink” for substances produced by the brain
- In equilibrium with the intracellular spaces?

CSF Circulation
- Low in cells and protein
- NOT simply a plasma exudate
- Choroid plexus like the kidney, both secretes and absorbs, makes at least half the CSF - rest from the brain
- Replaced 3 times a day
- CSF low in Ca and K, high in Mg and Cl
- Very stable compared to plasma levels
- Secretion an energy requiring process

Hydrocephaly
- Communicating
  - Overproduction - papilloma tumour of the plexus.
  - More rarely - poor absorption - obstruction of superior sagittal sinus or congenital absence of arachnoid villi

Hydrocephaly
- Non-communicating
  - Blockage of interventricular foramina
    - Trauma
    - Congenital
    - Meningitis
    - Diagnosis by ultrasound, CAT or MRI (pneumoencephaly now rare).
    - Treatment by surgery

MRI showing the ventricles
- Magnetic Resonance Imaging
  - Lateral Ventricle