Spinal CSF Leaks and Intracranial Hypotension

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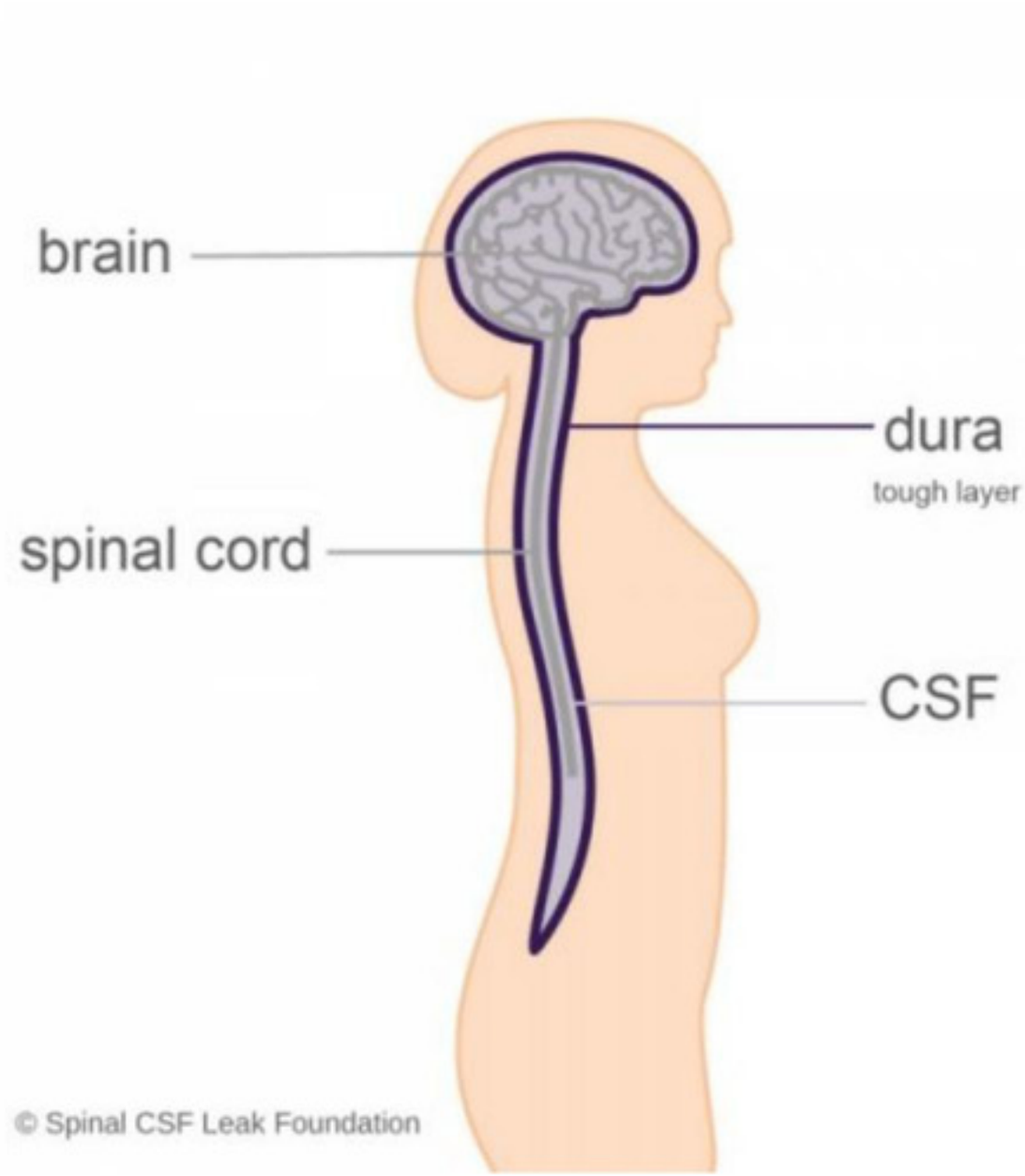


Definitions

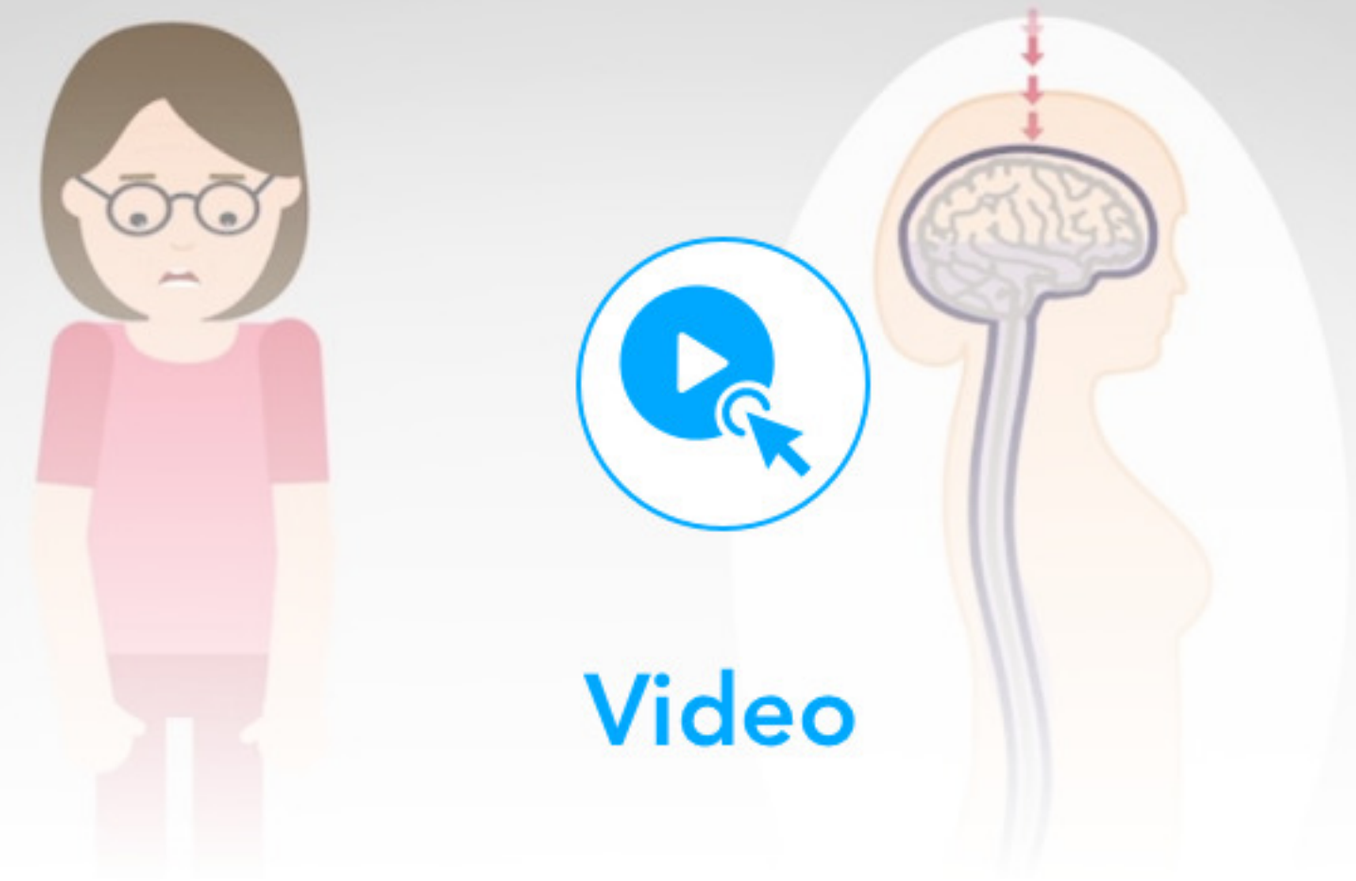
CSF = cerebrospinal fluid

Meninges = the layers of tissue covering the brain and spinal cord

Dura = the tough outer membrane of the meninges

Intracranial = inside of the skull

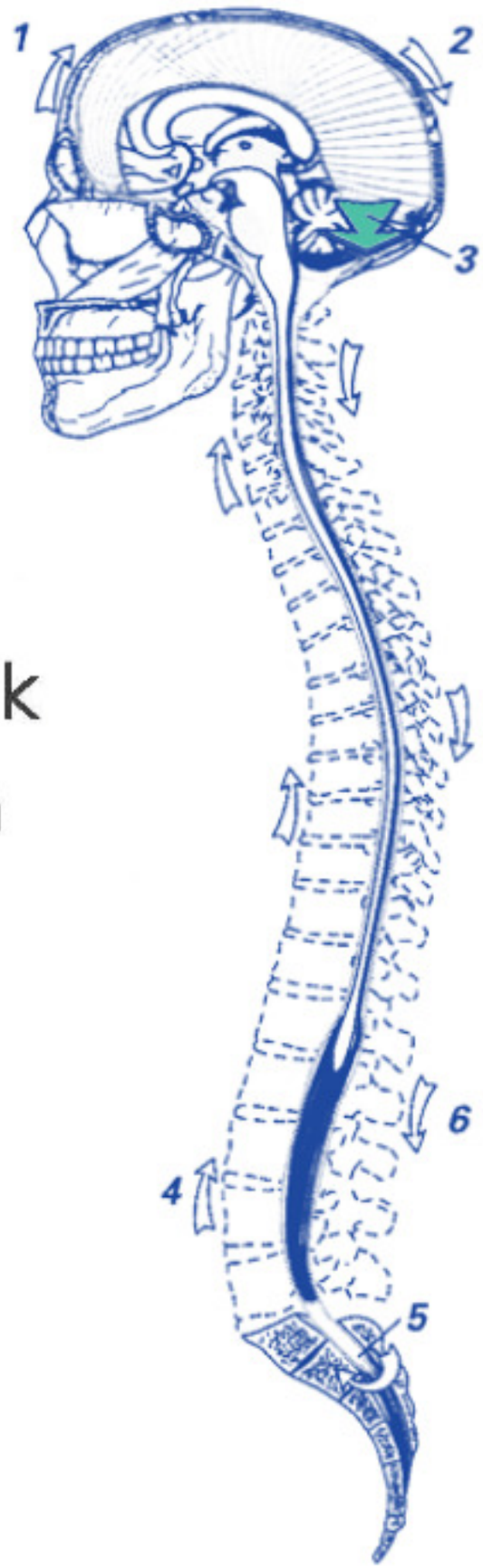
Hypotension = low pressure



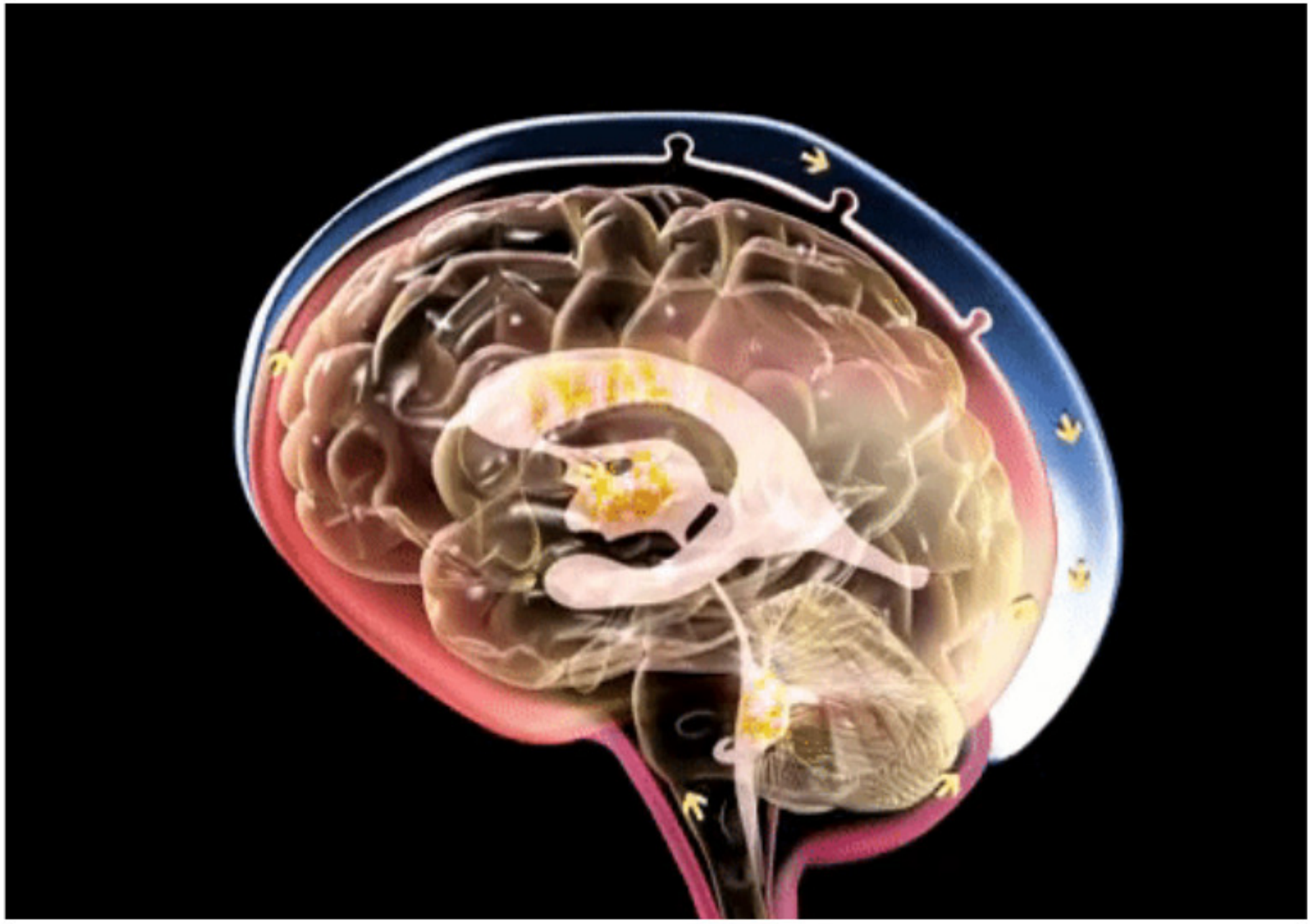
Upright Headache - my spinal CSF leak

Background

- CSF surrounds the brain and spinal cord
  - The brain should float in CSF
- Fluid volume is lost as a result of a CSF leak
  - Sagging of the brain causes compression on lower brain structures
- CURABLE cause of headache and cognitive disturbance
- Often misdiagnosed



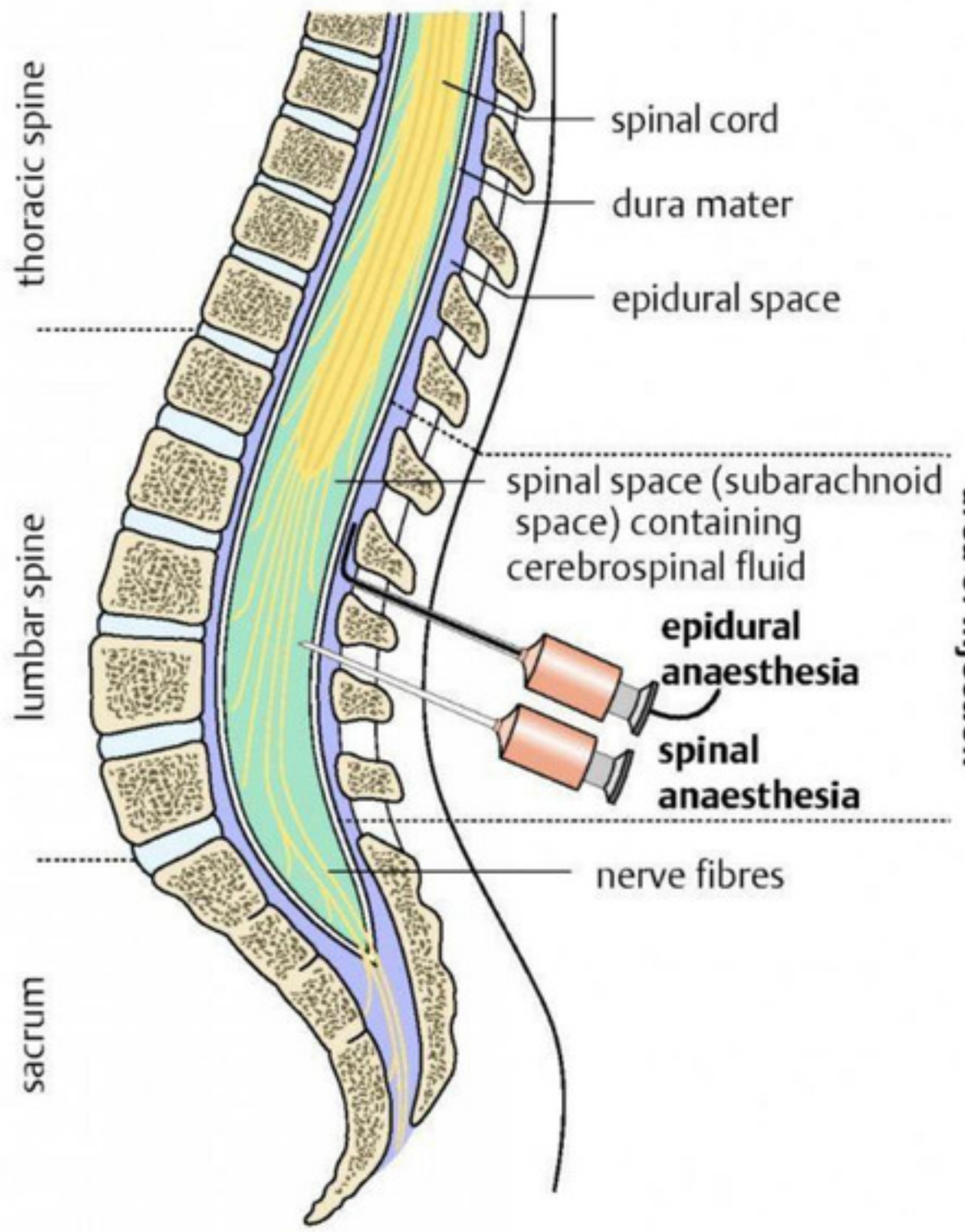
CSF Flow in the Brain



Types of CSF leaks

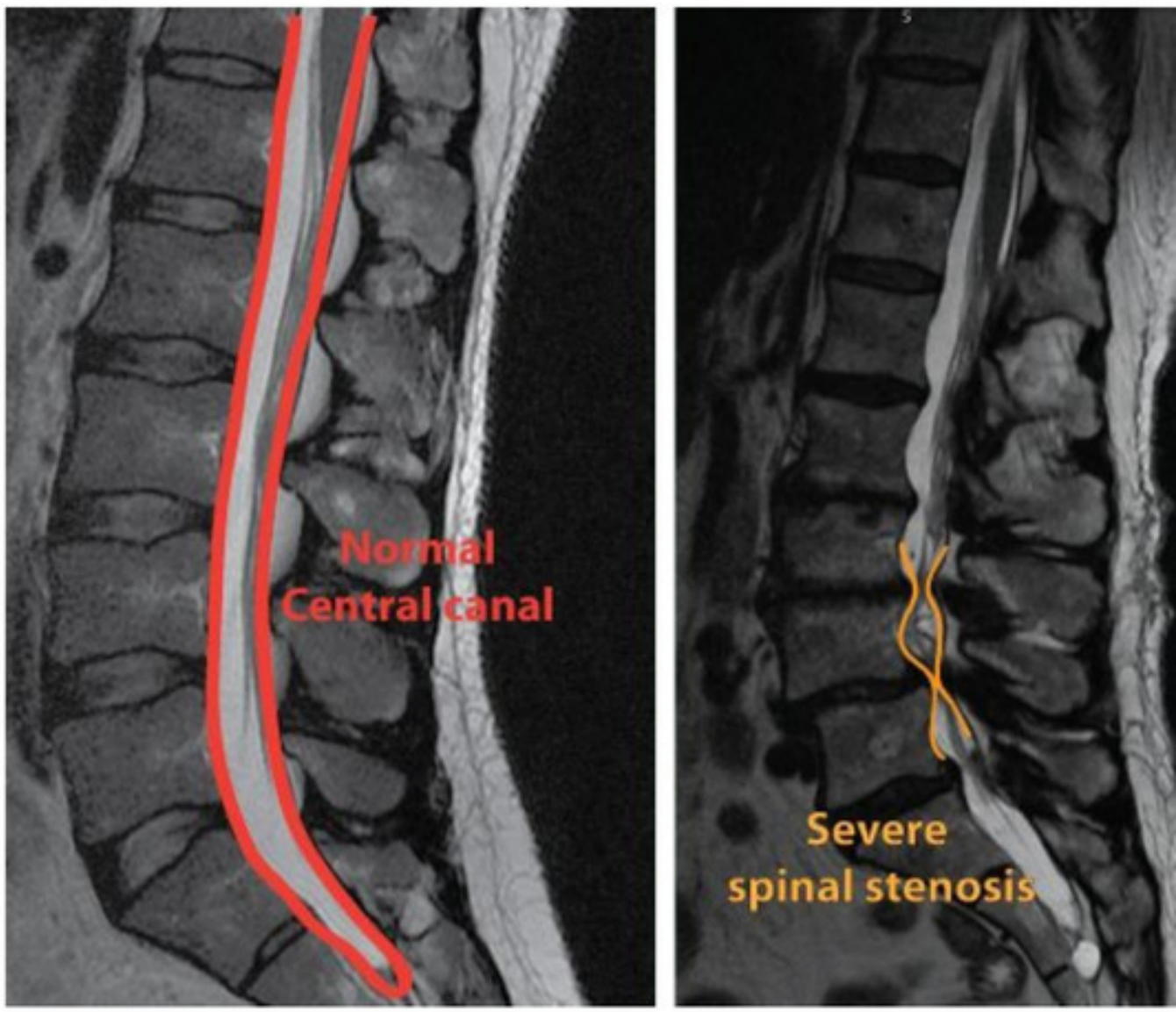
1. Iatrogenic
   - d/t medical procedure (surgery, spinal anesthesia)
   - shunt over-drainage

2. Traumatic
   - Whiplash, high impact



Types of CSF leaks

3. Spontaneous
   - d/t spinal pathology such as calcified disc, osteophyte
   - Possible underlying connective tissue d/o
   - Under-recognized



Poll

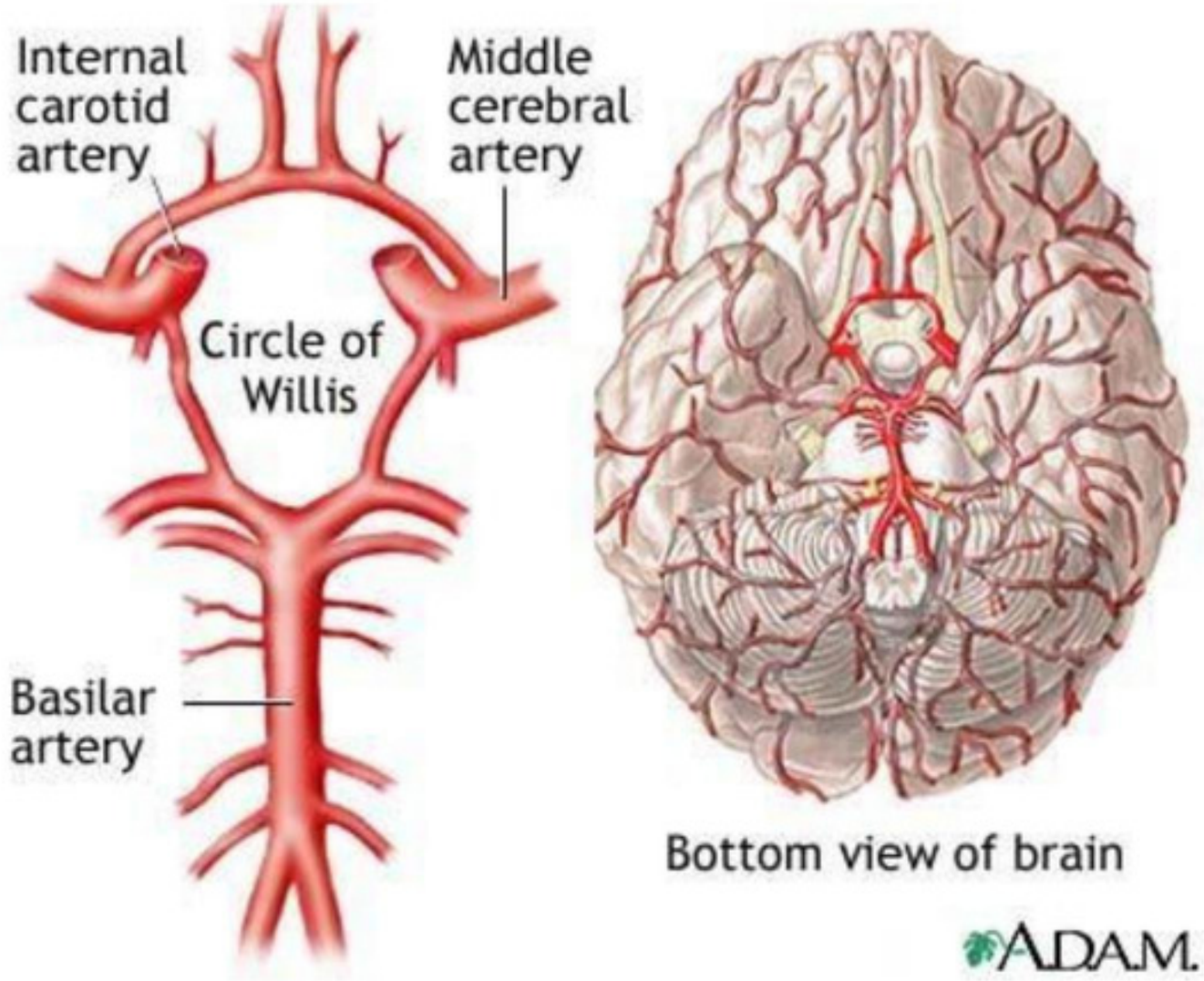
Check for understanding: which type of CSF leak is most common?

- iatrogenic (due to a medical procedure)
- traumatic
- spontaneous

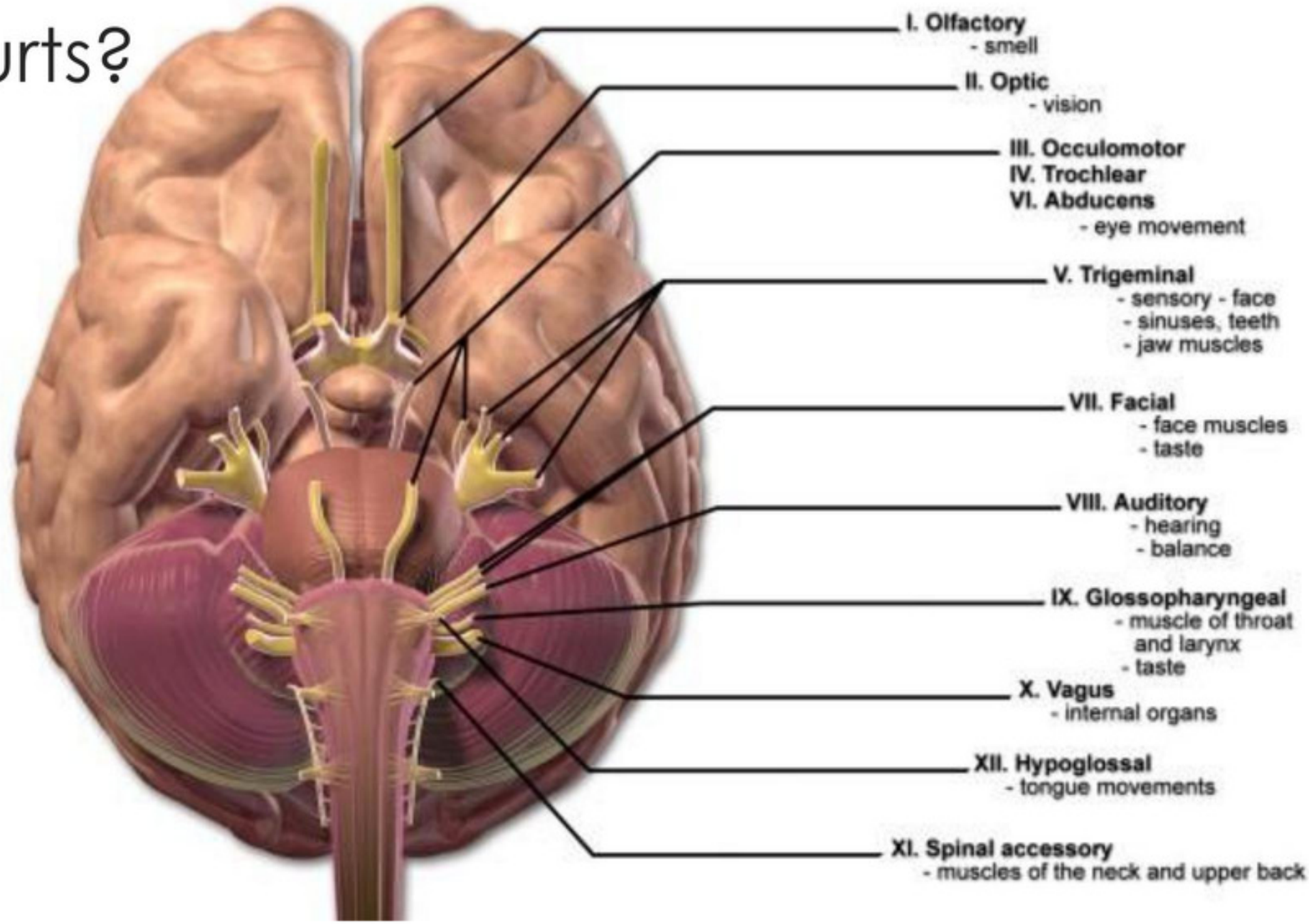
What Hurts?

Pain Sensitive

- **Arteries** near circle of Willis
- intracranial **venous sinuses**
- Lower **dura** and dural arteries
- **cranial nerves** (optic, oculomotor, vagus, glossopharyngeal, trigeminal)



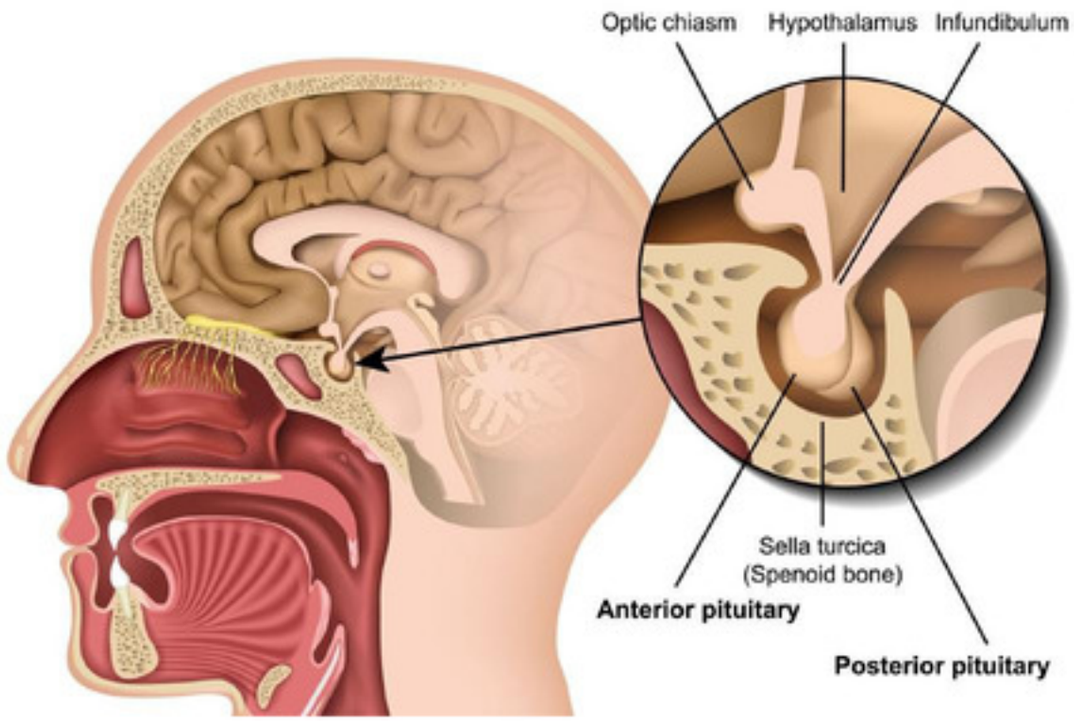
What Hurts?

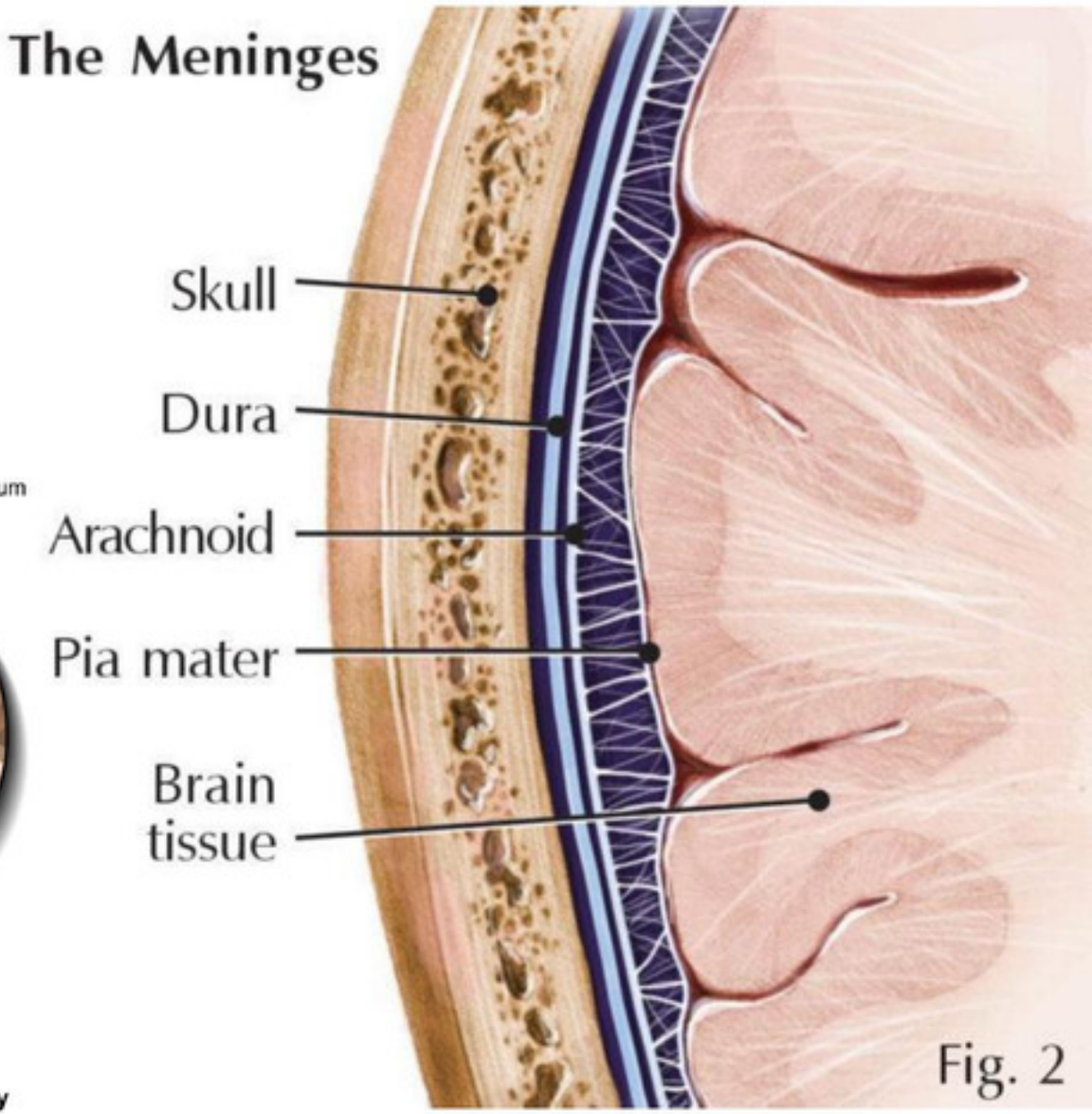

I. Olfactory
- smell
II. Optic
- vision
III. Occulomotor
IV. Trochlear
VI. Abducens
- eye movement
V. Trigeminal
- sensory - face
- sinuses, teeth
- jaw muscles
VII. Facial
- face muscles
- taste
VIII. Auditory
- hearing
- balance
IX. Glossopharyngeal
- muscle of throat and larynx
- taste
X. Vagus
- internal organs
XII. Hypoglossal
- tongue movements
XI. Spinal accessory
- muscles of the neck and upper back

What Doesn't Hurt?

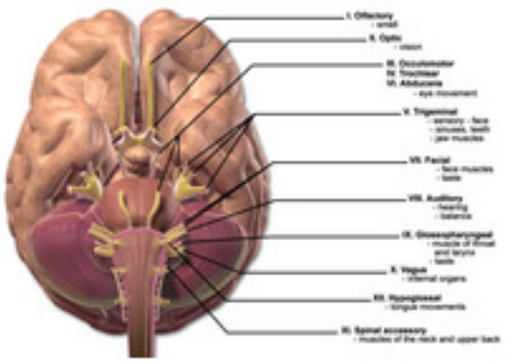
Pain Insensitive

- Arachnoid /Pia
- Skull base
- Brain tissue
- Choroid plexus
- Pituitary





Open Ended Question



Now that we know what areas of the brain are affected, what types of symptoms would we expect to see?

Please enter your answer here.

Signs/ symptoms

Common Symptoms

- positional headache
- interscapular pain
- impaired balance
- Sensitivity to light and sound
- cognition changes(brain fog)
- change in hearing (muffled, tinnitus, popping, cracking)
- neck pain or stiffness
- dizziness
- arm pain or numbness
- nausea and vomiting

Signs/ symptoms (continued)

Less Common Symptoms

- Visual changes
- Facial numbness or pain
- Changes in taste
- Pain/ numbness below arm
- Menstrual cycle and hormonal changes
- Tachycardia
- Fatigue

Signs/ symptoms (continued)

Rare Complications

- Quadriplegia
- Dementia
- Parkinsonism
- Ataxia/ tremor
- Dysautonomia
- Syrinx
- Cerebral vasoconstriction
- Stroke
- Stupor / coma
- Death

Poll

CSF will follow the rules of gravity, which is why symptoms get worse as the person stays upright. Knowing this, when do you think patients are likely to experience worsening symptoms?

- in the morning
- during sleep
- in the afternoon/ evening

Think CSF leak if…

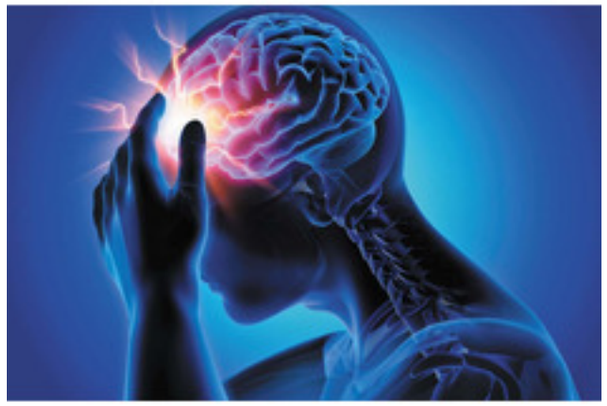
- Evidence of Heritable connective tissue disorder
  - joint hypermobility
  - heart valve issues
  - scoliosis/ known spinal problems
  - atrophic scars
  - tall stature
  - easy bruising
- Atypical Neurologic Findings
  - involvement of cranial nerves
  - gait disturbance
  - exam may be entirely normal
  - cognitive changes
  - Sensory and motor changes

Clinical Mimics

- Dementia/ AD
- Parkinson Disease
  - Movement disorders
- Migraine
- POTS

What do you think?

Open Ended Question



What do you think are some common misdiagnoses?

Please enter your answer here.

Key Points

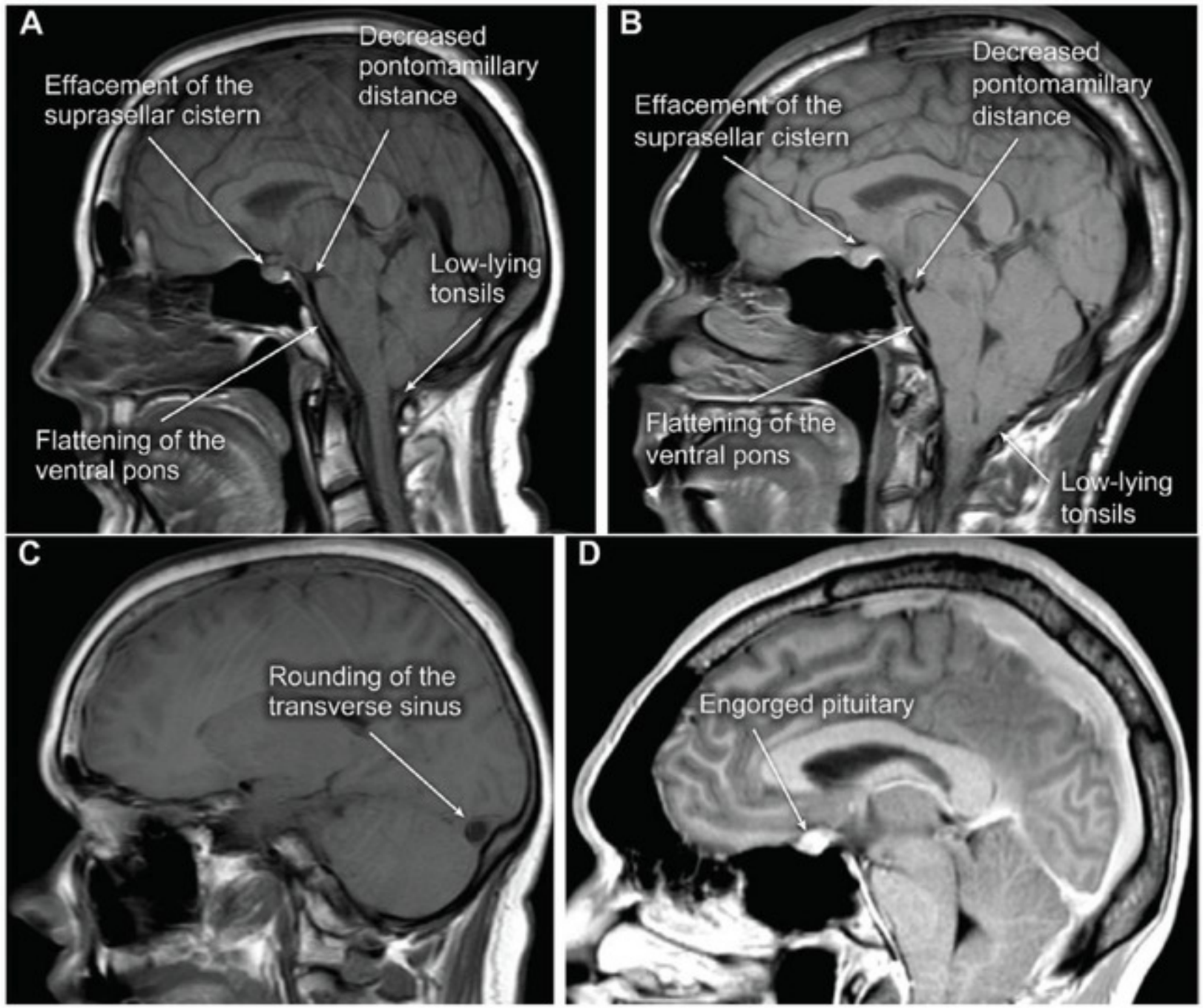
- headache may be trivial or absent with other symptoms being more prominent
- positional aspect of HA often ↓ with time, may be absent
- the severity of symptoms and associated disability is often underappreciated
- This is a CURABLE cause of headache and disability
- Profound complications (early dementia, death) can occur without recognition

Workup

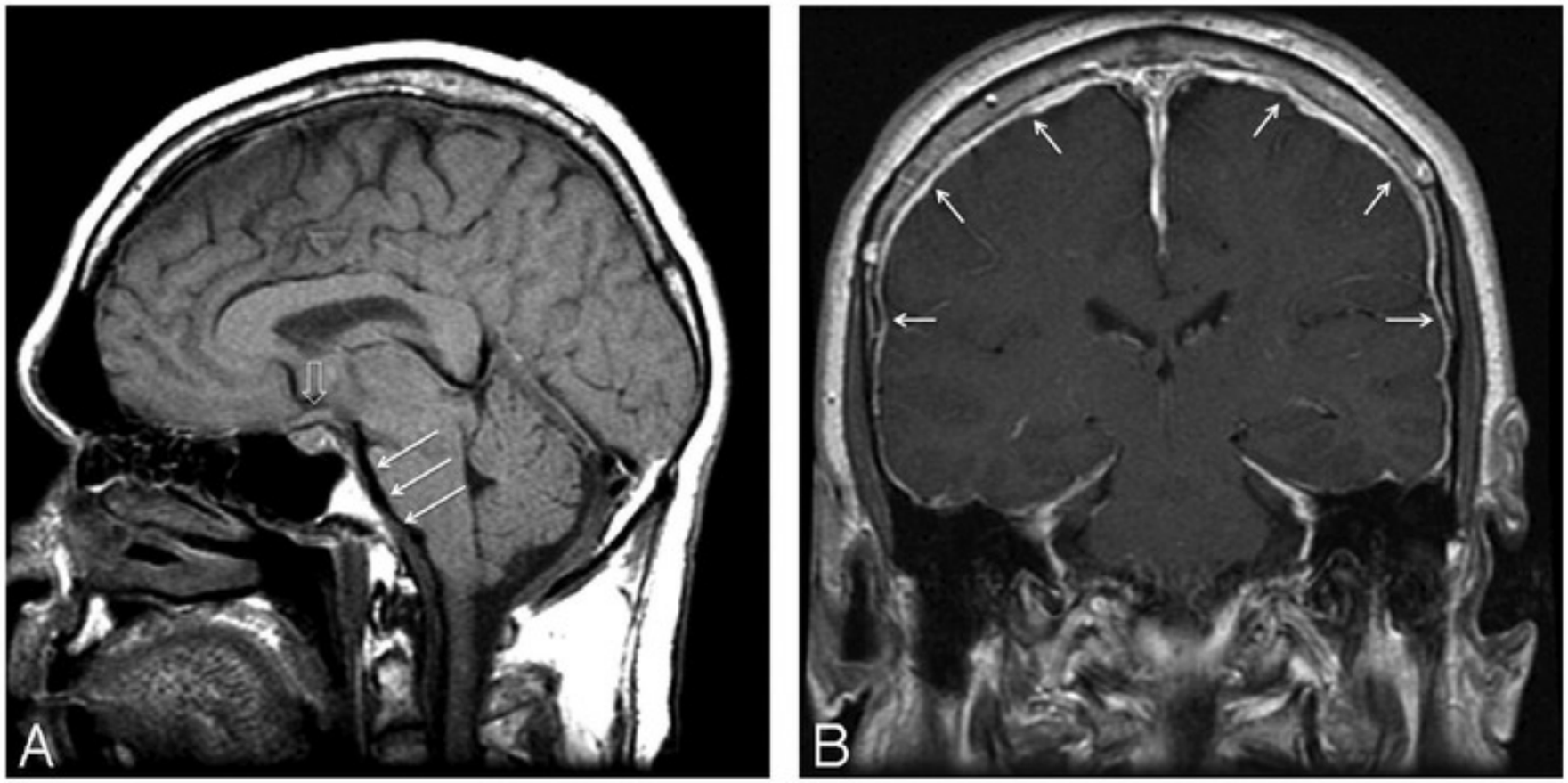
- Brain Imaging
  - MRI w/and w/o contrast
  - 80% of patients can be detected this way
- Spinal imaging
  - MRI
  - CT
    - Myelograms
  - Only ~50% of patients have findings on spine imaging
- Lumbar puncture

Brain imaging

- There are 5 common findings in 80% of patients with CSF leak-- **SEEPS**
  - **S**ubdural fluid collections
  - **E**nhancement of pachymeninges (83% of patients)
  - **E**ngorgement of venous structures (75% of patients
  - **P**ituitary hyperemia
  - **S**agging of the brain (61% of patients)


A
Effacement of the suprasellar cistern
Decreased pontomamillary distance
Low-lying tonsils
Flattening of the ventral pons
B
Effacement of the suprasellar cistern
Decreased pontomamillary distance
Flattening of the ventral pons
Low-lying tonsils
C
Rounding of the transverse sinus
D
Engorged pituitary

Classic findings of SIH on MR imaging of the brain



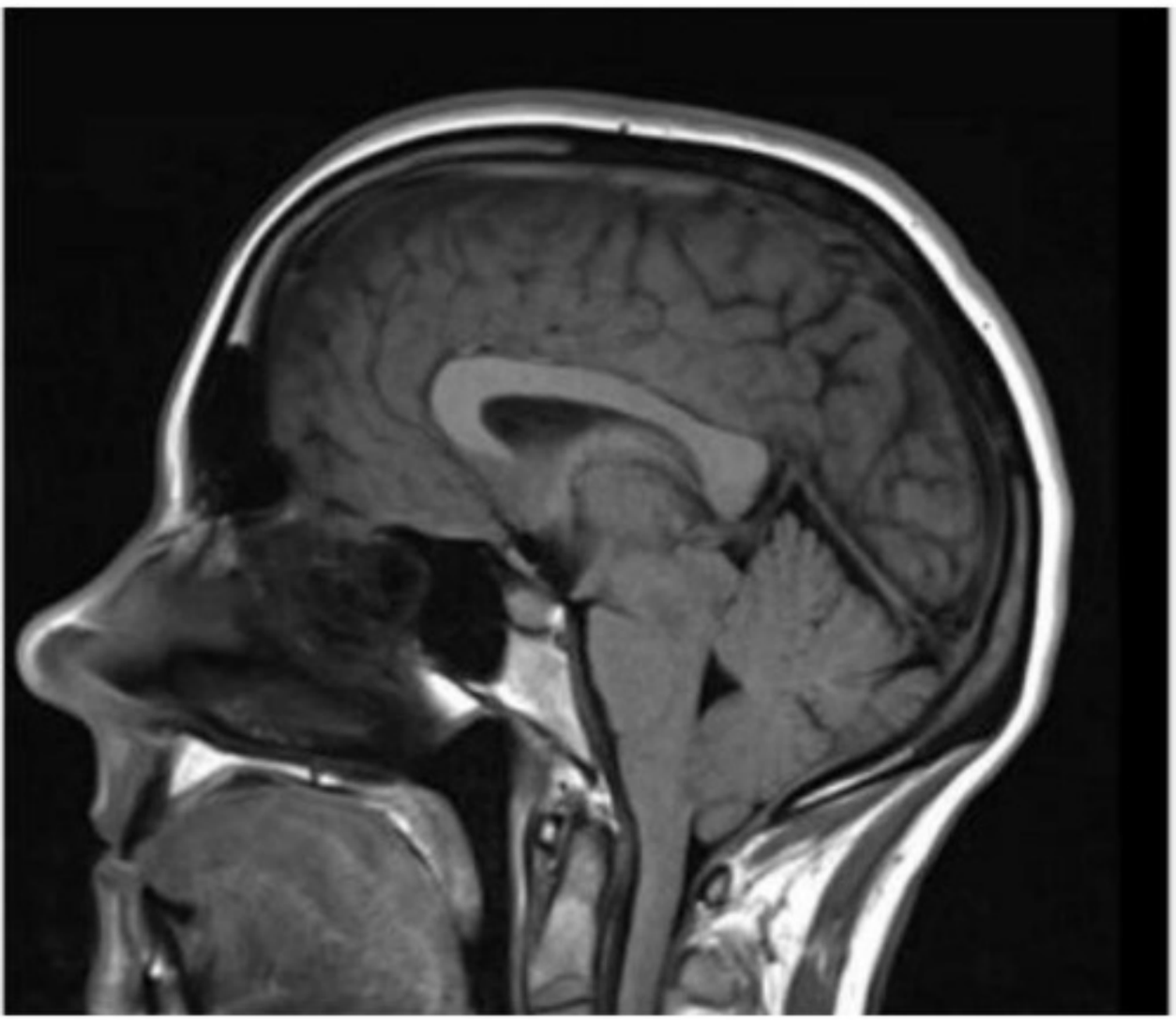
"Brain sag" demonstrated on midline sagittal T1 image(*A*), including descent of the cerebellar tonsils below the foramen magnum, flattening of the ventral pons (*white arrows*), and inferior displacement of the optic chiasm (*open arrow*).
Postgadolinium coronal T1 image (*B*) demonstrates diffuse dural enhancement (*white arrows*.)

P.H. Luetmer et al. AJNR Am J Neuroradiol 2012;33:690-694

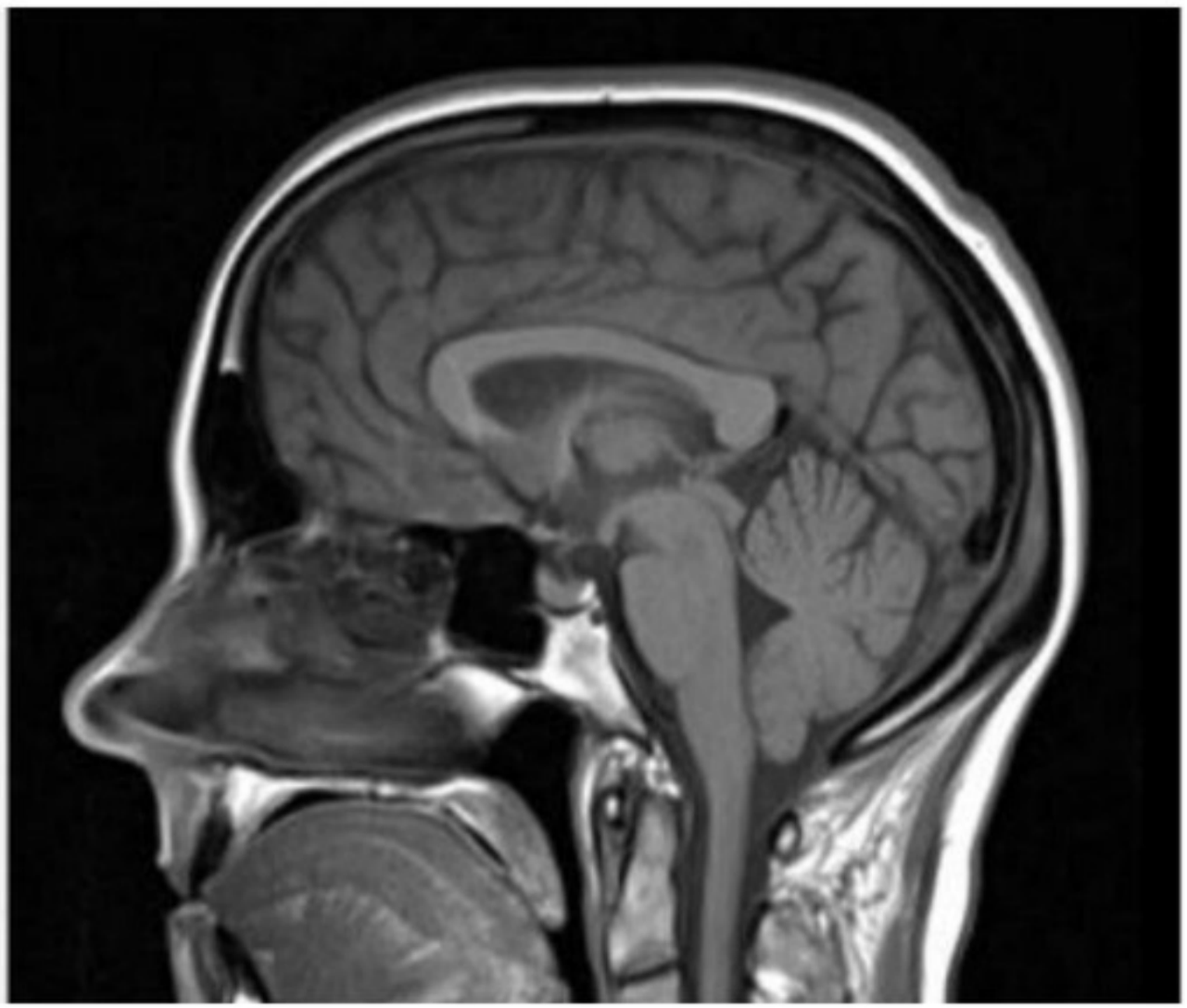
Draw It

What do you see?

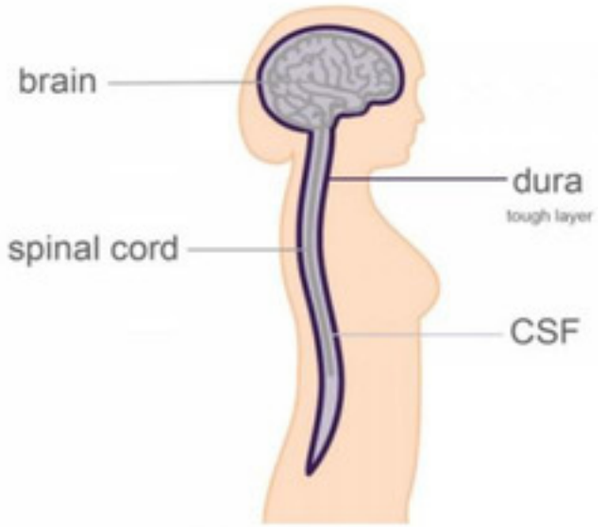
CSF Leak

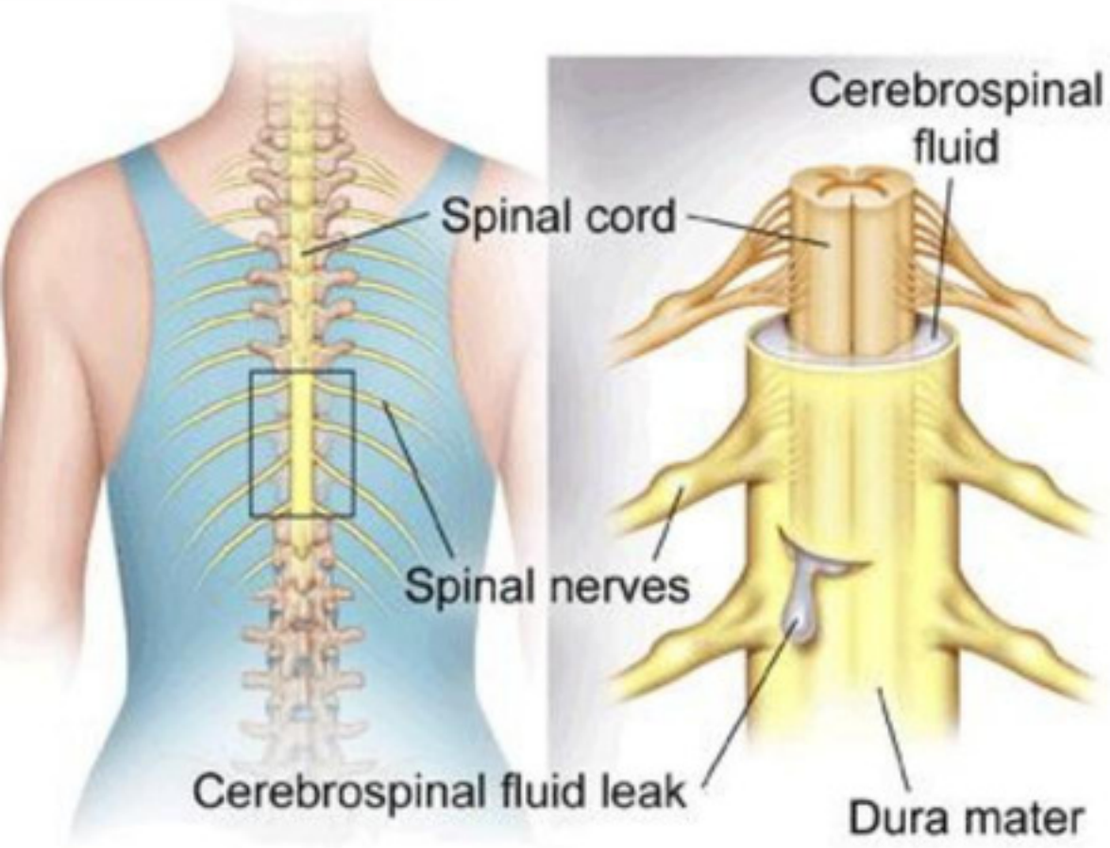


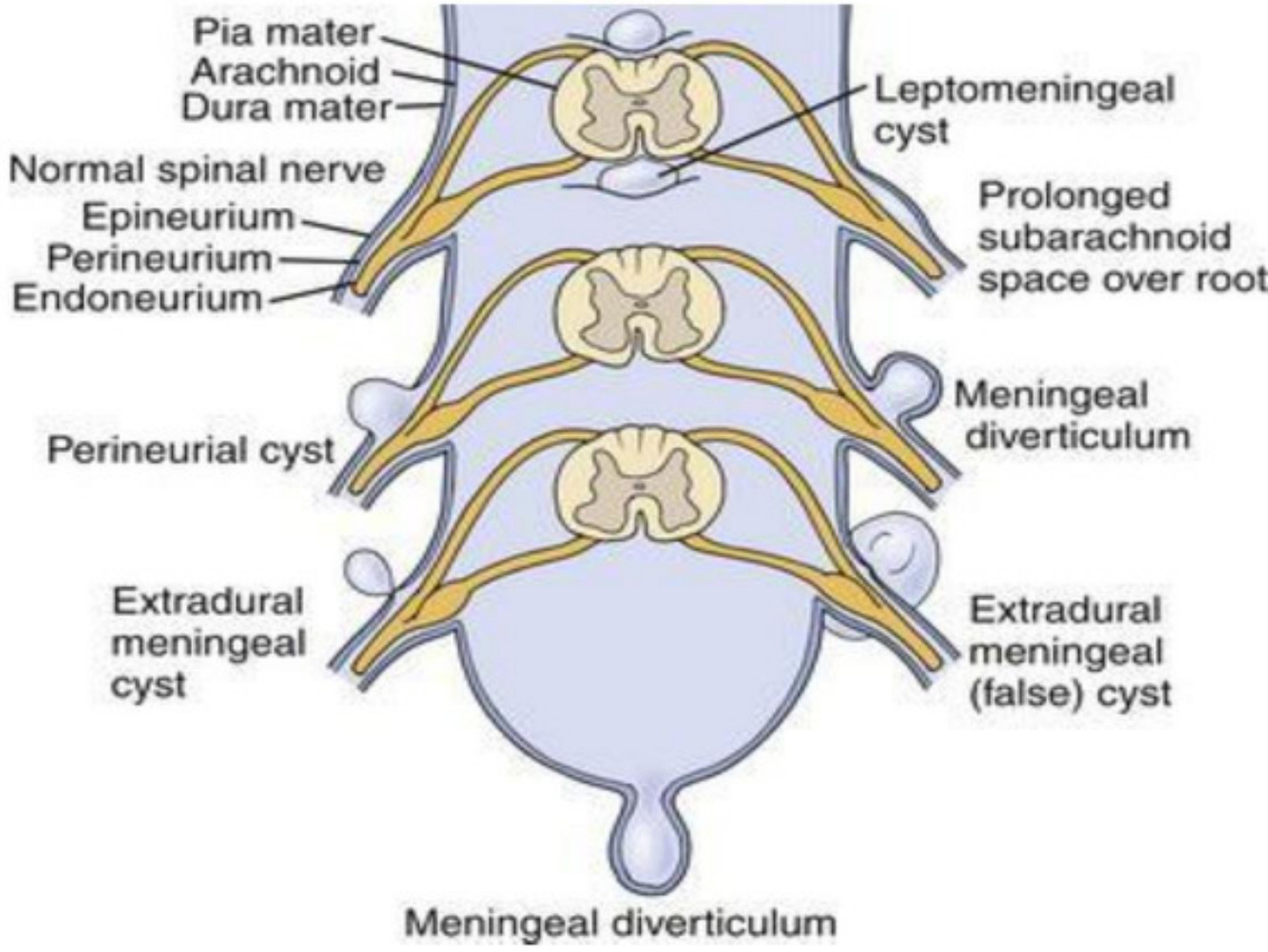
Normal



The dura is not just a simple tube

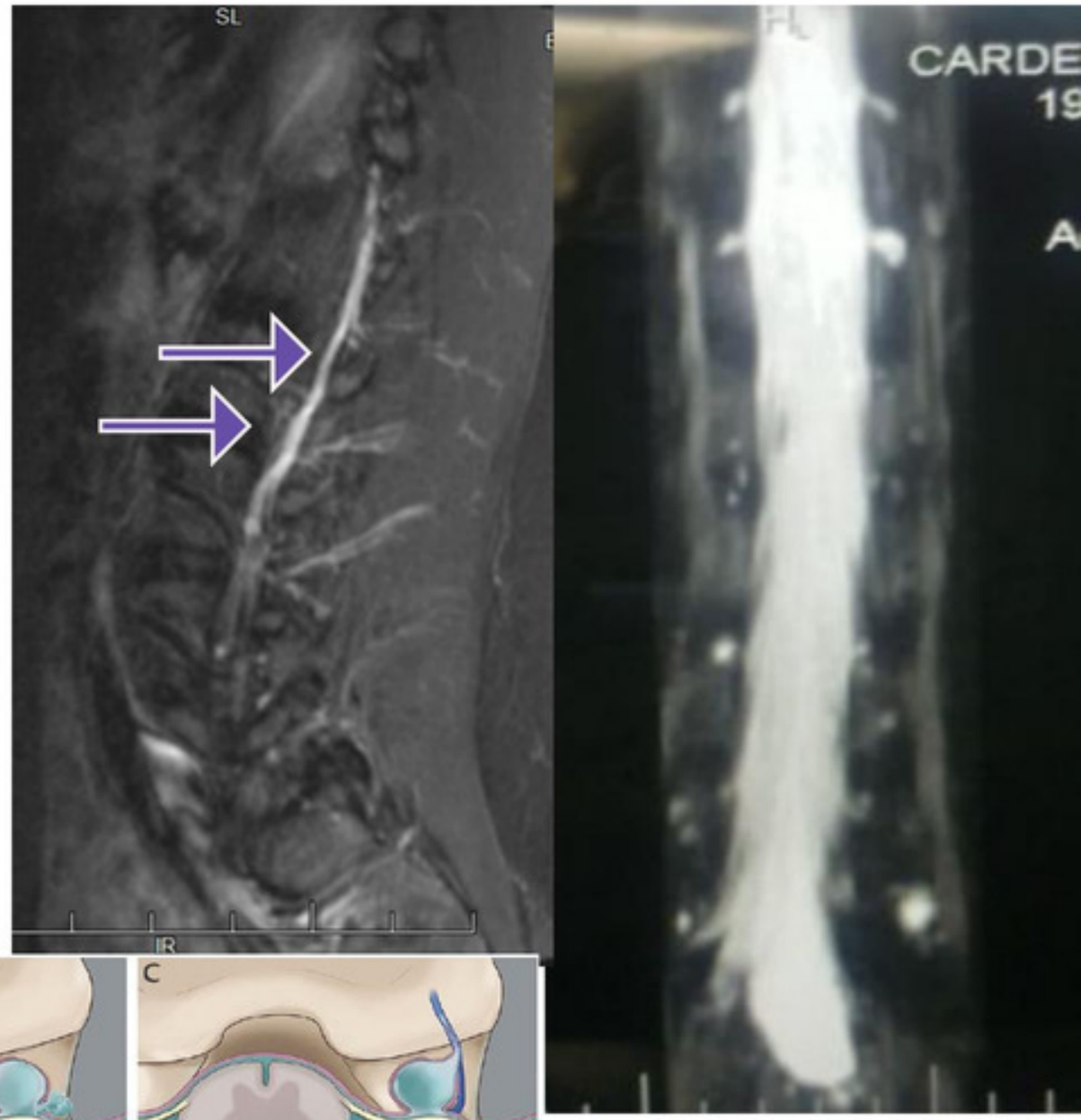


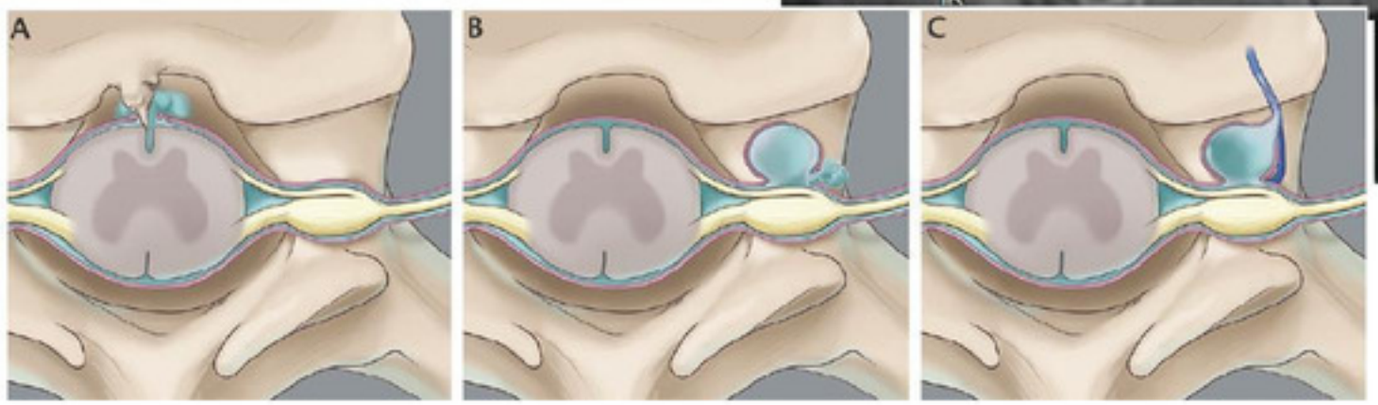




Spinal Imaging/ workup

- Repeat imaging is often necessary
- MRI with contrast
- CT myelography
  - Dynamic CT myelogram
  - Digital subtraction myelography
- Lumbar puncture/ Opening Pressure

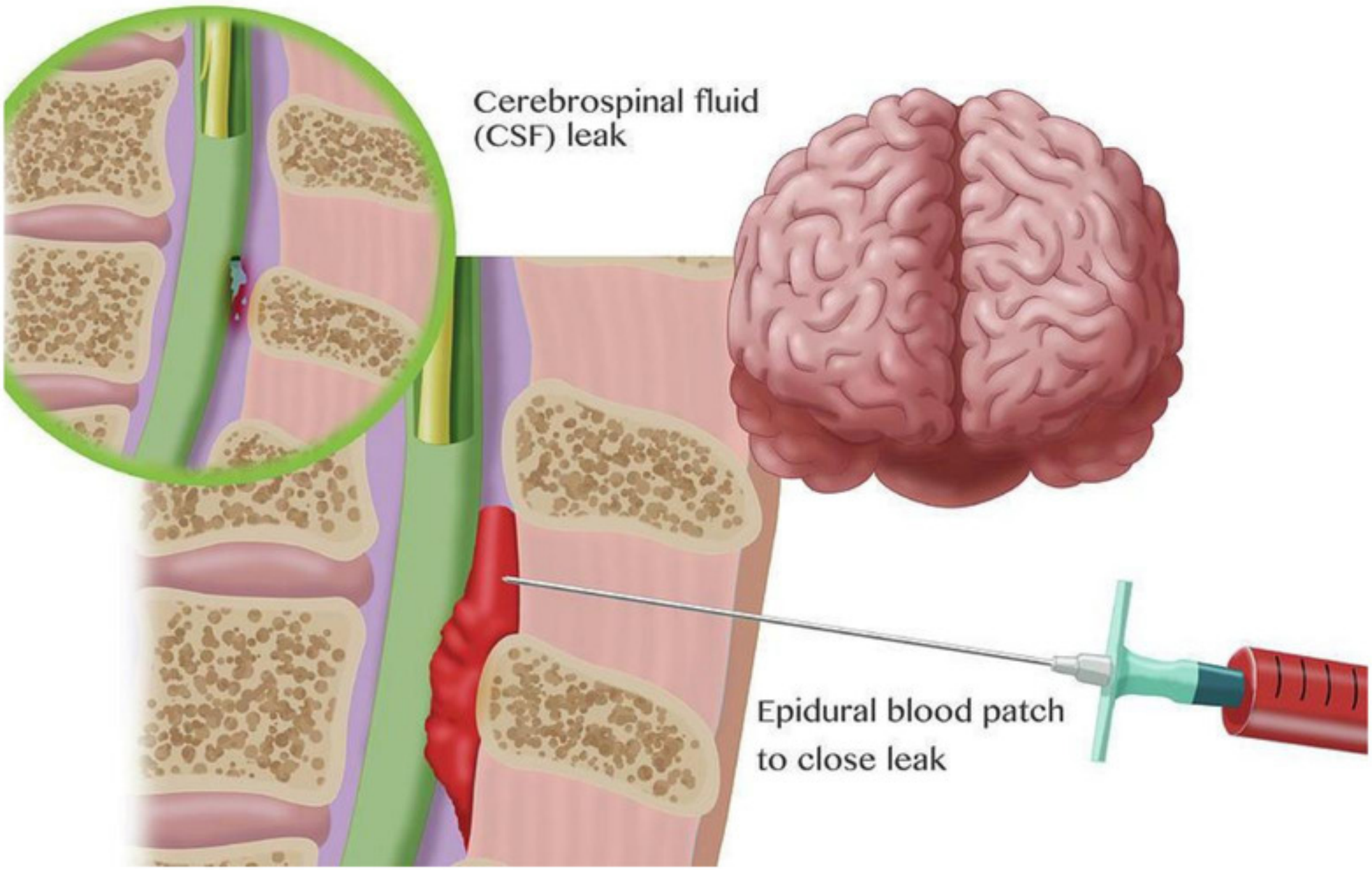




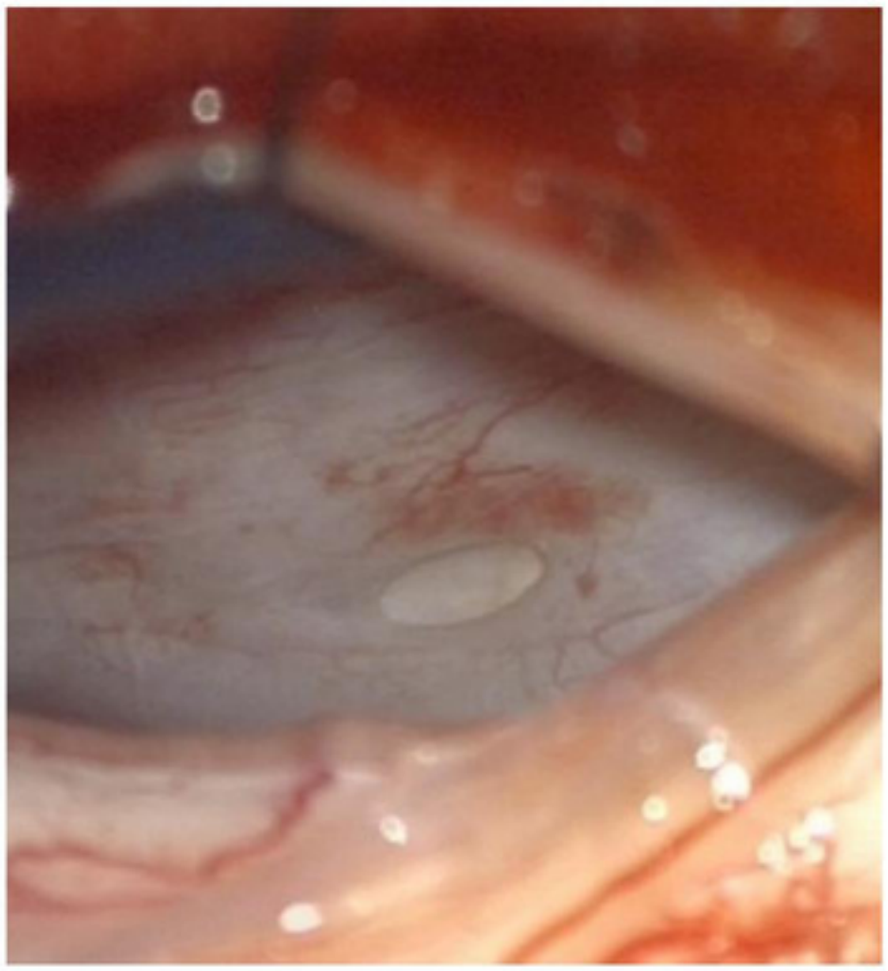
Treatment

- Conservative – Bedrest, fluids and caffeine are used if the symptoms are not severe
  - Abdominal binders to increase CSF pressure
  - CAM to treat secondary sx/sy
- Epidural blood patch (EBP)
- Epidural patch with fibrin glue +/- blood
- Surgery – Some patients will require one or more neurosurgical procedures

Epidural Blood Patching



Surgery



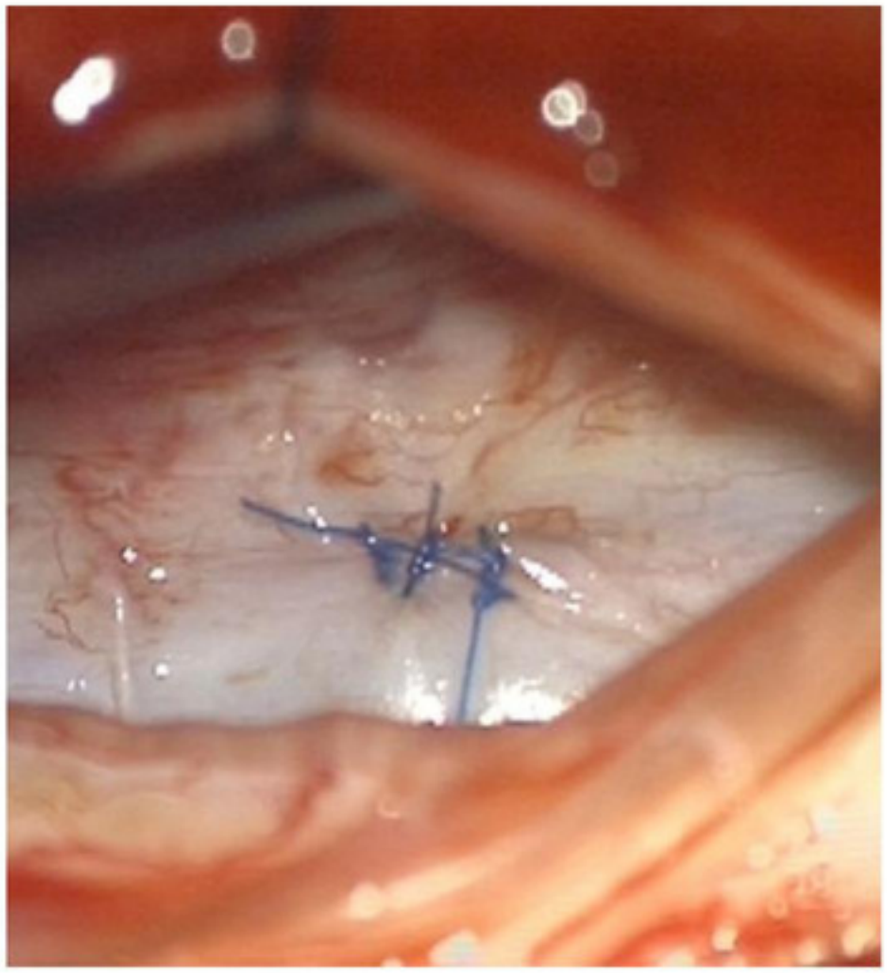
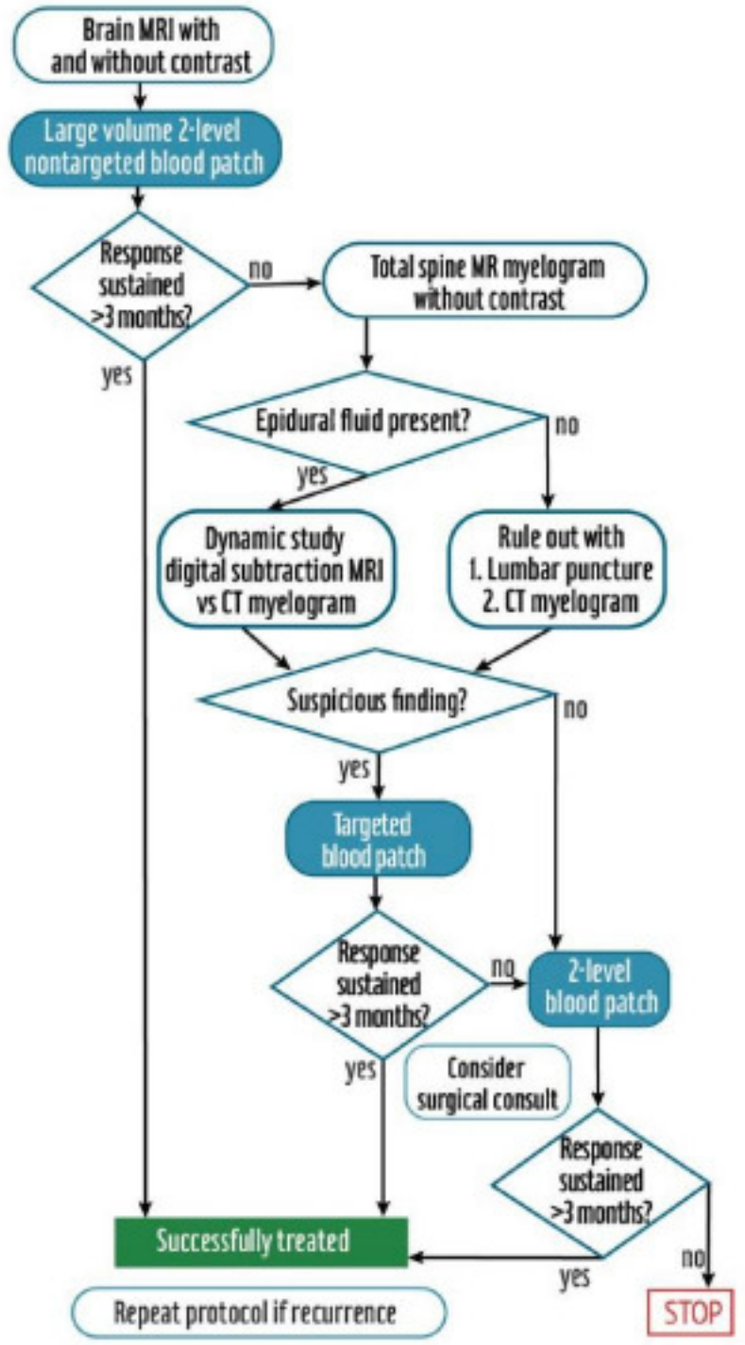


TABLE. DIAGNOSING HEADACHE ASSOCIATED WITH SPONTANEOUS INTRACRANIAL HYPOTENSION

International Classification of Headache Disorders 3rd ed.	
Developed in temporal relation to a low cerebrospinal fluid (CSF) pressure or leak, or led to discovery of low CSF pressure or leak	
OR	Either or both of the following CSF pressure <60 mm CSF Evidence of CSF leak on neuroimaging
AND	Not better accounted for by another ICHD-3 diagnosis
Schievink criteria	
Demonstration of extrathecal CSF on imaging	
OR	Cranial MRI consistent with spontaneous intracranial hypotension show by at least 1 of the following
	Opening pressure <60 mm CSF
	Spinal meningeal diverticulum
	Improvement after epidural blood patch
OR	Orthostatic headache with 2 of the following
	Low opening pressure (<60 mm CSF)
	Spinal meningeal diverticulum
	Improvement after epidural blood patch



Key points

- an unknown % of patients will have their symptoms resolve w/o any treatment
- rarely, serious complications such as coma or a large subdural hematoma will dictate emergent intervention
- epidural patching is effective for many patients but may lack durability
- **Correct interpretation of brain & spinal imaging is vital to diagnosis**
- outcomes are generally favorable but a subset of pts have persistent symptoms and associated disability

Prognosis

- Most patients do well, but some patients continue to suffer with residual symptoms of variable severity for years or decades
  - (limited studies)
- Depends on other comorbidities
- Depends on duration of symptoms
- **Dementia** secondary to repeated brain injury

vimeo

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Questions?

For more info, visit spinalcsfleak.org.

Linkedin: Brianna Cardenas, PA-C, ATC

Patients/ Referrals:

HealedandEmpowered.com
phone: 909-375-9011

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Final Thoughts?