

# Virtual Pediatric Lecture Series

## Common Neurosurgical Referrals: Low Back Pain and Chiari Malformations

Wednesday, February 5, 2025



***Common Neurosurgical  
Referrals:  
Low Back Pain and  
Chiari Malformations***

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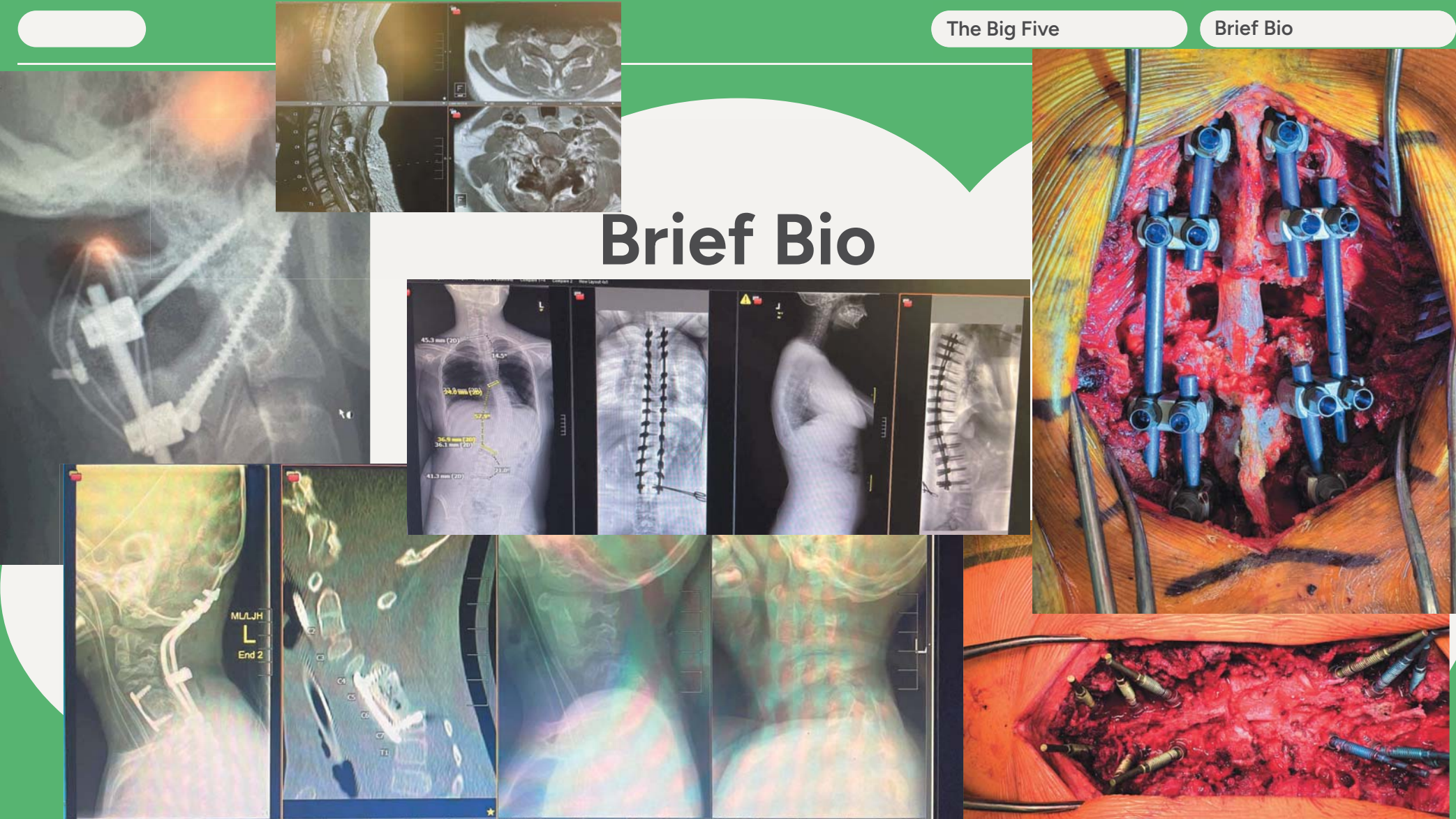
# Brief Background



The Big Five

Brief Bio

# Brief Bio



## Learning Objectives

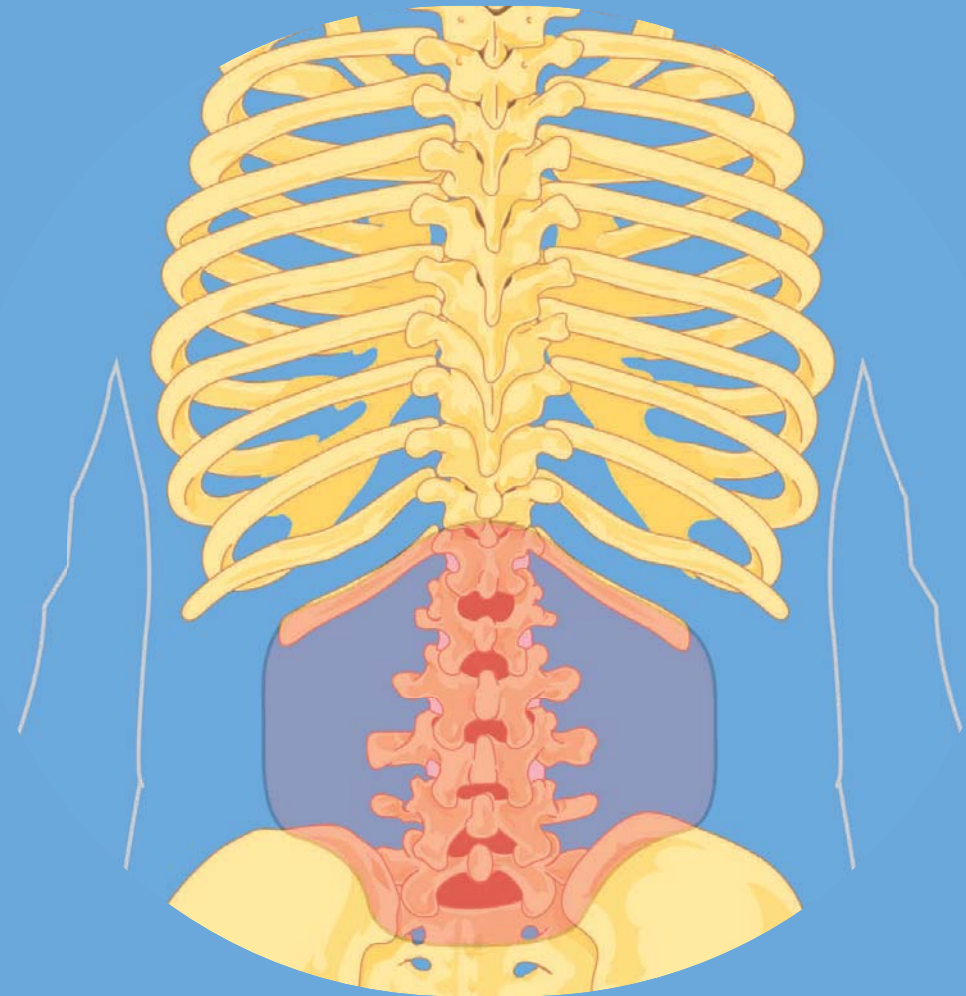
1. **Initiate the management and work-up of low back pain** and identify red flags requiring imaging and referral.
2. **Recognize symptoms of possible chiari malformation** across pediatric age spectrum and initiate appropriate imaging and referral as appropriate
3. **Counsel patients** on the general next steps in management to be expected at their visit to neurosurgery.



## Low Back Pain

In the Pediatric Patient

1. Prevalence 9-66% of pediatric population, up to 80% of people will have at least 1 episode in lifetime
2. Very common among athletes especially *high contact/ repetitive impact sports* like football and gymnasts



## **Low Back Pain**

In the Pediatric Patient

1. Targeted history/exam for red flags
2. Develop differential
3. Determine need for lab studies or imaging
4. Initiate management strategy
5. Consider referral

# Red Flags for Expedited Work-up

## Neurologic Deficits

1. Weakness
2. Numbness
3. Hyperreflexia/Clonus

## B Symptoms

1. Fevers
2. Night Sweats
3. Weight Loss
4. Nighttime pain

## Recent Significant Trauma

1. High speed MVC
2. Fall from heights

## Changes in Bowel/Bladder Function

1. Incontinent episodes
2. Increased frequency of voids

## Disability due to Severity

1. Pain is so severe that patient is using ambulatory aids/wheelchair
2. Missing significant amounts of school

## Cutaneous Stigmata

1. Hairy Patch
2. Lumbosacral hemangiomas
3. Sacral dimples
4. Lumbosacral lipomas



# Spine Physical Exam

## Basics

1. Observe gait and posture
2. Palpate spine including SI joints for focal pain
3. Full neurologic exam (cranial nerves, strength, sensation, reflexes)

## Advanced

1. Stork Test
2. Trendelenburg Test of Pelvic Tilt
3. Passive Hip ROM
4. Hamstring Tightness vs SLR
5. Adams forward bend

# Differential Diagnoses

## Biomechanical/Trauma

1. Disc herniation
2. Spondylolysis/  
Spondylolithesis
3. Muscular
4. Fracture

## Neoplastic

1. Benign Bony
2. Malignant Bony
3. Intradural/CNS  
Tumors

## Inflammatory/Infectious

1. Spondyloarthropathies  
(Reactive, ERA, PA,  
etc.)
2. Osteomyelitis/  
Osteodiscitis
3. Vasculitis

- Red Flags**
1. Neurologic Deficits
  2. B/B Issues
  3. B Symptoms
  4. Recent Trauma
  5. Cutaneous Stigmata

\* Consider standing x-rays if H&P exam findings suggestive of new scoliosis, spondylolysis

**Low Back Pain**

Red Flag Present

No Red Flags

1. Imaging (MRI? CT?)
2. Disposition (ED necessary?)
3. Neurosurgery Referral

- <6wks
1. Deload (backpack, wt loss?)
  2. PT
  3. Avoid becoming sedentary
  4. NSAIDs
  5. Consider steroids, muscle relaxants

Duration

>6wks

No

Leg pain?

Yes

1. MRI Lumbar Spine w/o contrast
2. Neurosurgery Referral

Steady Improvement

At 3 months?

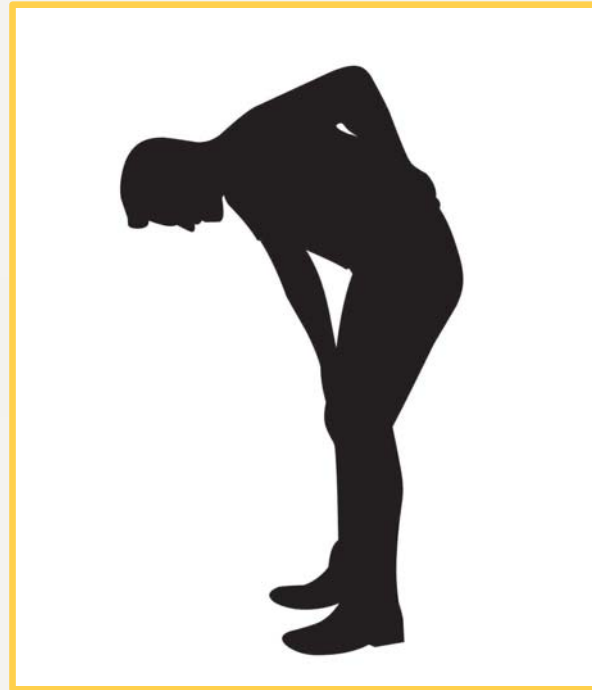
Resolution

Great!

Unchanged or worsening

1. Supine and Standing Thoracic and lumbar x-rays (AP, Lat)
2. Neurosurgery Referral

Case 1 - Back and Leg Pain

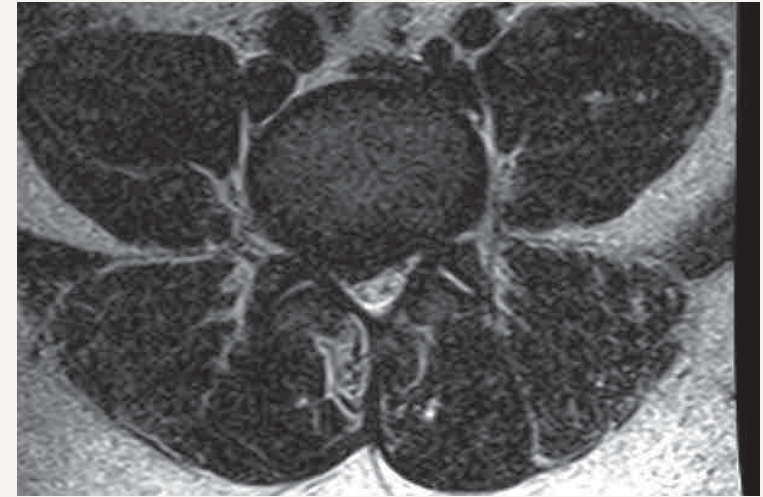
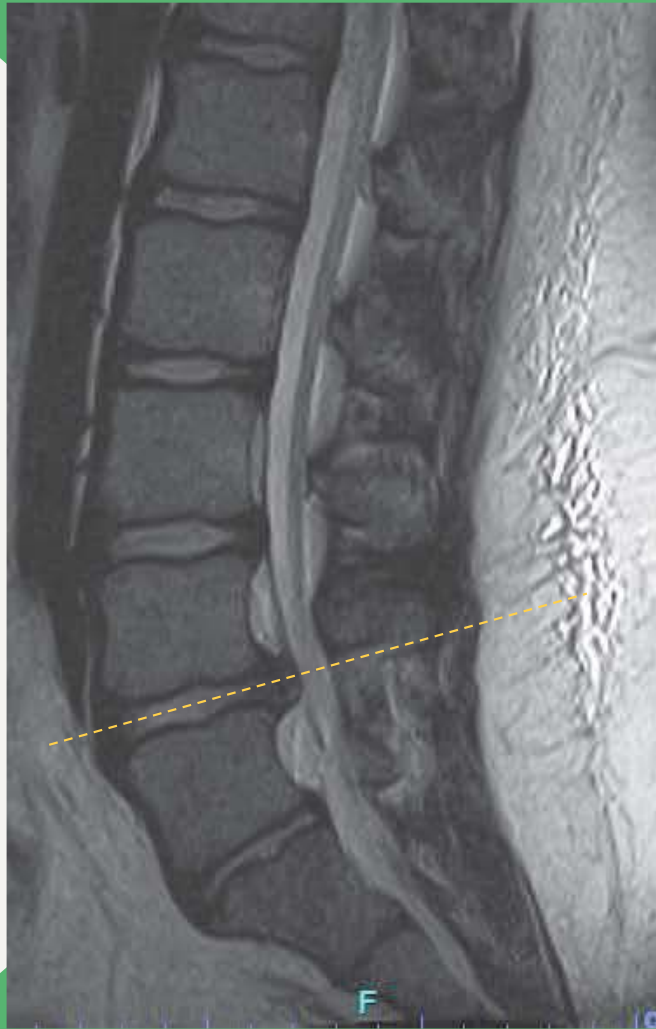


# 15yo M with back and right leg pain

## History

1. PMH: HTN, BMI 44
2. 1 month of pain starting after lifting heavy car parts
3. Back pain 8/10, R leg pain 7/10 radiating down posterolateral thigh to his foot
4. Legs "tighten up" after 0.5 mile walking
5. Numbness when prolonged standing, improves laying down
6. Baclofen tried and helpful
7. No red flags

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back and  
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## Management

1. Deload
2. PT referral
3. Considered epidural steroid injections (family declined)

# 15yo M with back and right leg pain

## 6 week f/u

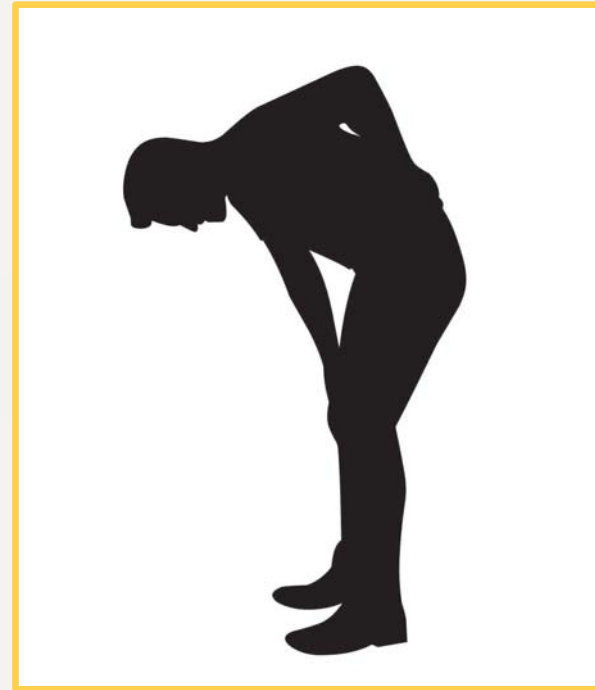
1. Exercising daily without excessive weight loading (aerobic, body weight etc)
2. Lost >30 lbs!
3. Back pain significantly improved, no longer experiencing leg tightness
4. Leg pain less severe and less frequent

## Management

1. Continue Deload
2. Continue PT
3. Defer injections
4. F/u 3 months



Case 2 - Left back and Hip Pain



# Left LBP with radiation to left hip

## History/Exam

1. Has been going on for 1 month
2. Saw orthopedics for hip, XR negative

## Management

1. Naproxen
2. PT
3. MRI considered

## **Left LBP with radiation to left hip**

### **1 month F/u**

1. Has been going on for 2
2. PT eval occurred but has not been able to participate fully in exercise
3. Pain now radiating down lateral thigh into lateral leg

### **Management**

1. MRI ordered
2. Continuing PT
3. Medrol dosepak given more severe radicular pain

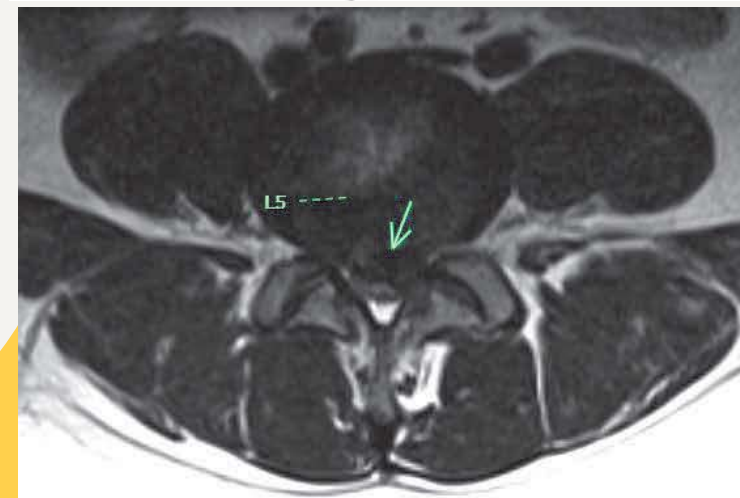
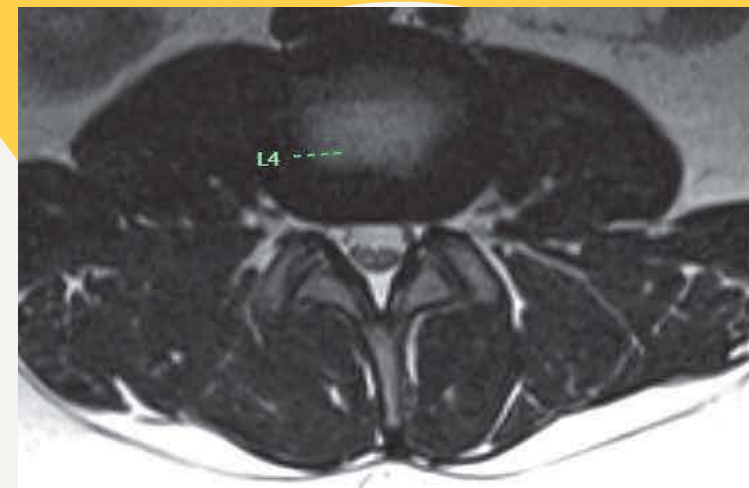
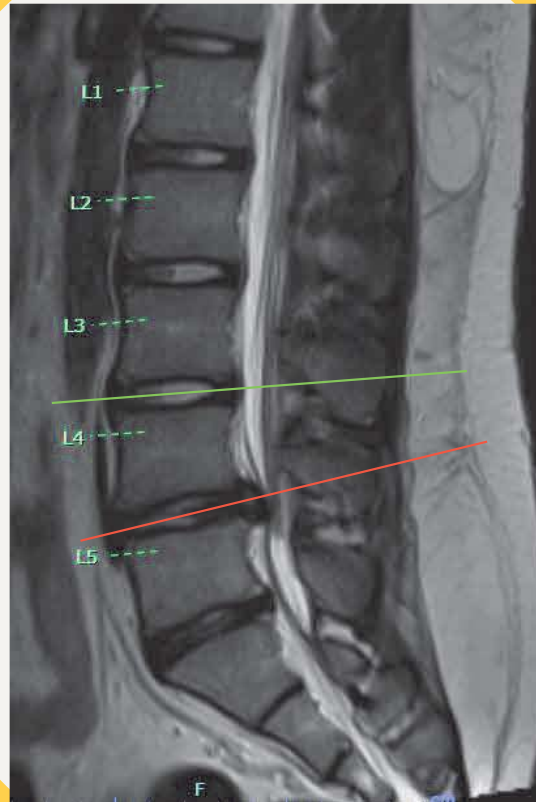
## Left LBP with radiation to left hip

### 2 month F/u

1. 3 months of pain now back mild but severe radiation of pain left hip through lateral ankle
2. MRI here ->
3. Medrol helped transiently
4. Continuing PT
5. Exam without deficits



# Left LBP with radiation to left hip



# Left LBP with radiation to left hip

## 2 month F/u

1. 3 months of pain now back mild but severe radiation of pain left hip through lateral ankle
2. MRI reviewed - large L4-5 LDH
3. Medrol helped transiently
4. Continuing PT
5. Exam without deficits

## Management

1. Continue PT
2. Referred for epidural steroid injections
3. Added gabapentin

## Left LBP with radiation to left hip

### 6 month F/u

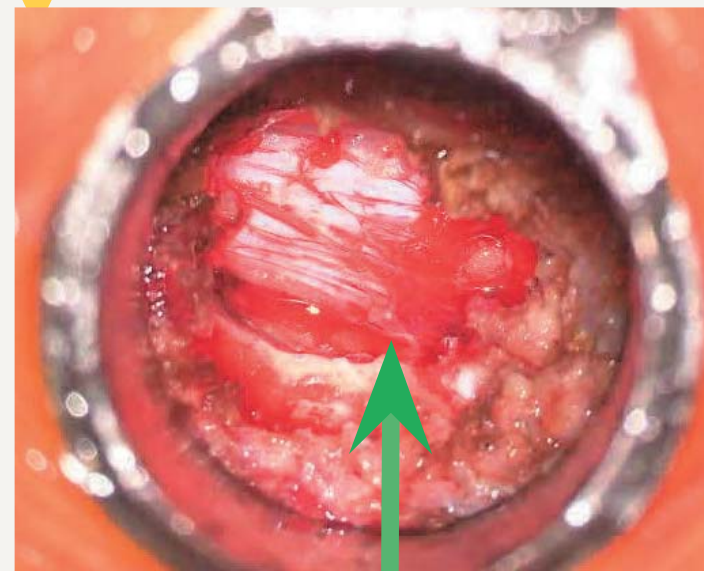
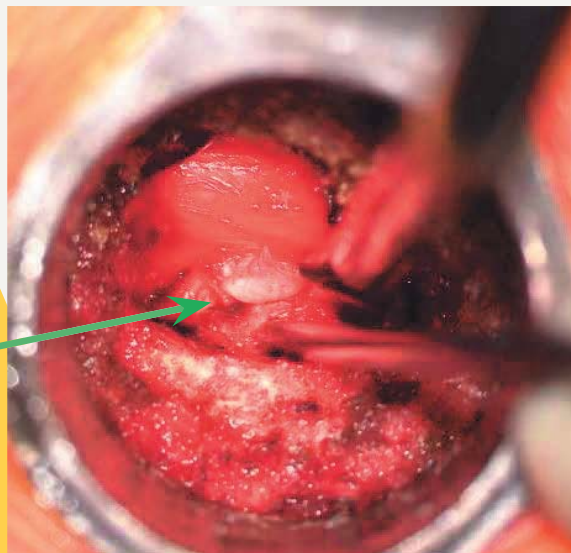
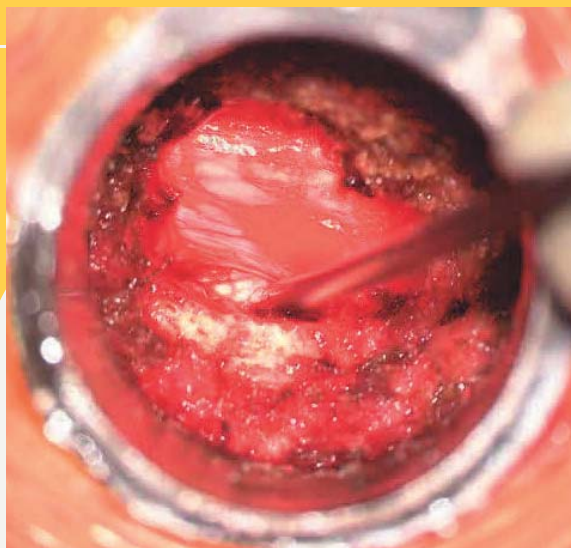
1. 7 months pain, limiting mobility, difficulty sitting
2. 2 rounds of injections with very temporary relief
3. No subjective motor or sensory change
4. Exam with subtle EHL weakness

### Management

1. Recommended microdiscectomy

# Left LBP with radiation to left hip

Annular Tear with disc extrusion



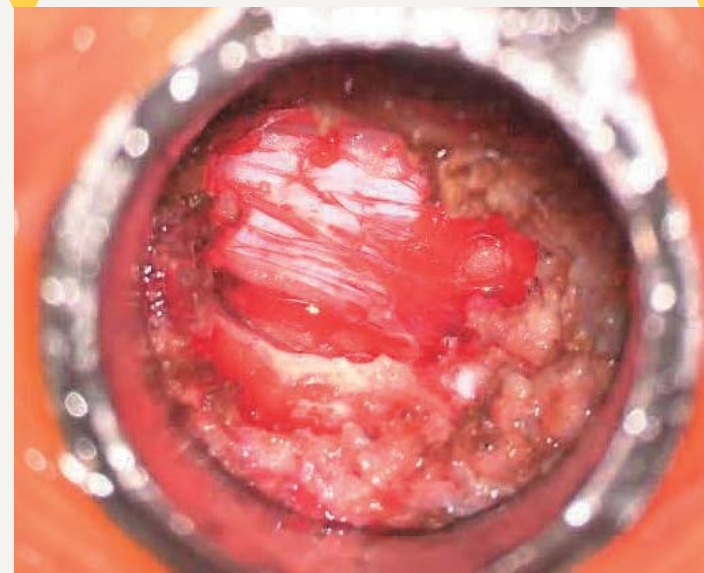
L5 Root



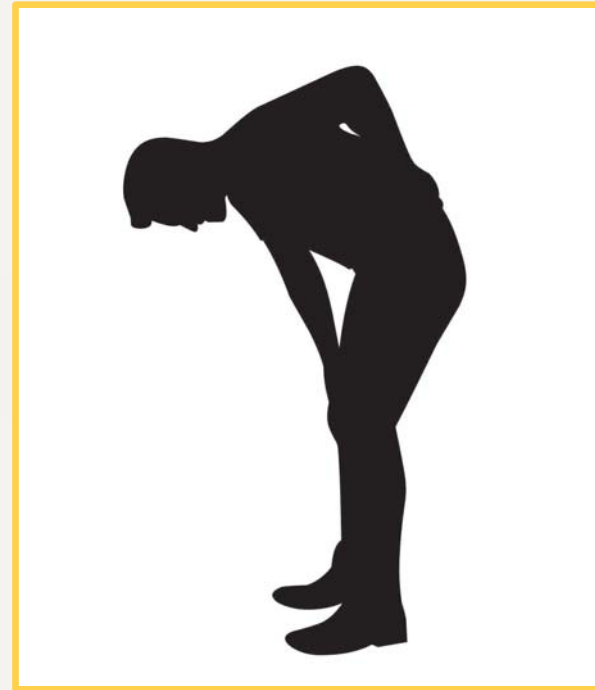
## Left LBP with radiation to left hip

### 6 week Post-op F/u

1. Leg pain resolved
2. Back pain resolved
3. Returning to weight lifting
4. Waiting until 3-6 months to return to "mushing"



Case 3 - Back pain and disc bulges



# 17yo athlete with back pain

## History

1. Notable PMH of tibial LCH
2. Presents with 6 months of back pain
3. MRI obtained by oncology and found disc bulges
4. Pain better with activity, worse at rest
5. Left hip historically higher than right



**17yo athlete  
with back pain**



**19yo M  
skateboarder  
with back pain**

- No PMH
- Back pain for many months
- Has been doing PT which helps him stay loose, but pain persists
- Pain in upper thoracic spine and low back
- Recently balance has felt off on skateboard

**19yo M  
skateboarder  
with back pain**

- No PMH
- Back pain for many months
- Has been doing PT which helps him stay loose, but pain persists
- Pain in upper thoracic spine and low back
- Recently balance has felt off on skateboard
- Notable exam findings: **left leg diffusely weak, calf atrophy, hyperreflexia**

**19yo M  
skateboarder  
with back pain**

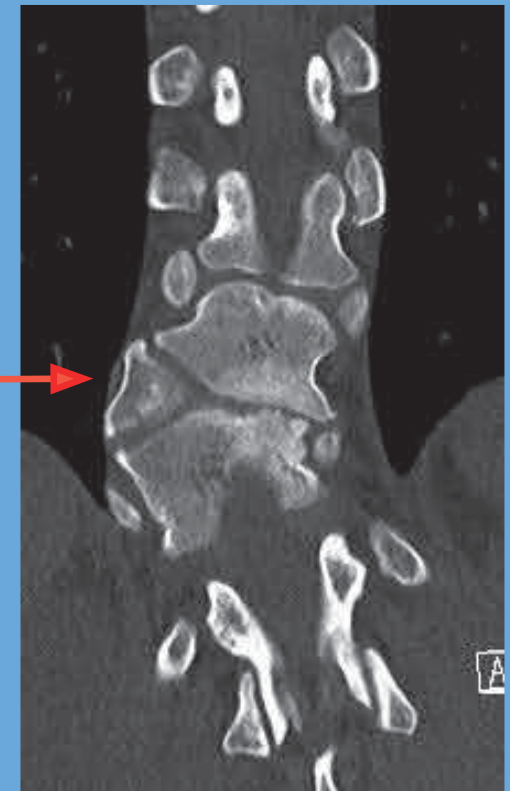


**19yo M  
skateboarder  
with back pain**





**19yo M  
skateboarder  
with back pain**



# 19yo M skateboarder with back pain

## Diagnoses

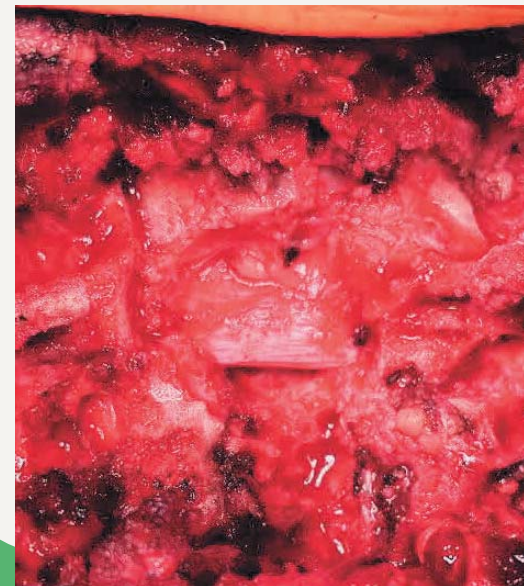
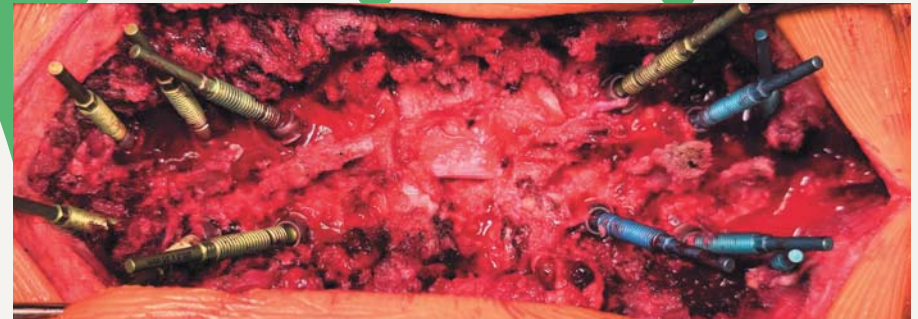
1. Thoracic myelopathy
2. Congenital scoliosis due to T10 hemivertebrae

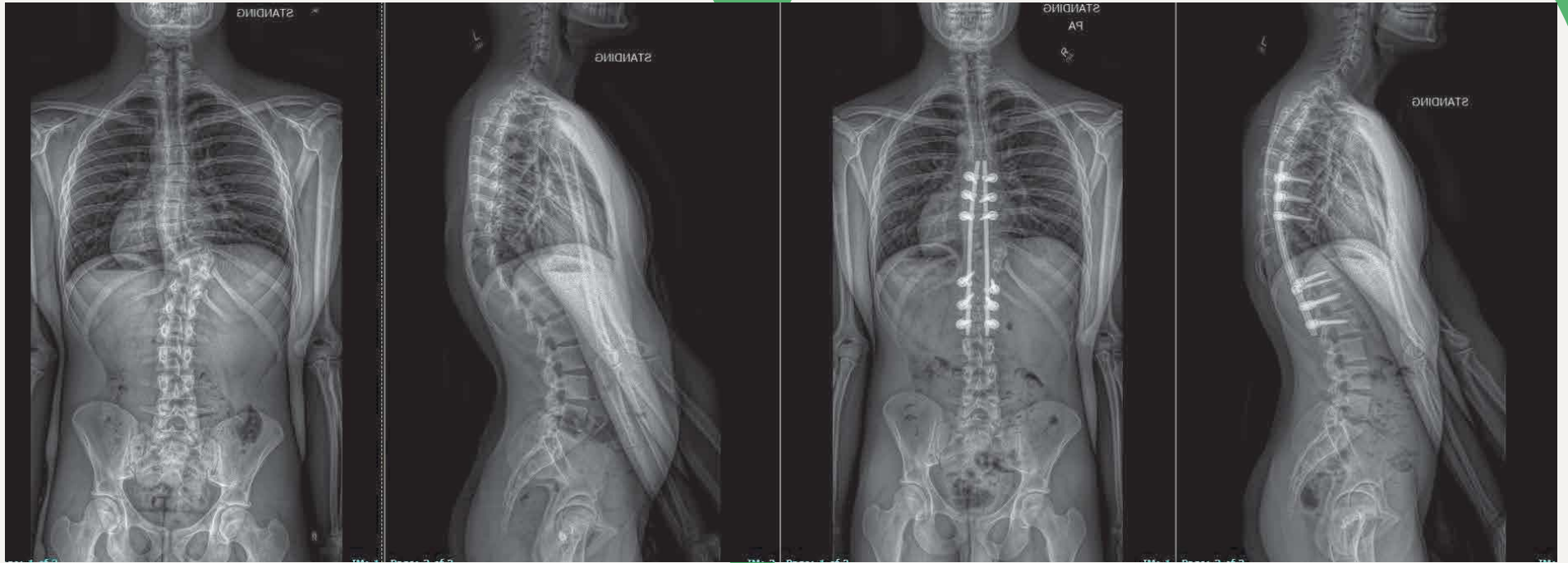
## Management

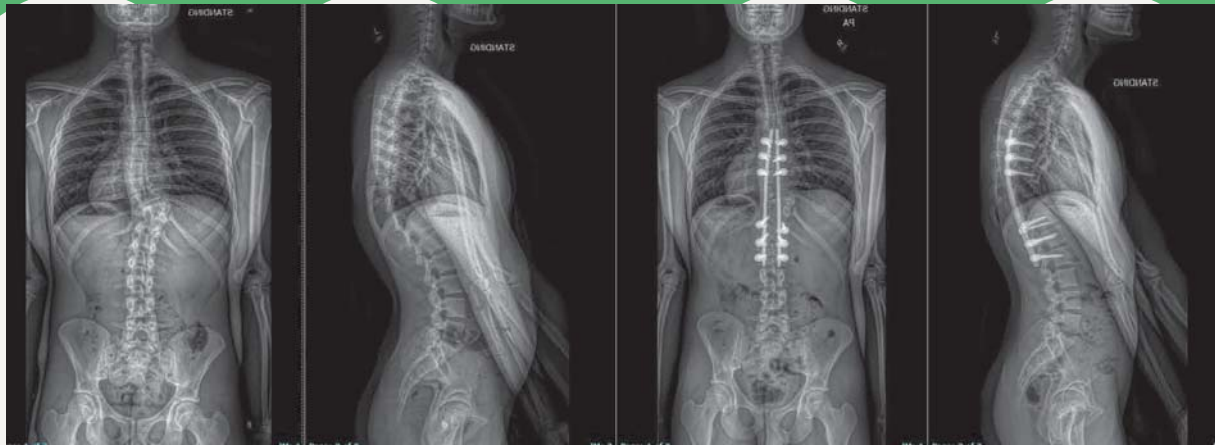
### Surgery

1. Decompression with costotransversectomy and two level partial corpectomy
2. Posterior spinal fusion due to iatrogenic instability and deformity correction

**19yo M  
skateboarder with  
back pain**







3 months post-op

1. Minimal back pain
2. Strength at baseline or better
3. Numbness in left foot resolved
4. Balance improved

# Chiari Malformation

Basics in Work-Up, Treatment, Post-operative Management

# 15yo F with headaches

15yo F with no medical history presents with headaches for over a year.

# 15yo F with headaches

15yo F with no medical history presents with headaches for over a year.

- headaches worse after lacrosse practice
- difficulty training, exercising last year
- hands feel different, trouble opening bottles



**15yo F with headaches**



# Classic Pathology

## Chiari Malformations

1. Chiari I - posterior fossa is too small for the contents
2. Chiari II - associated with open spina bifida defects (“hind brain herniation”)
3. Chiari III - associated with occipital encephalocele
4. Chiari IV - cerebellar/brainstem malformations



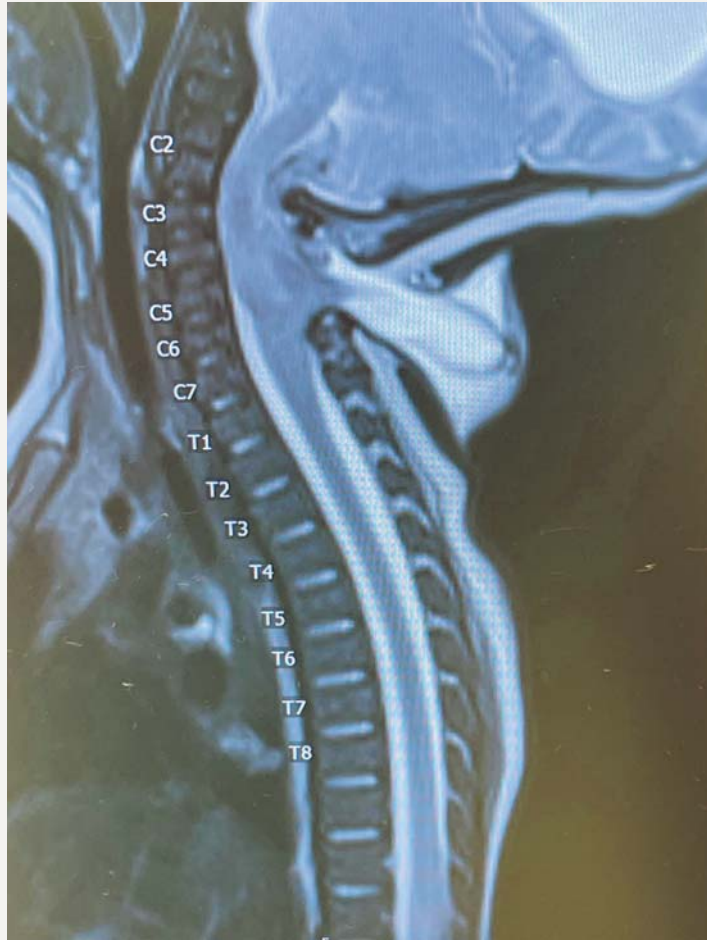
# Classic Pathology

## Chiari Malformations

1. Chiari I - posterior fossa is too small for the contents
2. Chiari II - associated with open spina bifida defects (“hind brain herniation”)
3. Chiari III - associated with occipital/high cervical encephalocele
4. Chiari IV - cerebellar/brainstem malformations

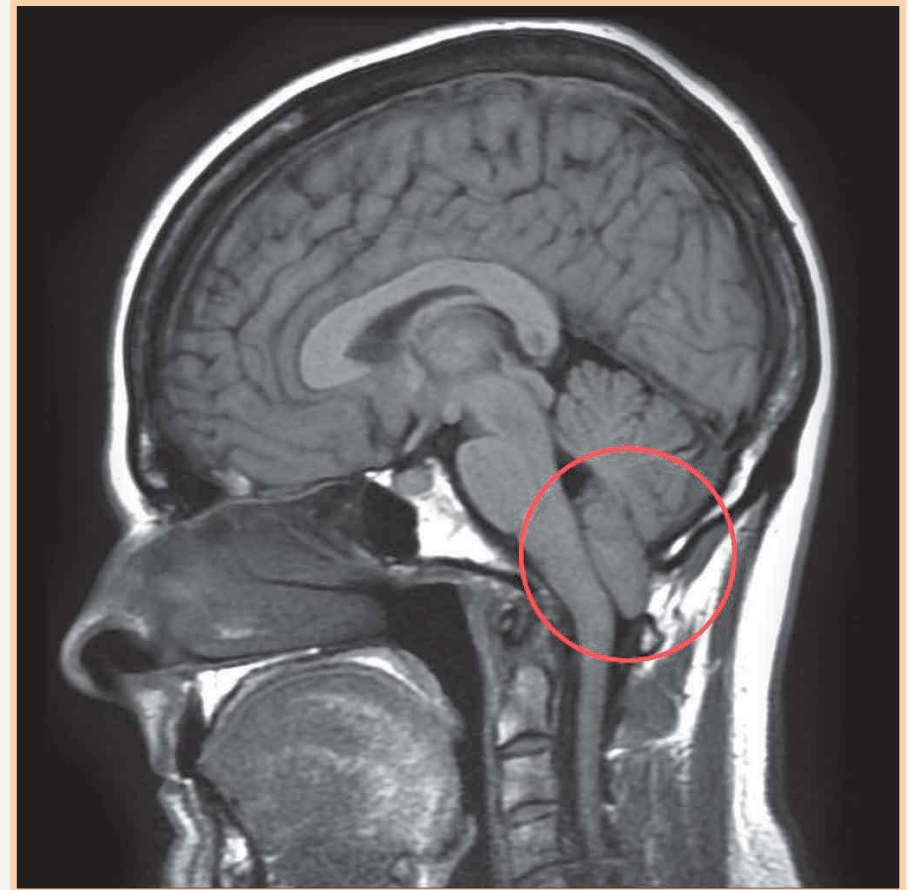






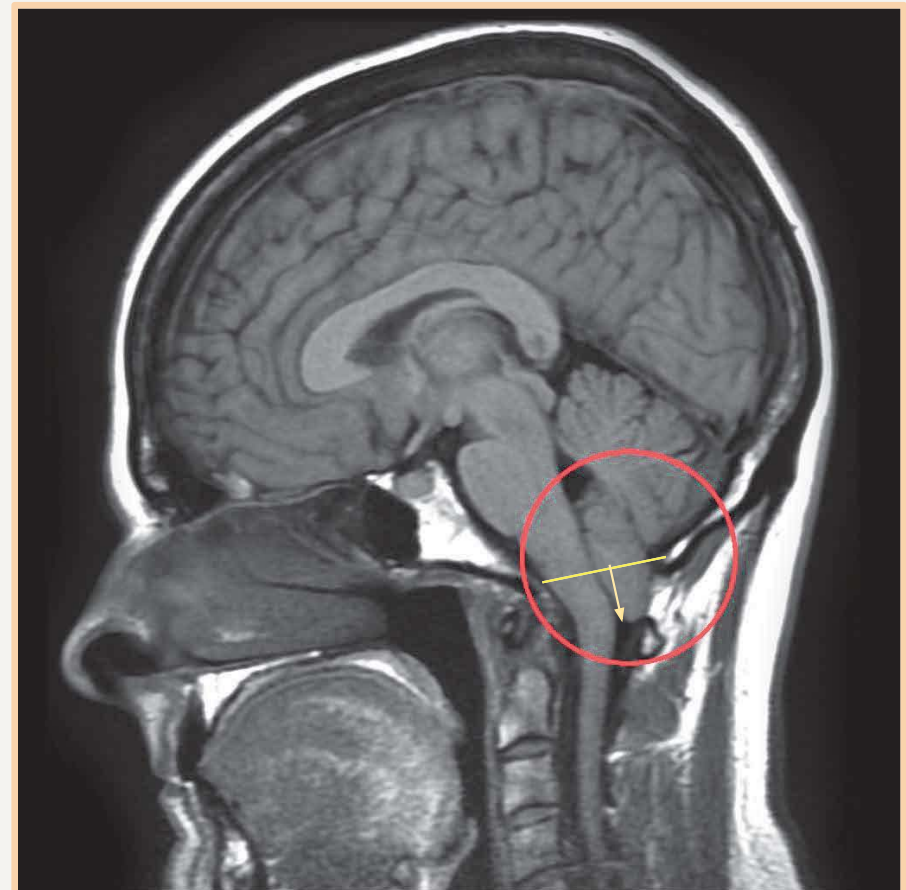
# Chiari I Malformation

- Very Common - 0.5-3.5% prevalence in general population
- Female > Male
- Occasionally genetic association with “chiari families”
- Typically not a medical emergency!



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- Typically not a medical emergency!



# Classic Pathology

## Chiari I Malformations

1. Valsalva-induced headaches
2. Central sleep apnea
3. Swallowing difficulties
4. Syrinx up to 20%
  - i. sensory/motor deficits possible
5. Scoliosis





# Chiari I Malformation Presentation Spectrum

Swallow Apraxia

Headaches

Sleep Disordered Breathing

Decreased Activity

Behavioral Symptoms

Balance Problems

Focal Neurologic Symptoms

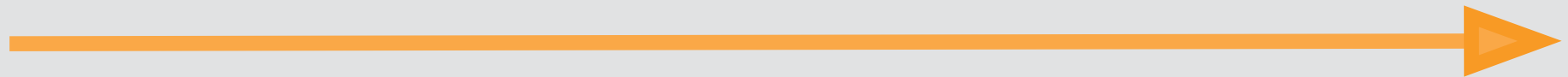
Infant

Toddler

Adolescent

Teen

Adult



# Chiari I Malformation Evaluation



# MRI Evaluation

Intracranial Mass  
lesion?

Hydrocephalus?

CSF Leak?

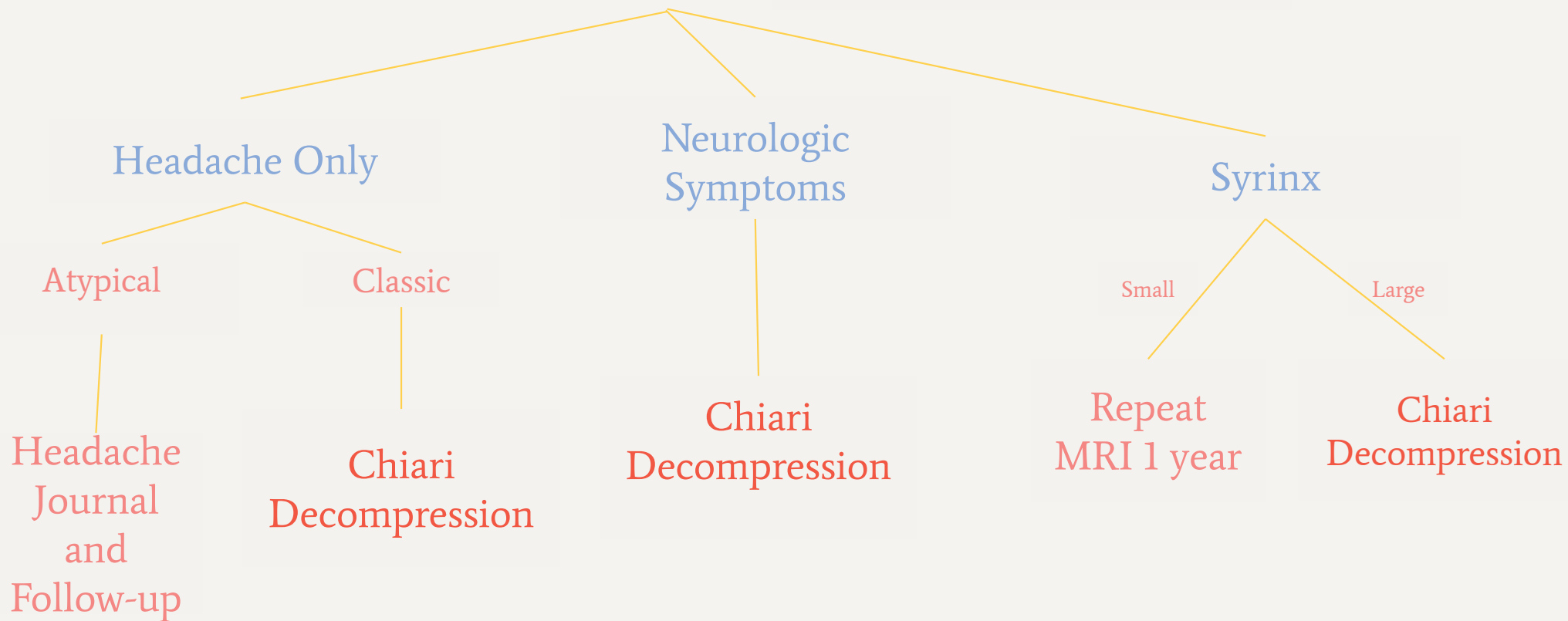
Tonsils are down

Syrinx?

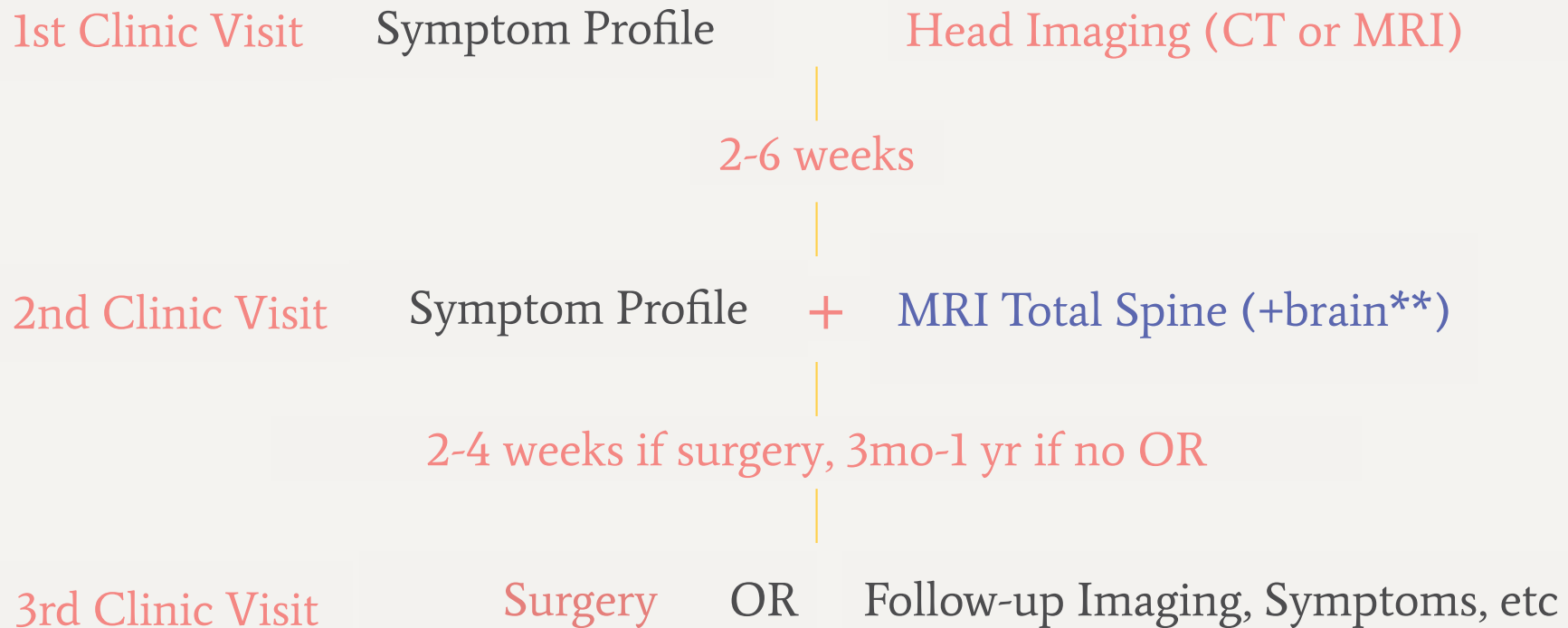
Tethered Cord?

# Chiari I Malformation Evaluation

Symptom Profile + MRI Total Spine (+brain\*\*)



# Chiari I Malformation Evaluation Prior to OR



# Choosing an Operation

- 1st Operation Options
  - Bone only decompression
  - Decompression with duraplasty
    - Tonsillar resection?
- Bone only and duraplasty equivalent in clinical improvement
- Duraplasty = higher rate of syrinx regression, less redo operations

**JNS** PEDIATRICS CLINICAL ARTICLE  
J Neurosurg Pediatr 30:39-61, 2022

**Complications and outcomes of posterior fossa decompression with duraplasty versus without duraplasty for pediatric patients with Chiari malformation type I and syringomyelia: a study from the Park-Reeves Syringomyelia Research Consortium**

	PFD (n = 75)	PFDD (n = 76)	P value	Mean difference (PFDD - PFD) (95% CI)	Odds ratio (PFDD vs PFD) (95% CI)
Clinical improvement <sup>a</sup> ≤24 mo after surgery, % (No.)	77.33 (58)	69.74 (53)	.29	-7.6 (-21.61 to 6.42)	0.58 (0.25- 1.40)
Syrinx regression <sup>b</sup> ≤24 mo after surgery, mean (SD), mm	1.15 (1.90) 73	3.07 (2.40) 74	.0001	1.92 (1.21- 2.62)	3.97 (2.25- 7.01)

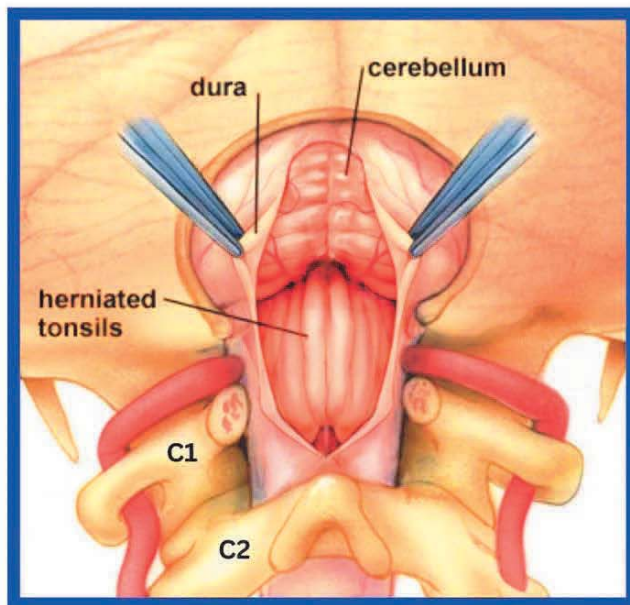
# Choosing an Operation



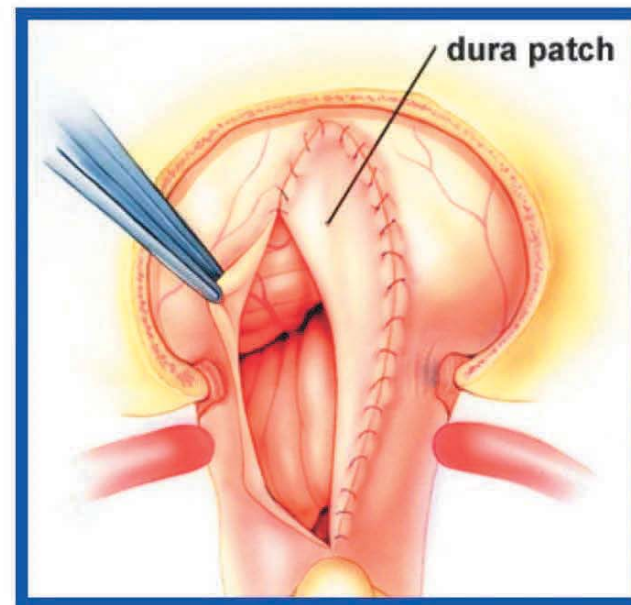
- Dural repair with autograft -> *lower rates of pseudomeningoceles, meningitis*

# 15yo F with headaches

## Chiari Decompression Surgery



The opening of the dura mater to visualize and reduce the herniated cerebellar tonsils.

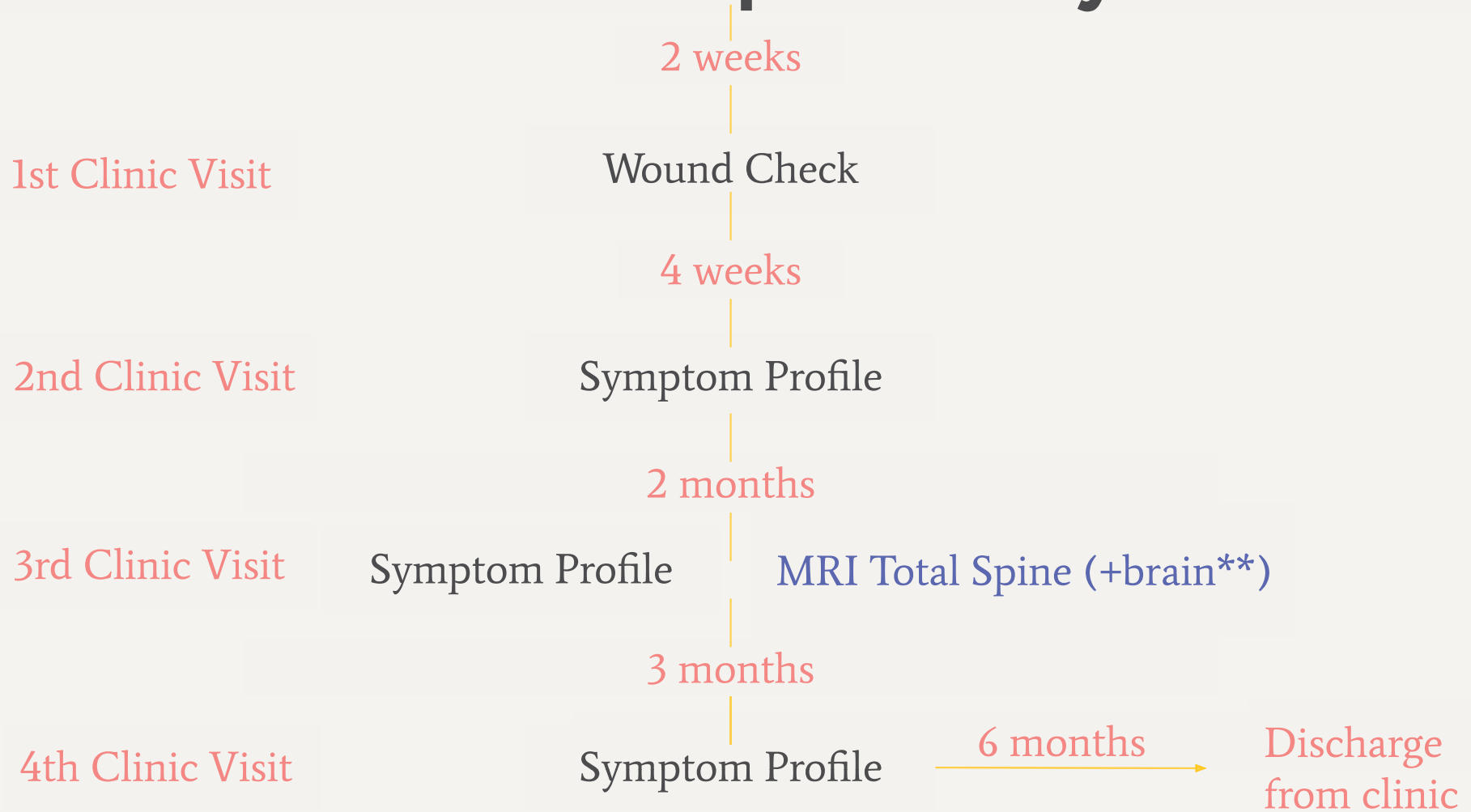


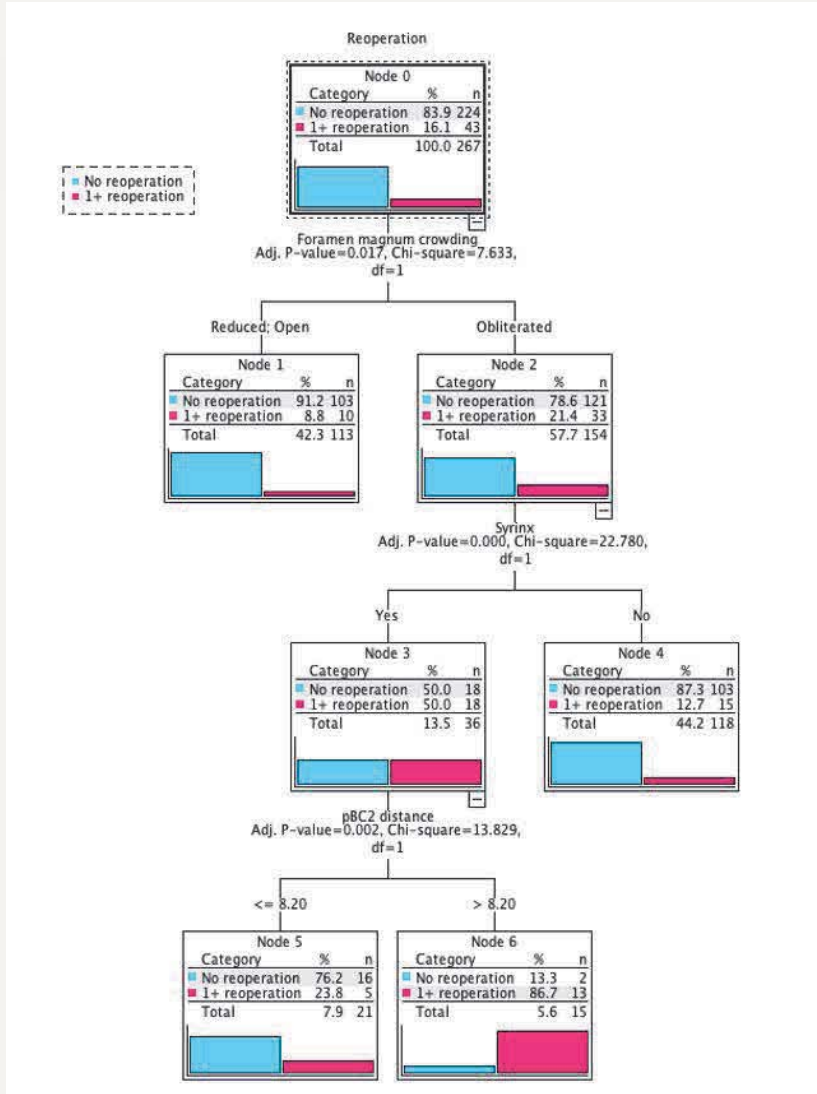
The closing of the dura mater with a patch once the cerebellar tonsils have been reduced.



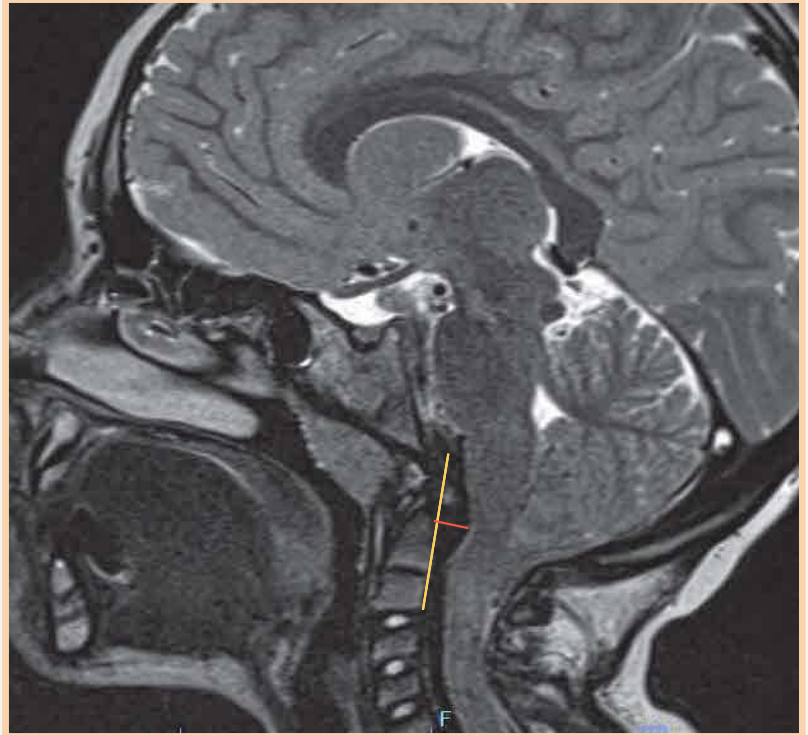


# Post-Operatively

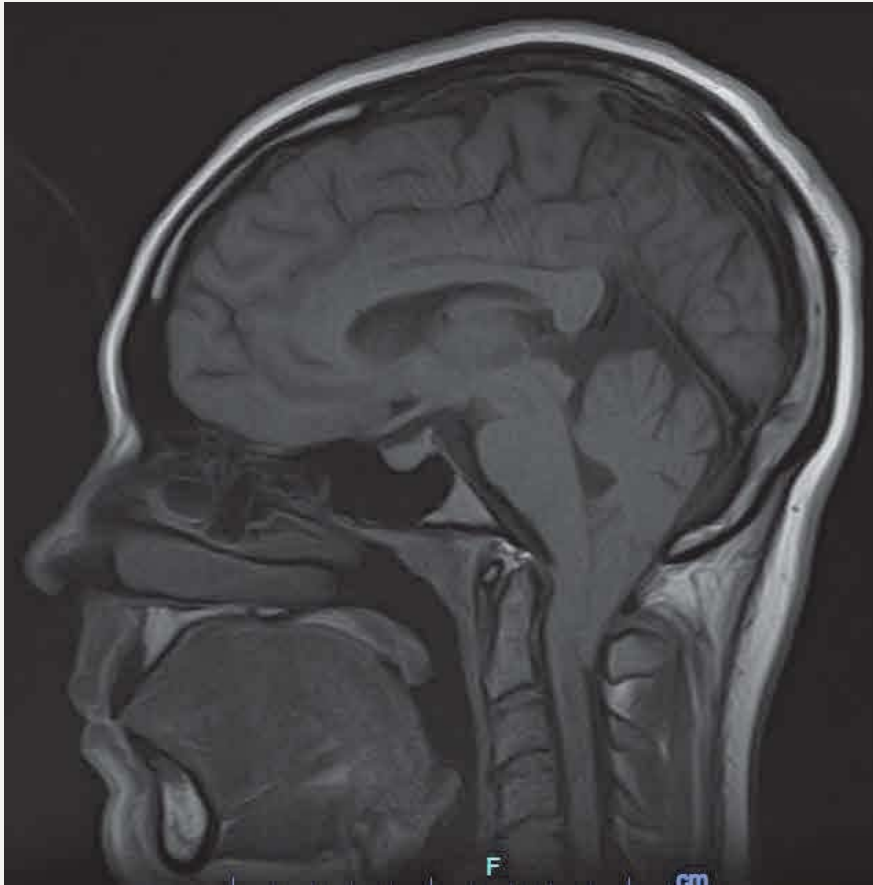




's



# 27yo F with debilitating exertional headaches



Chiari decompression and duraplasty.

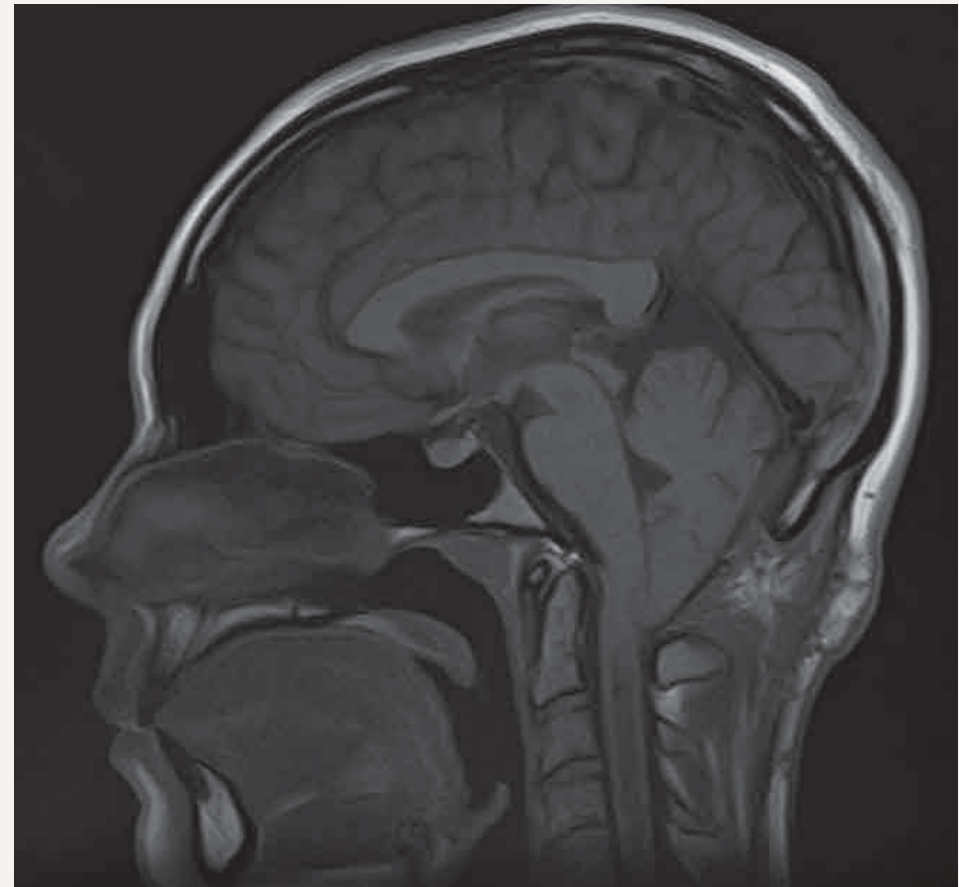
Initial improvement in headaches.

Few months later, headaches return and strange hot/cold sensory changes on arms.

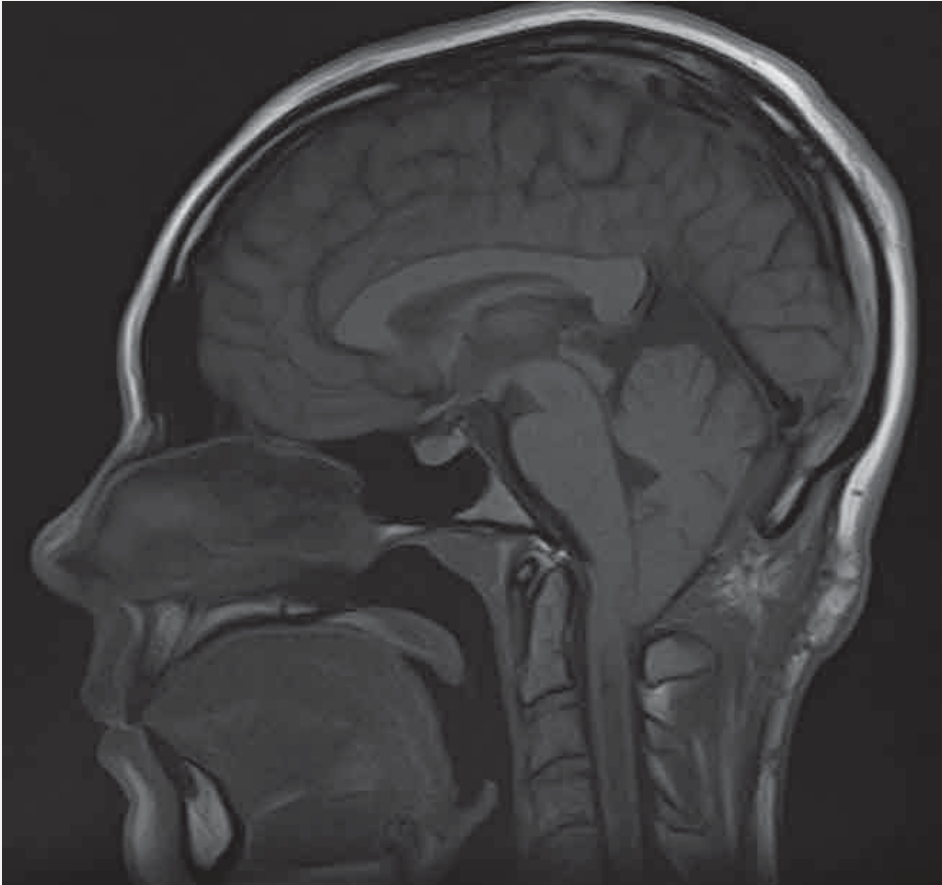
# 25yo F with debilitating exertional headaches



6 wks  
post-op



# 27yo F with debilitating exertional headaches



12 wks  
post-op



# 27yo F with debilitating exertional headaches



Revision decompression and duraplasty with dissection of 4th ventricle adhesions

Again improves for several months.

# 27yo F with debilitating exertional headaches



6 month f/u

Improved  
syrinx



# 27yo F with debilitating exertional headaches



18 month f/u

Headaches  
returned.

Balance  
problems.

Right arm  
weak





# 27yo F with debilitating exertional headaches



Return to OR for revision decompression and placement of 4th ventricular stent.

Immediate post-op improvement in strength, headaches and balance.

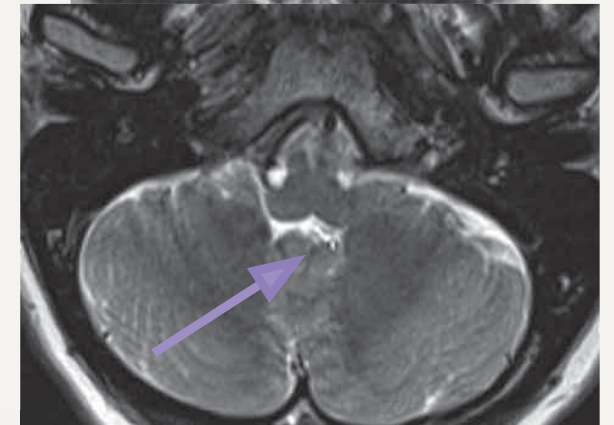
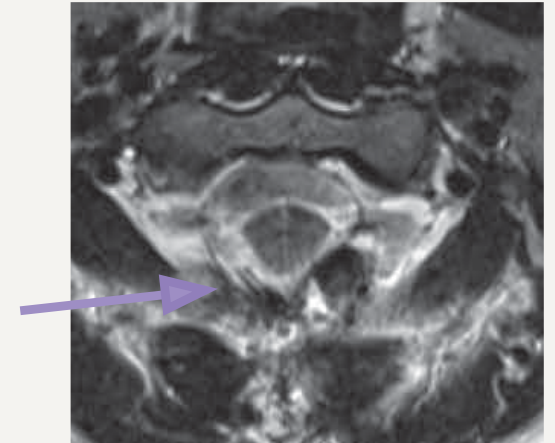
# 27yo F with debilitating exertional headaches



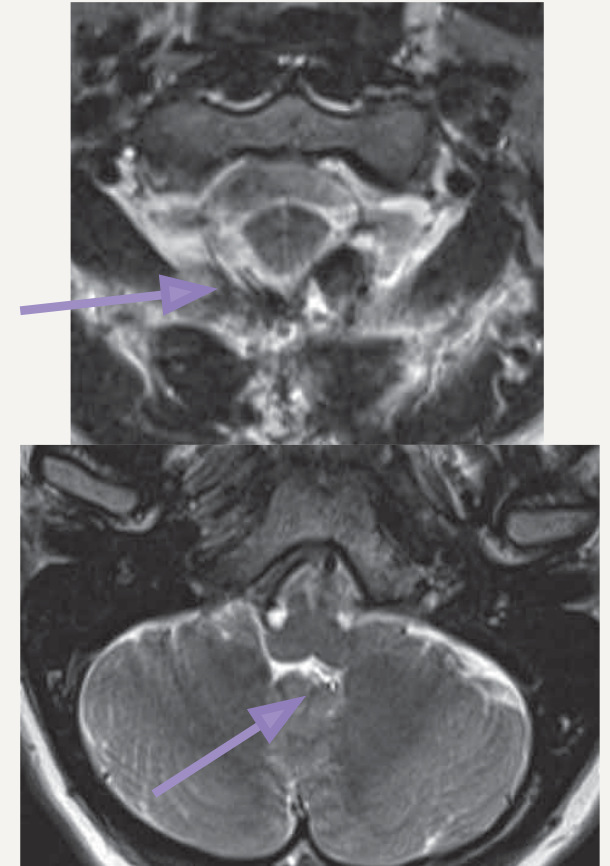
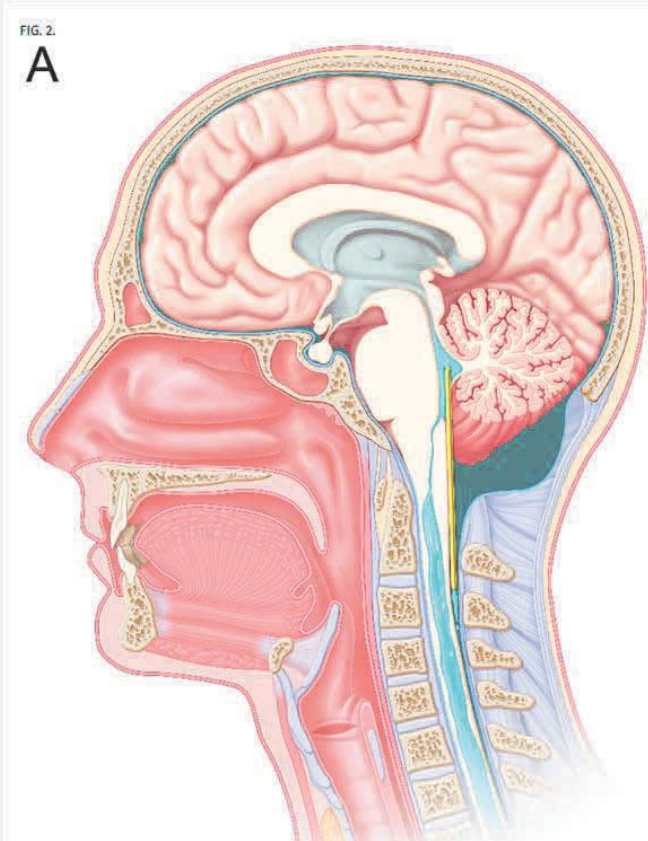
Pre



Post



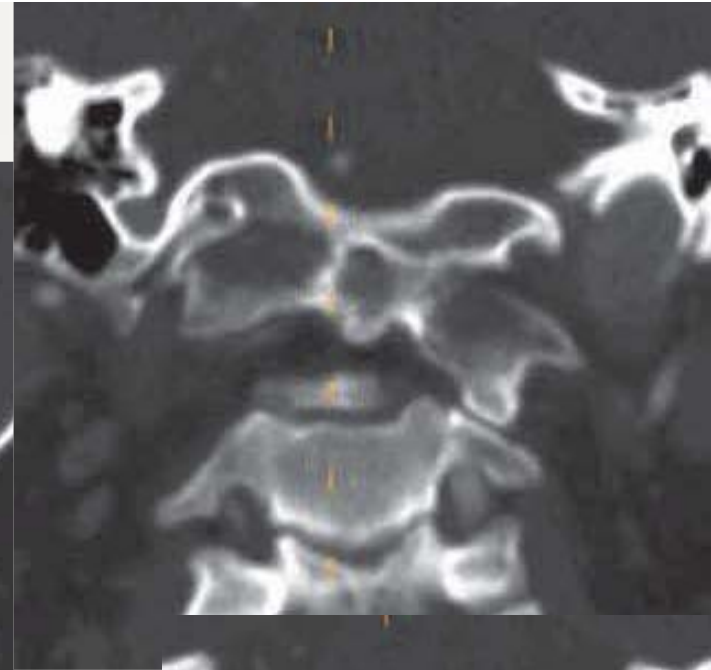
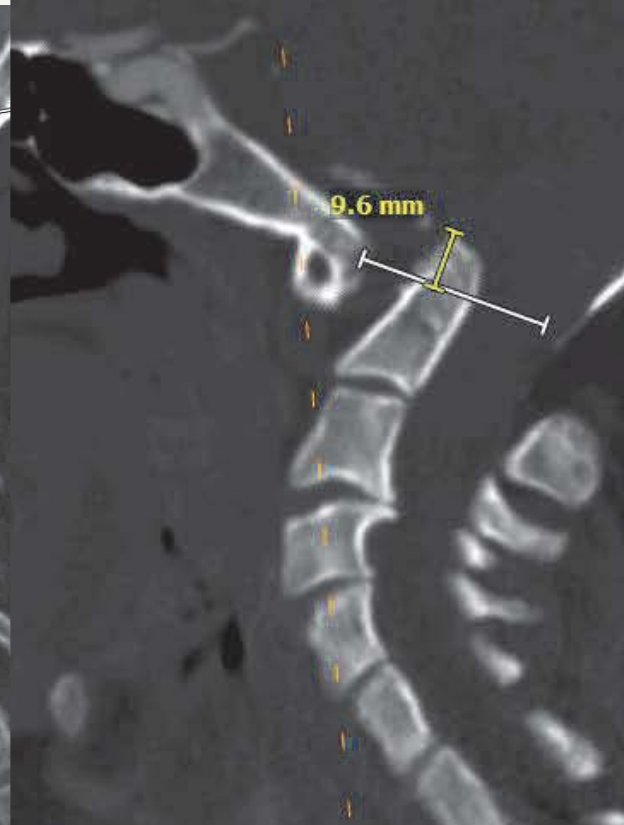
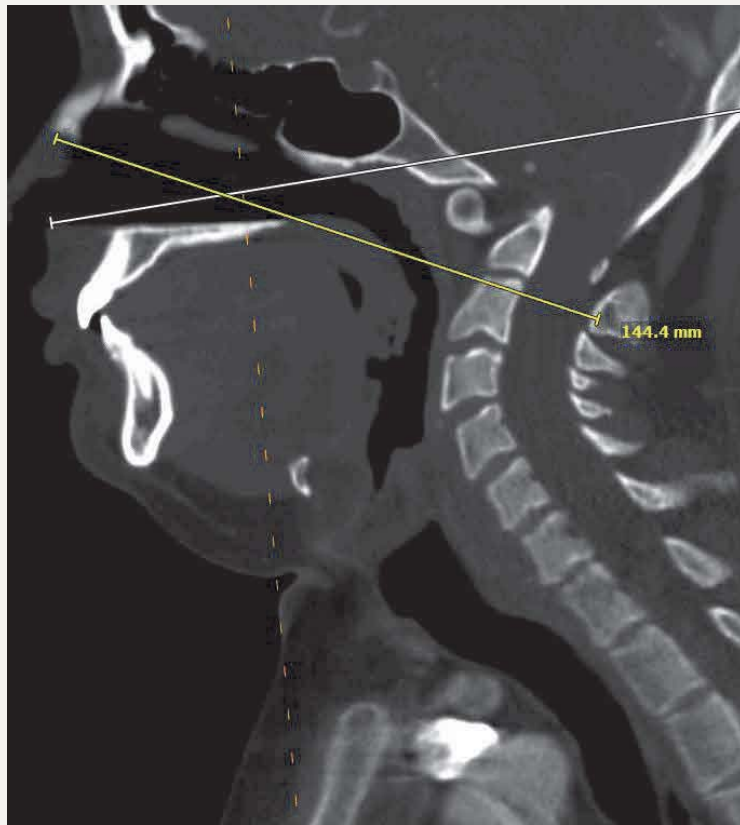
# 27yo F with debilitating exertional headaches



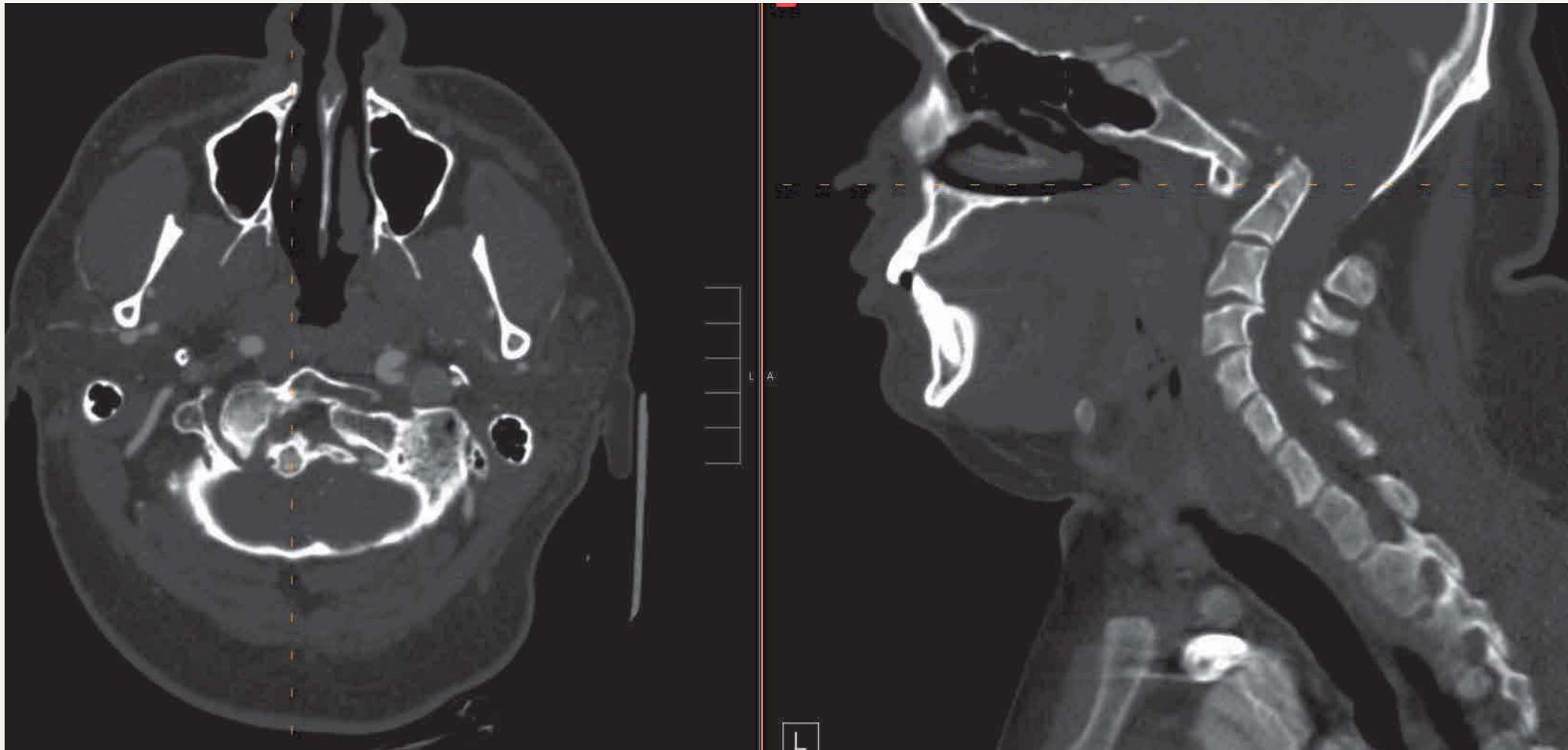
**25yo M**

Acute right sided hemisensory loss, tongue fasciculations, bulbomyelopathy

# Midline craniocervical anatomy



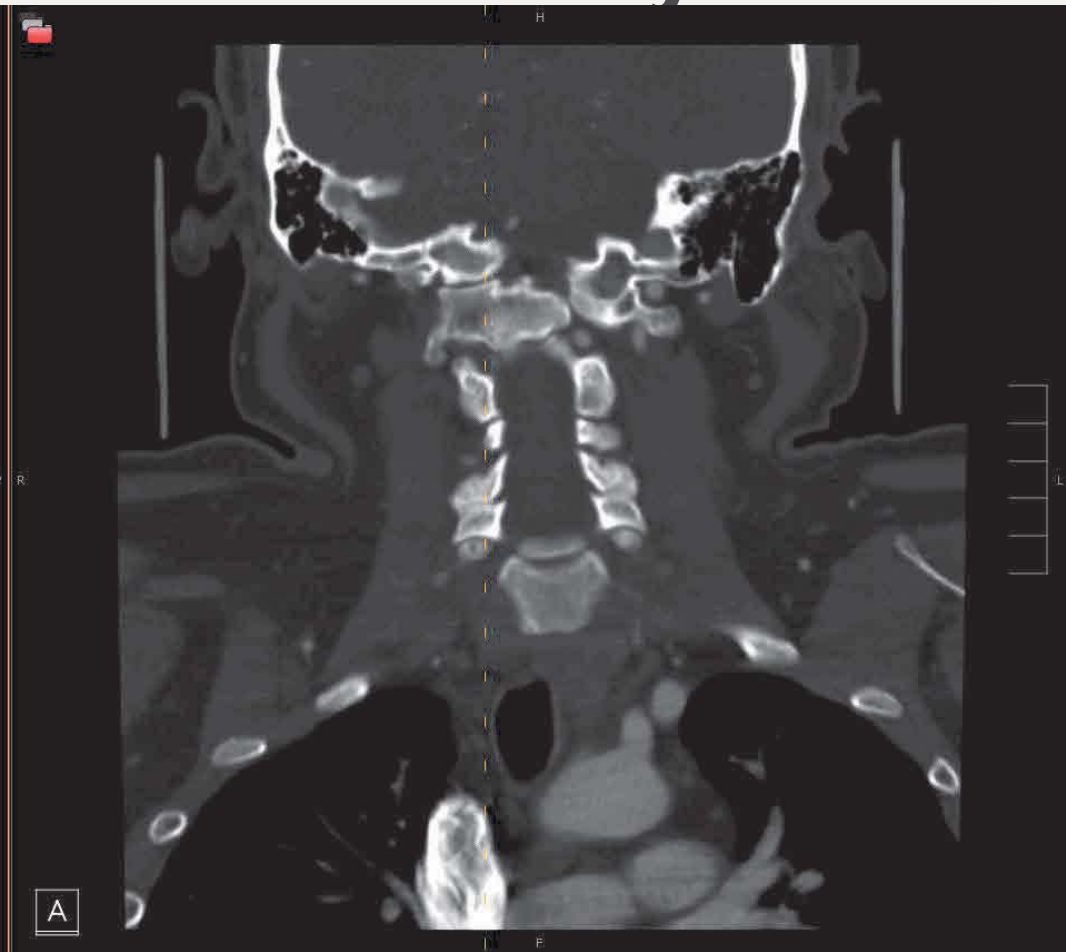
# Midline craniocervical anatomy



# Left craniocervical anatomy

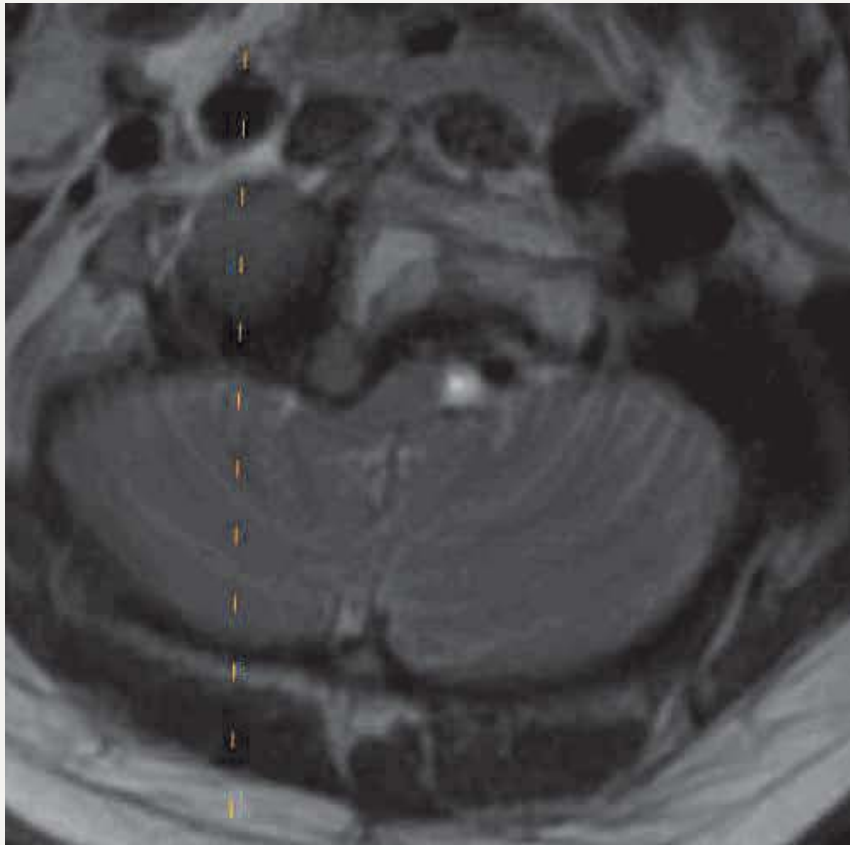


# Right craniocervical anatomy





# MRI - rhombencephalopathy (chiari 1.5), syringomyelia



# Surgical Plan

1. Posterior decompression w/duraplasty and tonsillopepy
  - a. Get safe decompression
2. Posterior OCF
  - a. C2 hemivertebrae and C1 assimilation  
-> natural history is to worsen BI with time
3. Test mobility intra-op and potential to reduce craniocervical kyphosis
4. Extreme lateral approach for odontoid resection if needed
  - a. Diminutive right side vertebral artery ("BTO" intra-op with clipping and IOM) that could potentially be sacrificed to increase working corridor
  - b. Transoral/Endonasal route increased risk with medial right ICA and anomalous left vertebral artery course

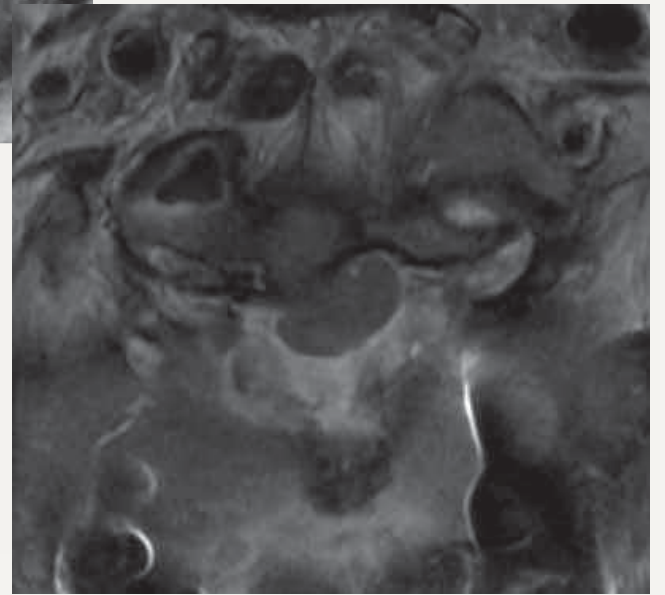
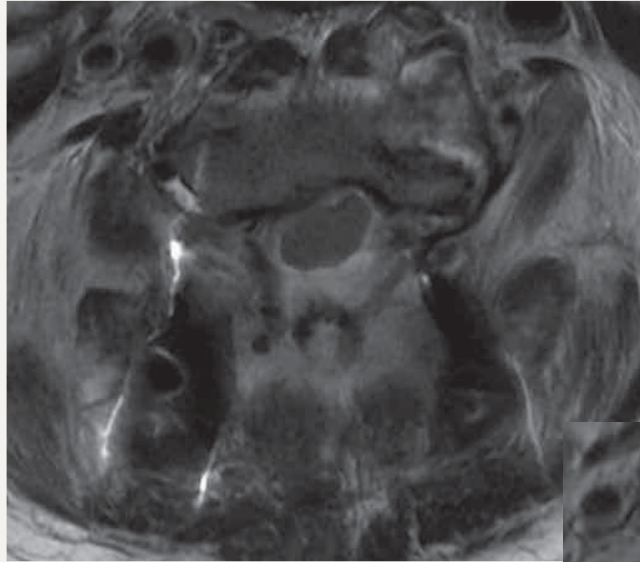
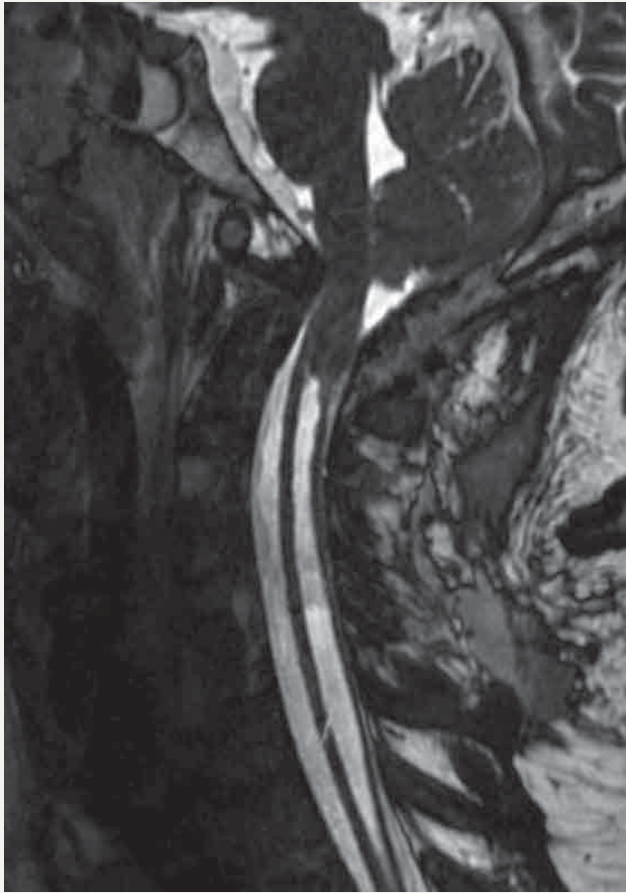
# Setup

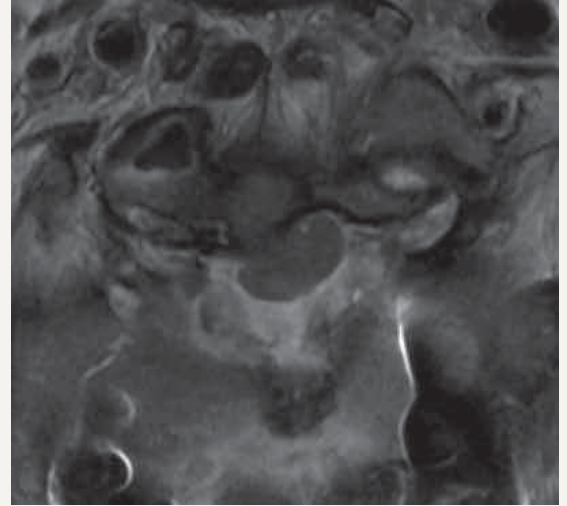
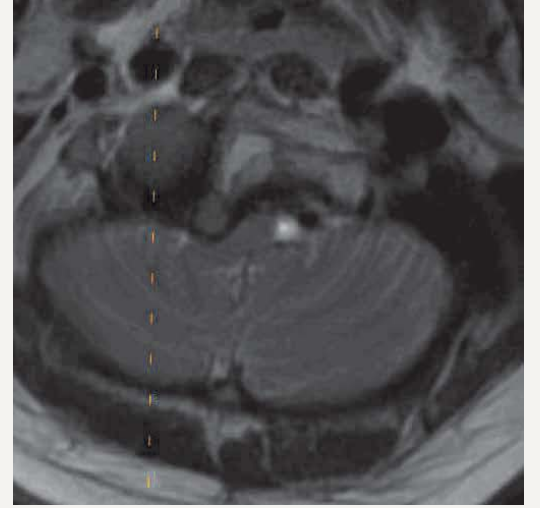
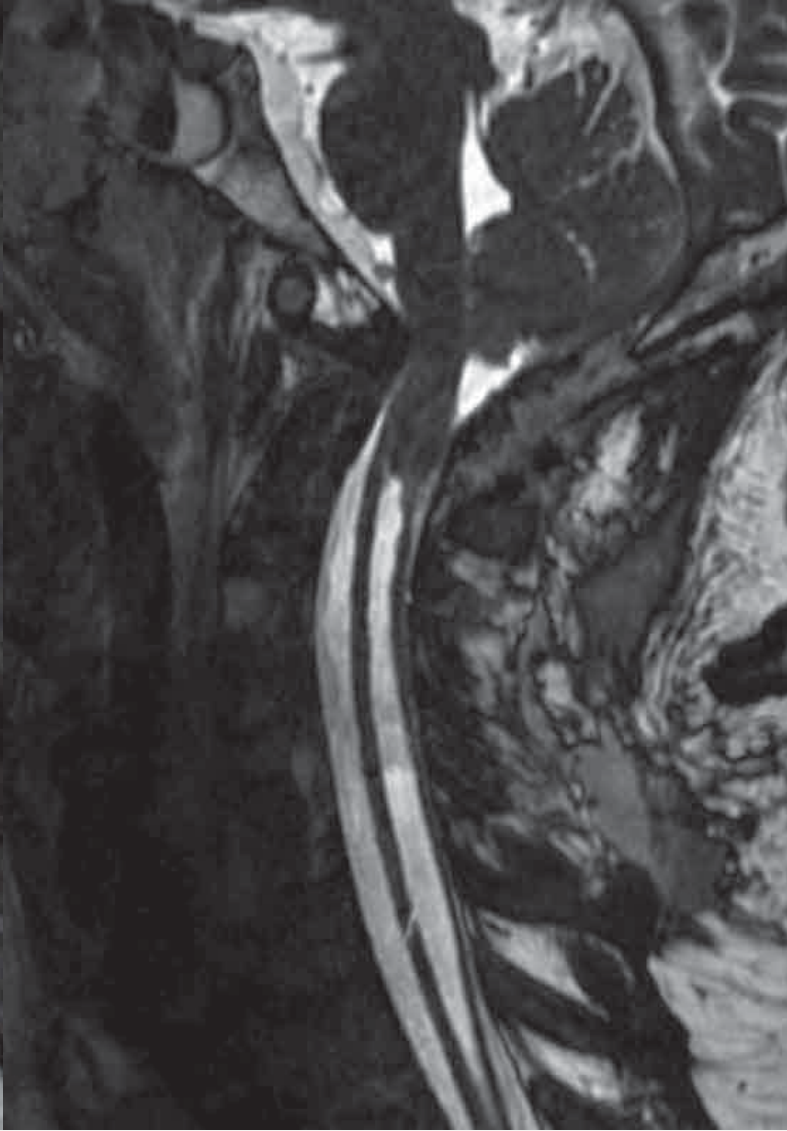
1. Phase 1 prone
2. Anesthesia
  - a. TIVA
  - b. A-line
  - c. CVC
  - d. MAP>80
  - e. Foley
  - f. Dexamethasone
3. IOM
  - a. SSEPs, MEPS, consider lower cranial nerves
  - b. Pre-flip baseline with significant pre-op deficits on exam
4. Stealth CTA head merged with thin slice C-spine (for extreme lateral)

# Intra-op

1. C2 noted to be highly mobile
2. Large tonsils were easily reduced leaving foramen magnum well decompressed.
3. Key - screw into C2 pars on the right to distract against
4. Rod plates fixed to skull and loose in the cervical screws.
5. Distracted spine away from skull w/lamina spreader between right C2 screw and skull base.
6. Locked in place -> O-arm to check reduction







# Practice Contact Information

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### To refer patients, please call:

- **Appointments:** 714-509-7070
- **Fax:** 714-509-7074
- **Online Referral Portal:** [choc.org/referrals](http://choc.org/referrals)

### Specialty Care Physician Concierge Service

- 714-509-4013

*Physicians available via Voalte®*



# Contact Us

## CHOC, now part of Rady Children's Health Business Development

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Phone: 714-509-4291

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Thank you.

