PRESSURE PROBLEMS AND THE SPINE

By: Chiari Bridges

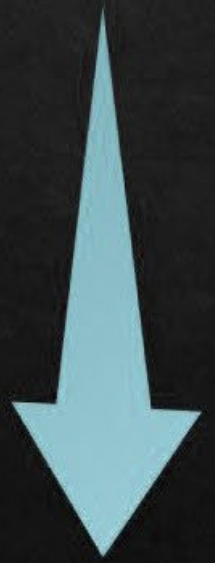
Hyper vs. Hypo

Intracranial HYPERtension

HIGH
pressure

Intracranial HYPOtension

LOW
pressure



IT'S A MATTER OF GRAVITY

UPRIGHT

- Intracranial Pressure decreases

Supine

- Intracranial Pressure increases

- **HIGH PRESSURE**
  - Upright decreases ✓
  - Supine increases
- **LOW PRESSURE**
  - Upright decreases
  - Supine increases ✓

POSITIONAL ELEMENT OF IH

Head pressure that is worse when laying down and relieved by being upright.

POSITIONAL ELEMENT OF LOW-PRESSURE HEADACHES

- Pressure headaches tend to be worse when upright and relieved by laying flat.

SYMPTOMS OF IH vs SIH

HIGH PRESSURE (HYPERtension) SYMPTOMS

- Pressure headaches that are worse when laying down and relieved by being upright
    - Except with IJV Stenosis (which is worse upright)
- You sleep more comfortably when your head is inclined (multiple pillows, recliner)
- Worse in the morning
- Pressure involves most of the head and tends to be worse behind the eyes
- Pressure feels like your head is going to explode
- Feels like the pressure is going to push your eyes out of the sockets
- Problems with hormones (Empty Sella Syndrome)
- Pulsatile Tinnitus

LOW PRESSURE (HYPOtension) SYMPTOMS

- Pressure headaches that are worse when upright and relieved by laying flat
- You sleep most comfortably when you can lay flat
- Worse later in the day (different than occipital headaches)
- Pressure is usually localized at the top of your head, like someone is pushing on the top of your head
- Pressure feels like your head is going implode
- Feels like your eyes are being sucked into their sockets
- Problems with prolactin (lactating hormone)
- Nausea

PRESSURE HEADACHES ARE NOT OCCIPITAL HEADACHES

WHAT IS INTRACRANIAL HYPERTENSION (IH)?

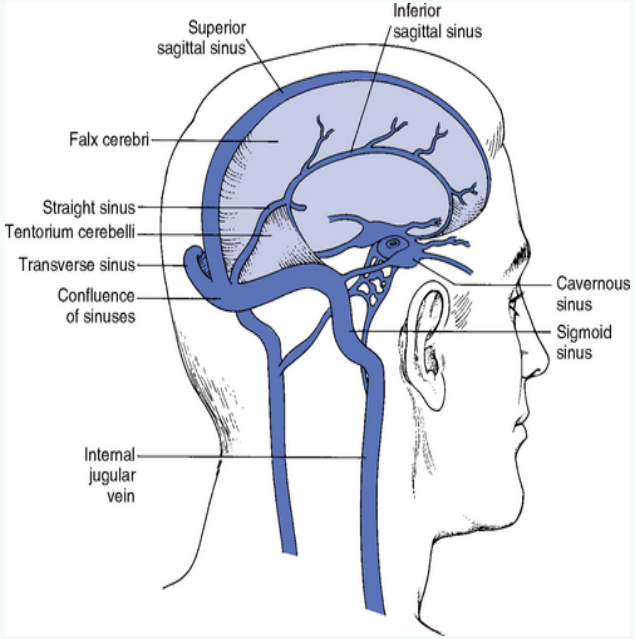
Intracranial Hypertension (IH) means high pressure inside of the skull.

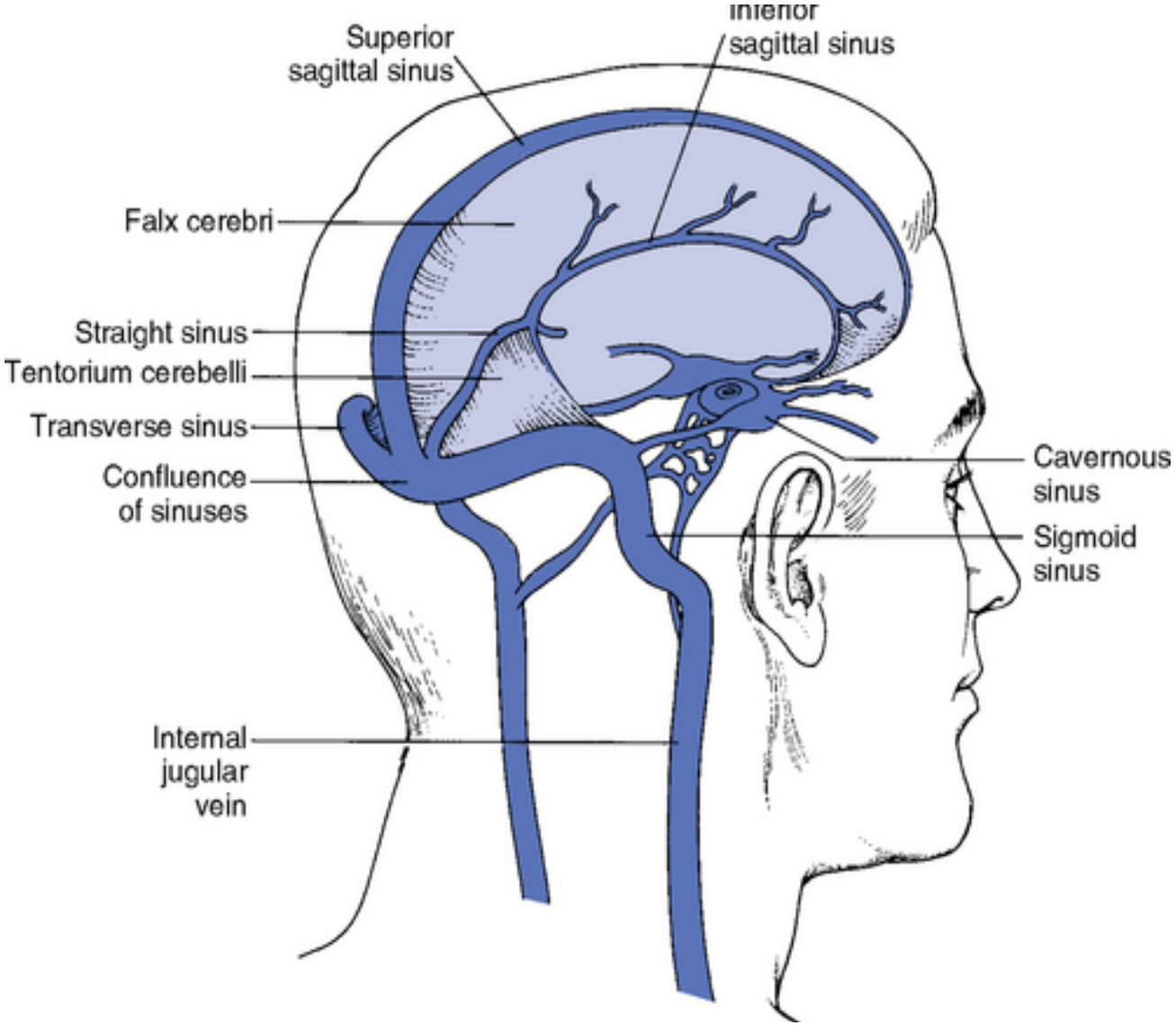
Intracranial Pressure (ICP) is traditionally measured in millimeters of mercury (mmHg). Most scholars agree that on average:

- Normal ICP: 5-15 mmHg
- Mild/Moderate ICP: between 20-30 mmHg
  (Requires treatment in most circumstances)
- Severe ICP: > 40 mmHg
  (Severe and possibly life-threatening intracranial pressure)

PATHOLOGIES OF IH

- Blockage of CSF at Foramen Magnum (FM)
  - Congenital Chiari Malformation
  - Acquired Chiari Malformation
- (90-100%) of those diagnosed with IIH had an underlying venous sinus stenosis problem
  - Transverse Sinus Stenosis
  - Internal Jugular Vein (IJV) Stenosis



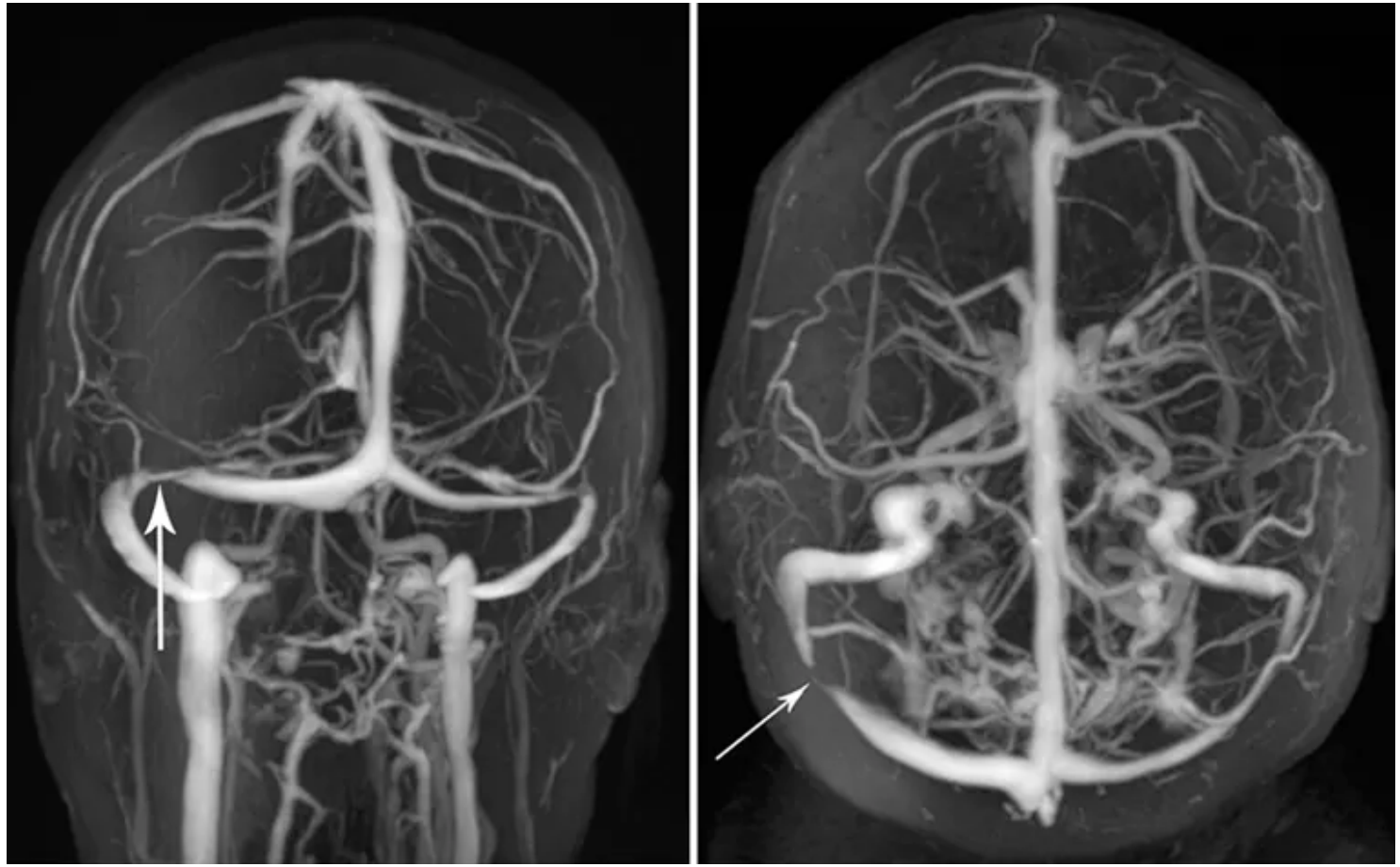


Dural Venus Sinuses

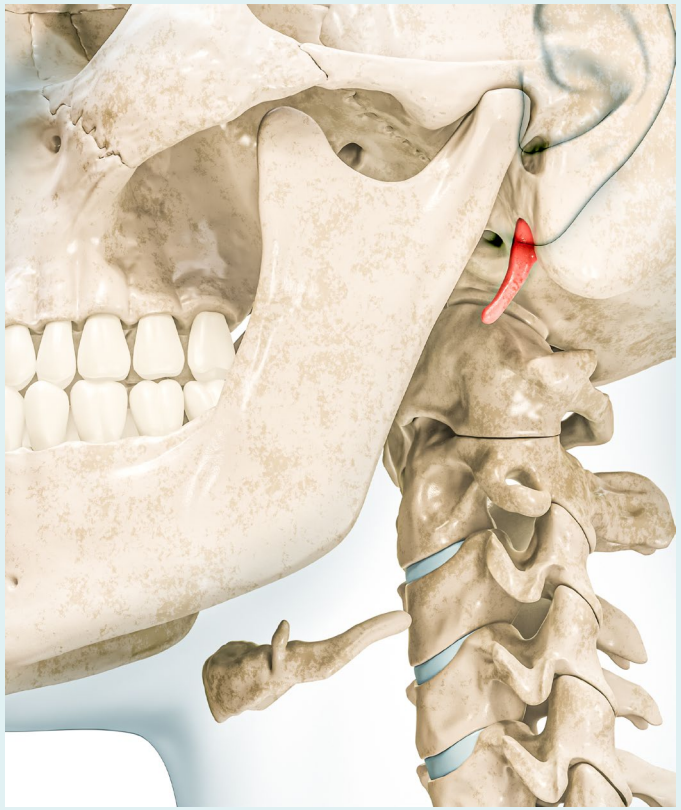
- Transverse Sinus Stenosis (TSS) – most common
- Internal Jugular Vein Stenosis (IJVS)

Plethora Factor = both can exist at once

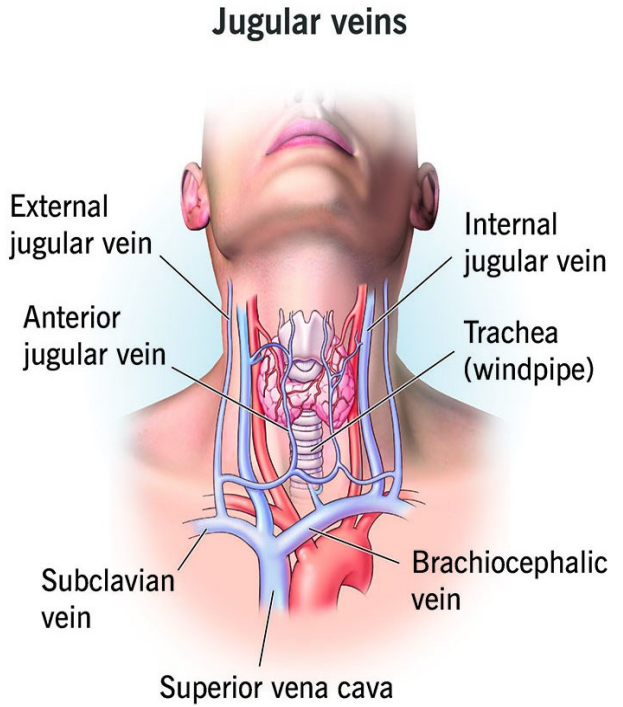
Transverse Sinus Stenosis



INTERNAL JUGULAR VEIN STENOSIS (IJVS)



headaches tend to be worse upright… commonly misdiagnosed as a spontaneous intracranial hypotension problem



EMPTY SELLA SYNDROME (ESS)

94%

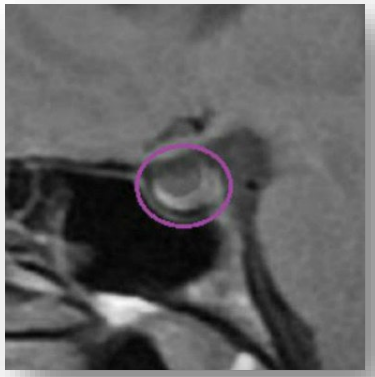


Illustration depicts the pituitary gland flattened at the bottom of the sella, from the cerebrospinal fluid filled arachnoid herniation above it. Sella should have little/no cerebrospinal fluid in it.

Endocrine Dysfunction (50%)

- Fatigue
- Irregular nipple discharge
- Irregular menstruation or absent periods
- Low or no libido
- Unexplained weight gain

Patients with ESS should routinely be subjected to endocrine evaluation to detect these deficiencies early.

PAPILLEDEMA

95% - 2%

- Eye pain
- Light sensitivity
- Fleeting visual changes
  - Dimmed vision
  - Blurred vision
  - Double vision
  - Flickering/Flashing lights
  - Color blindness (esp. red)
  - Field of vision loss
  - Blindness

TESTING & TREATMENTS

TESTING

- Imaging (MRI, MRV, MRA, Cerebral Venogram)
- Neuro-ophthalmologist (papilledema)
- Lumbar Puncture (LP)

TREATMENTS

- Avoid caffeine
- Change birth control to non-hormonal method (progestin)
- Weight loss
- Medicinal Route (Topamax, Diamox)
- Shunting (Ventricular, never lumbar with herniated tonsils)
- Stenting

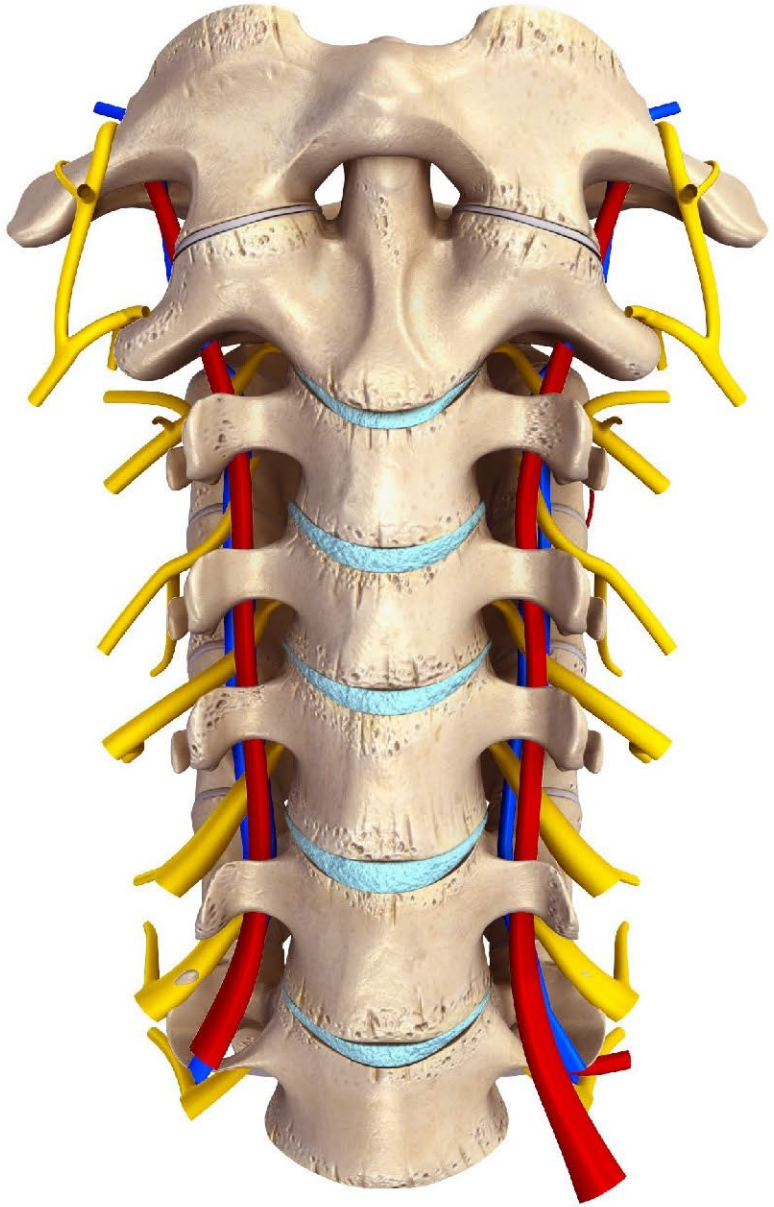
CRANIAL LEAKS

CSF Rhinorrhea

- Associated with high-pressure, not low
- When prolonged high pressure wears away the bones (usually the cribriform plate) that separates the nose and brain
- Weak dura mater
- Spontaneous leak through the nose, ears, or throat
- Can offer intermittent relief from the high pressure
- Increased risk of meningitis
- Can spontaneously seal, making diagnosis difficult

LOW-PRESSURE HEADACHES

- PRESSURE IS USUALLY LOCALIZED AT THE TOP OF YOUR HEAD, LIKE SOMEONE IS PUSHING ON THE TOP OF YOUR HEAD



CSF VENOUS FISTULA (CVF)

An abnormal connection between the spinal subarachnoid space and adjacent paraspinal veins that allow unregulated egress of CSF into the venous system.

- Cerebrospinal fluid enters the veins as it returns blood to heart.
- Resultant CSF depletion causes intracranial **hypo**tension.

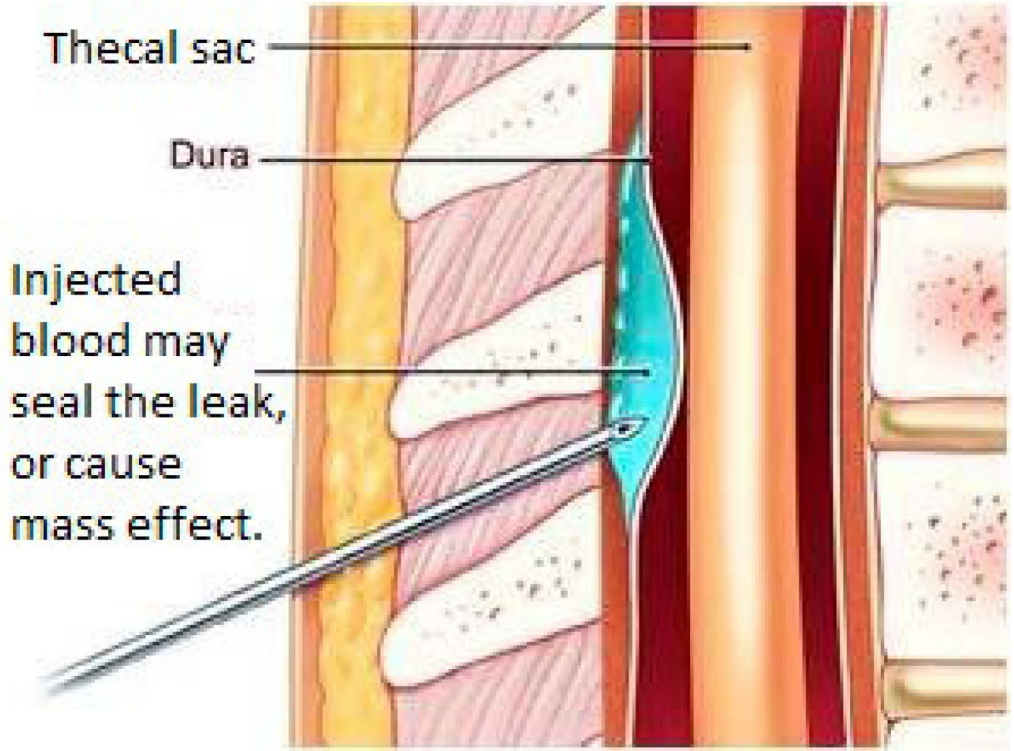
CSF VENOUS FISTULA (CVF)
ADDITIONAL SYMPTOMS

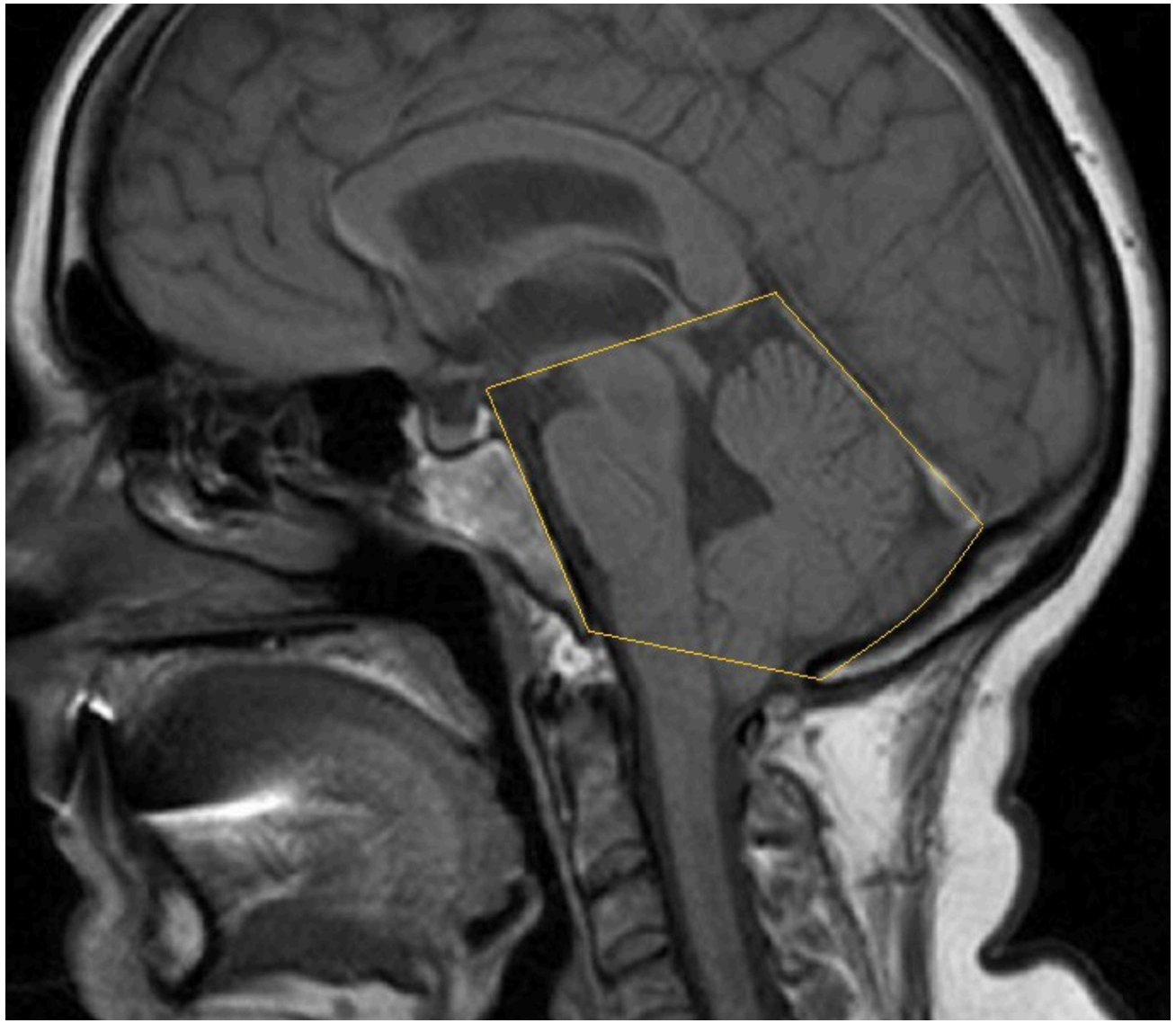
Similar to that of Tethered Cord Syndrome (TCS)

- Leg pain, weakness, tingling, numbing, burning
- Back pain
- Changes in bowel or bladder function
- Difficulty walking

TREATMENT OPTIONS

- Epidural Blood Patch (EBP)
  - With or without fibrin glue
- Spontaneously heal (rare)
- Dural repair
- Surgical Ligation (CVF)
- Transvenous Embolization (CVF)

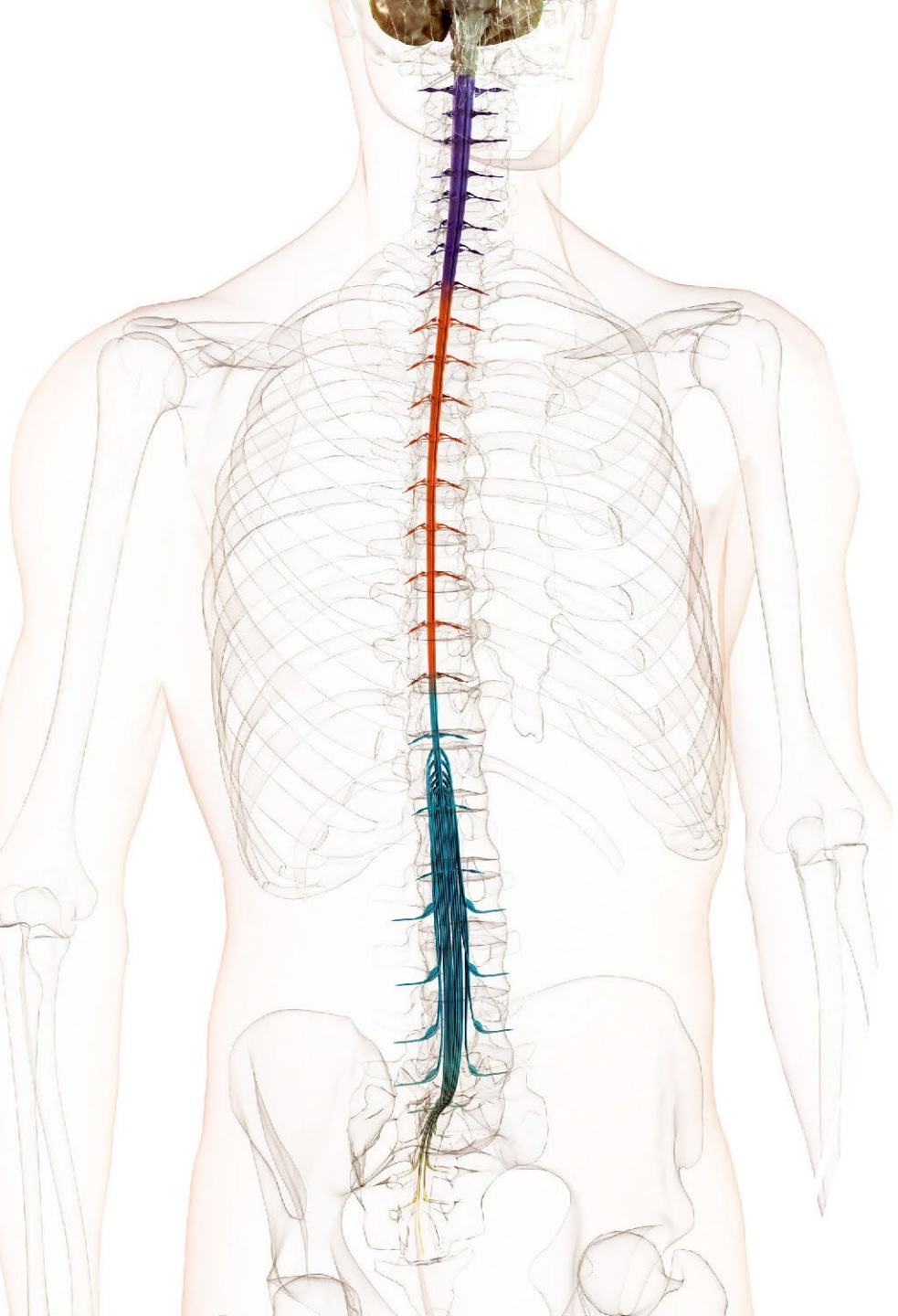




POSTERIOR FOSSA

Other things going on than the posterior fossa:

- Empty Sella (IH)
- Flattened Pons (SIH)
- Elongated medulla (TCS)

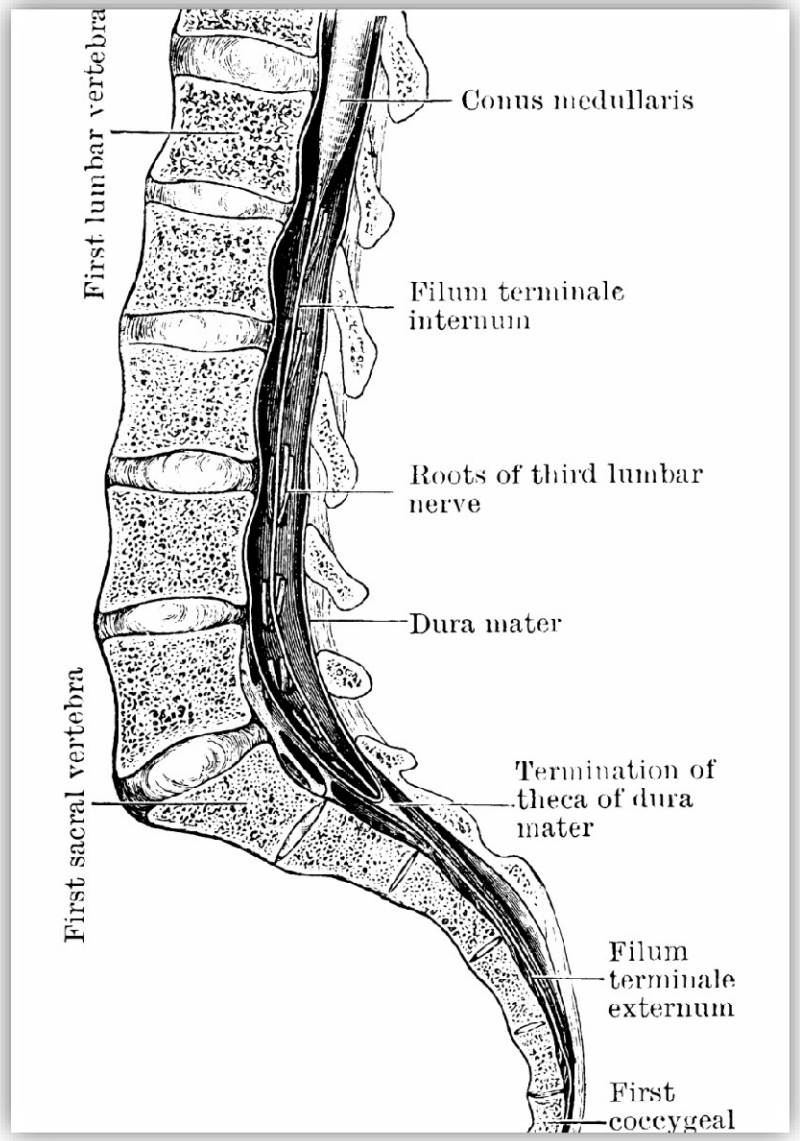


Anatomical Features

- Vertebral Column
- Intravertebral Discs (collagen)
- Spinal Canal
- Cerebrospinal Fluid (CSF)
- Meninges (dura mater)
- **Spinal Cord**
- **Brainstem (midbrain, pons, medulla)**
- **Conus Medullaris**
- **Filum Terminale**

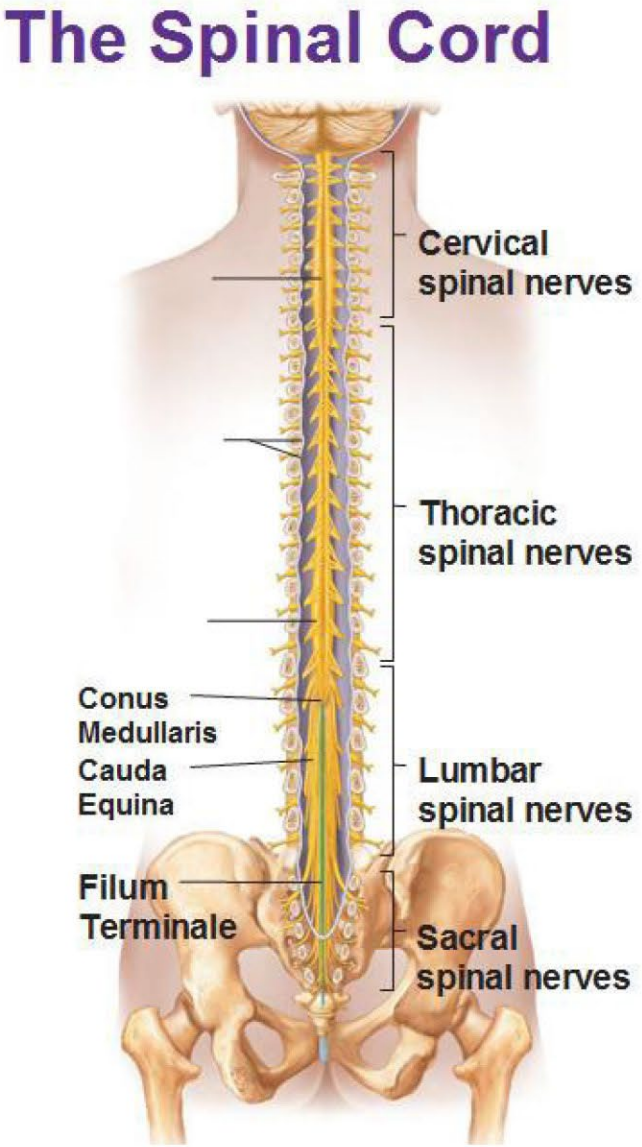
About Tethered Cord

- Tethered cord can be congenital or acquired.
- Tethered Cord is most common in patients with Spina Bifida (myelomeningocele, meningocele), Spina Bifida Occulta (lipomeningomyelocele, lipomyelocele) and patients with Ehlers-Danlos Syndromes (EDS), a Hereditary Disorder of Connective Tissue (HDCT) where one or more of the types of collagen (the most abundant protein in the human body) is mutated at a cellular level.
- It can be obvious in childhood or symptoms may not present themselves until adulthood. Some children may develop minor signs that are overlooked by untrained medical professionals and can progress slowly or rapidly over time.
- Tethered Cord commonly happens when the sticky fibrous tissue of the filum adheres to fatty/scar tissue or the dura lining of the spinal canal.
- Most common at the lumbosacral level.
- When the tethered filum pulls the spinal cord tightly enough that it causes neurological problems, it becomes known as **Tethered Cord Syndrome (TCS)**.



WHAT IS OCCULT TETHERED CORD

- When the **conus medullaris** is within normal range a cord can still be tethered and becomes known as Occult Tethered Cord.



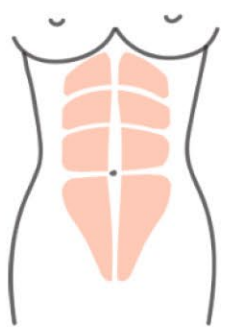
- ✓ Lower back pain
- ✓ Leg pain
- ✓ Numbness in lower legs and/or feet (tingling/pins & needles sensation)
- ✓ Gait disturbances
- ✓ History of growing pains
- ✓ History of heel/toe walking as a child
- ✓ High arches
- ✓ Frequent urinary tract infections (or the sensation of a UTI)
- ✓ Decreased sensations in pelvic area
- ✓ Urinary dysfunction (incontinence)
- ✓ Bowel dysfunction (incontinence)
- ✓ Sexual dysfunction
- ✓ Dysautonomia (if the medulla is damaged)

Diastasis Recti

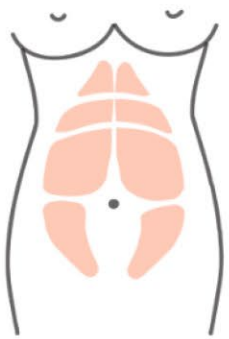
Symptoms

- A visible bulge or "pooch" that protrudes just above or below the belly button.
- Softness or jelly-like feeling around your belly button.
- Coning or doming when you contract your ab muscles.
- Difficulty lifting objects, walking or performing everyday tasks.
- Pain during sex.
- Pelvic or hip pain.
- Low back pain.
- Poor posture.
- Urine leaking when you sneeze or cough.
- Constipation.
- Feeling weak in your abdominals.

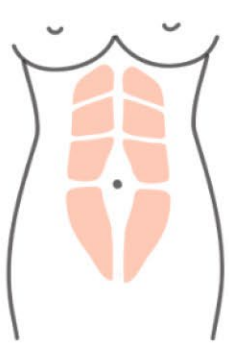
Types of Diastasis Recti



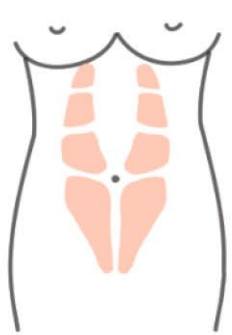
Normal rectus abdominis



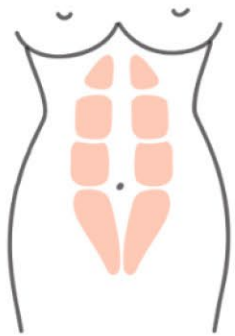
Below navel



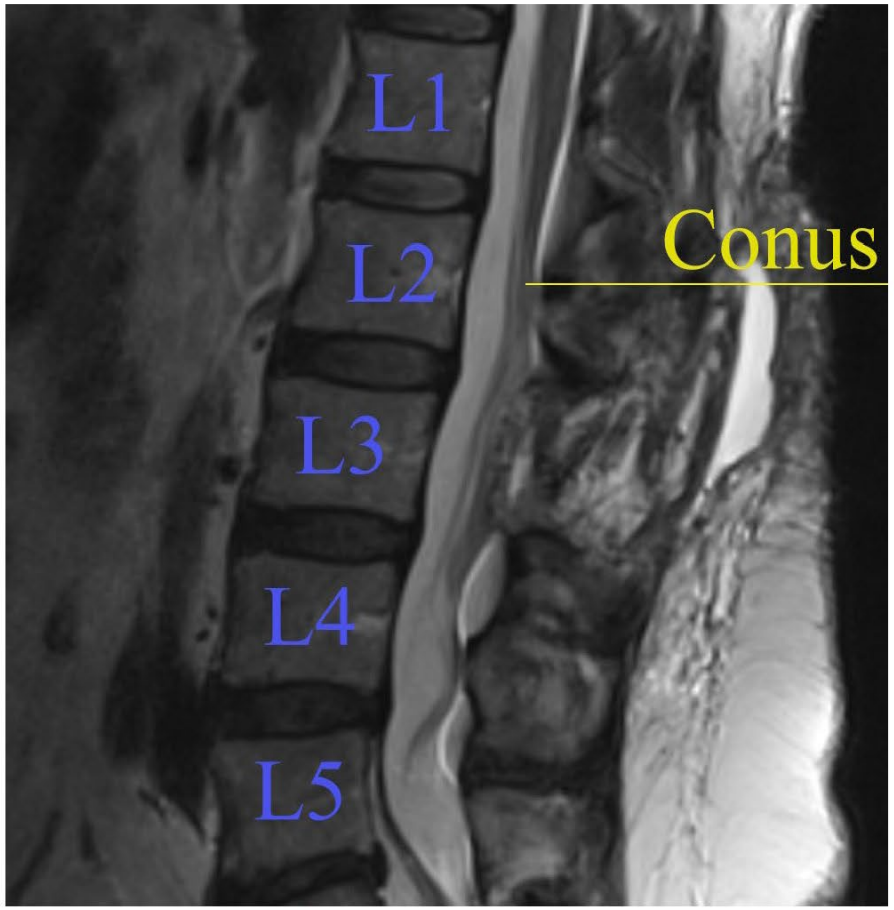
Around navel



Above navel



Open diastasis



MRIs to Evaluate TCS/OTC

LUMBAR MRI

PRONE MRI

CISS MRI

Treatment Options

- For some, physical therapy can help with symptoms for a while. However, ultimately it will likely need to be surgically treated with a Tethered Cord Release (TCR).

- Tethered Cord Release (TCR) Surgery involves the untethering of the spinal cord. An incision is made in the lumbar area, the filum terminale is separated and the factors that are tethering the spinal cord to the vertebrae are severed. Surgical treatment is not without risk and does not guarantee relief of symptoms. However, in a large study, up to 83% of adult patients report relief, 16% unchanged, and 1% report feeling worse. In children, the numbers are even better with 93% obtaining improved symptoms and 7% unchanged. Most patients describe the surgery as extremely painful for the first two weeks and "better than they ever remember feeling" (often because they have been tethered for much of their lives) after two weeks. The most common complication involves retethering (often from the scar tissue from the release) and multiple surgeries may be required over a lifetime. Finding a neurosurgeon experienced with TCRs and the surgical treatment of Ehlers-Danlos patients can sometimes help reduce the risks associated with scar tissue formation, but scar tissue can happen with even the best of neurosurgeons.

- **For the TCS patient, herniated tonsils really should be assumed an Acquired Chiari Malformation (even if a small posterior fossa is evident)**

ACQUIRED (SECONDARY) CHIARI MALFORMATION

Chiari Malformation has many conditions that can be associated with it *(comorbid conditions)*.

Some comorbid conditions can be at the root cause ***(etiological)***.

→

Some comorbid conditions are one of the causes along the way ***(pathological)***.

↓

Why are the cerebellar tonsils as low as they are?