The Treatment of Neural Compressive Conditions in the Cervical Spine

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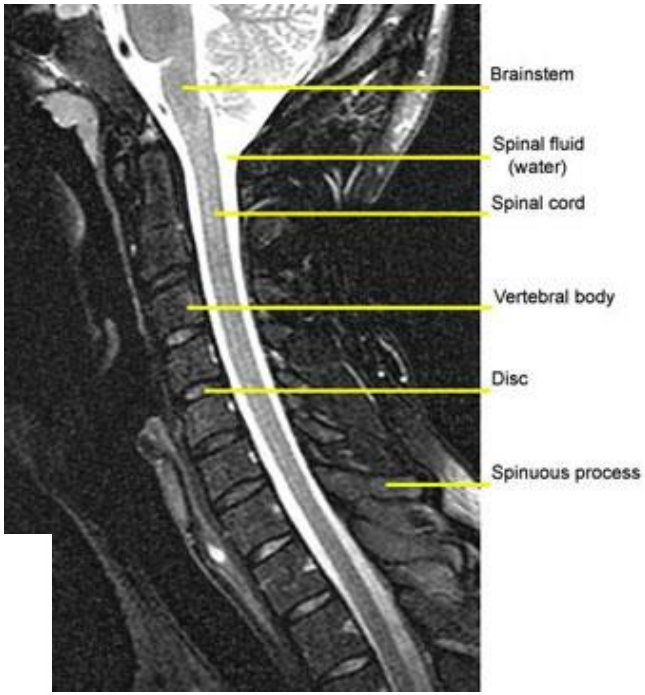
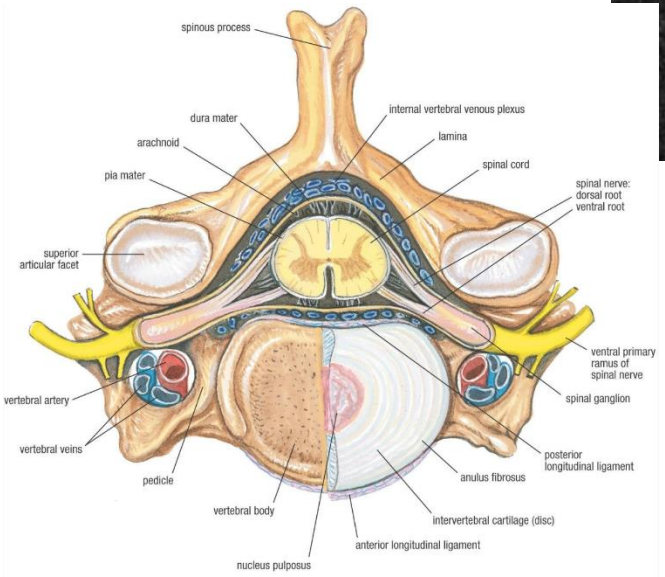
Cervical Spine Anatomy

- Three components of the cervical spine

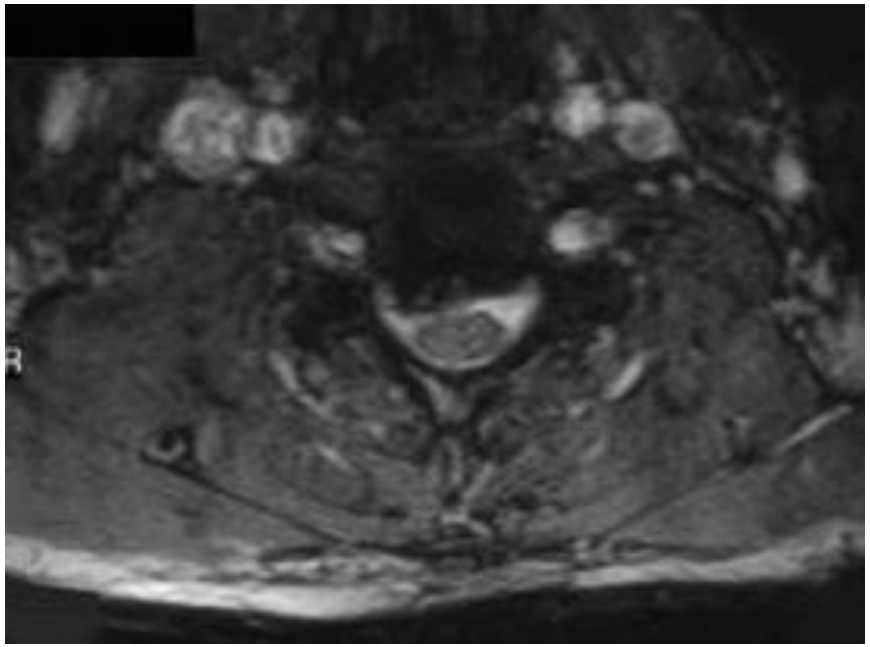
1. Vertebral Body
2. Intervertebral Discs
3. Neural Elements (spinal cord, nerve root)





Clinical Conditions of the Cervical Spine– Radiculopathy

- **Radiculopathy**: Mechanical compression of the nerve root



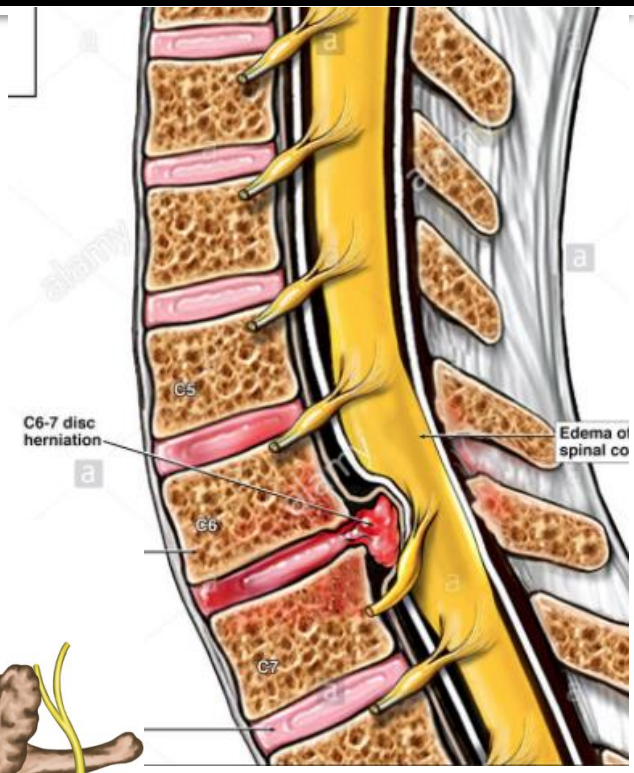
Clinical Conditions of the Cervical Spine– Myelopathy

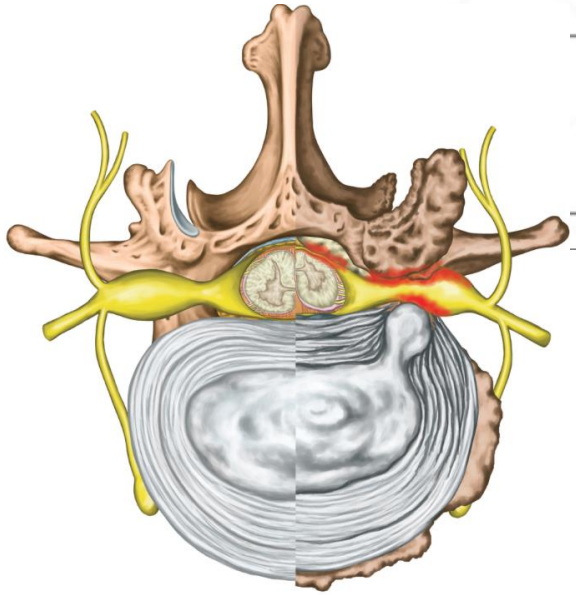
- **Myelopathy**: Mechanical compression of the spinal cord

Etiologies of Cervical Spine Disorders

Disc Herniation:

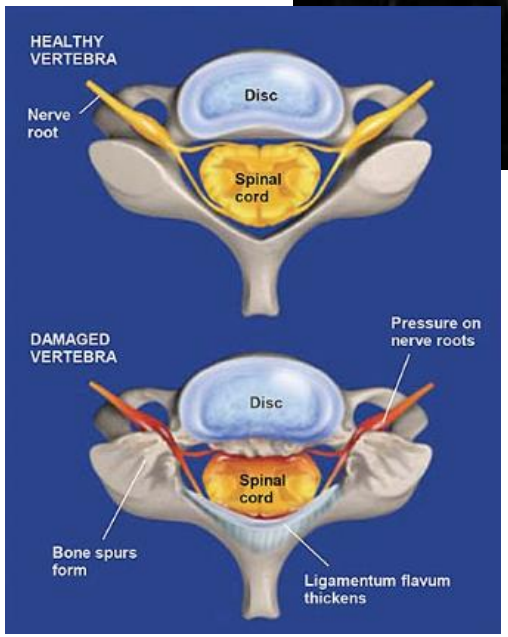
Contents of the intervertebral disc push against the spinal cord/ nerve roots





Spinal Stenosis

Spinal Stenosis: The space available for the spinal cord/ nerve root is small because of hereditary or degenerative factors



Symptoms and Physical Exam Findings

- Obtaining a detailed history is very important
  - Traumatic vs. atraumatic
  - Acute vs. chronic

- Disc herniation: may be traumatic or atraumatic
- Spinal stenosis: pre-exists, but may be aggravated by trauma

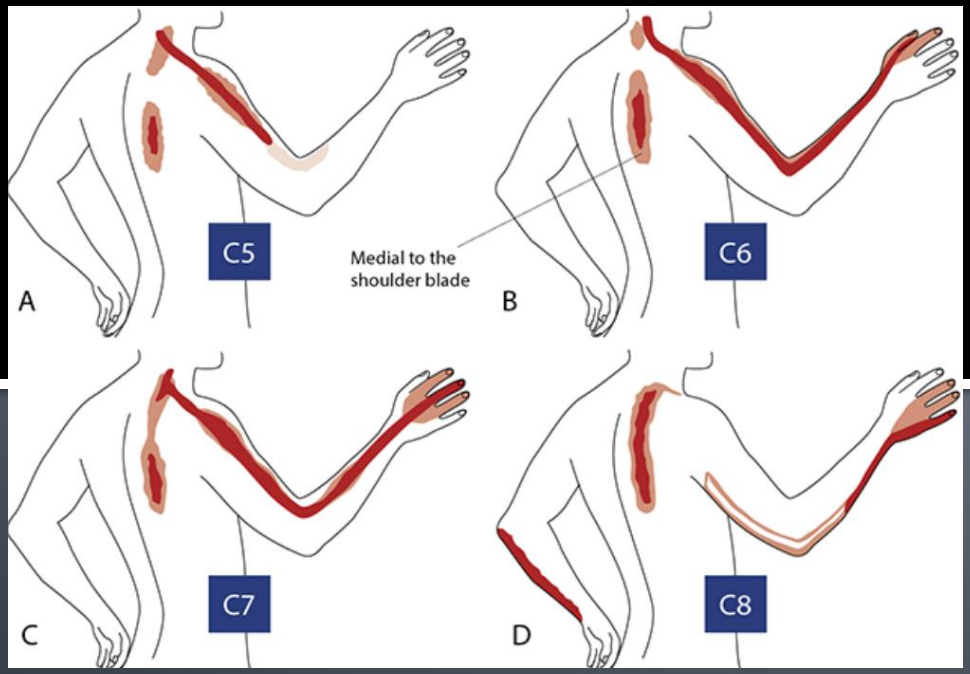
Radiculopathy

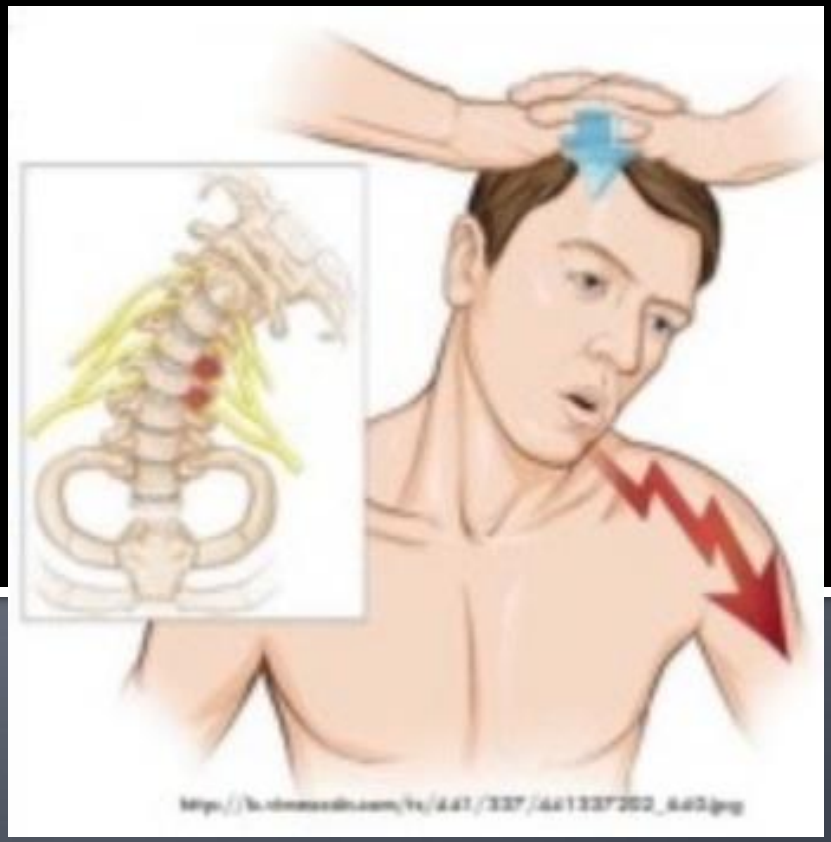
- **Symptoms:** burning, numbness, tingling, muscle weakness of neck/shoulder/arm/hand
- **Physical Exam:** decreased sensation and/or muscle strength, hypoactive reflex (specific to the nerve root being compressed)

Physical Exam Findings Radiculopathy

Spurling Test

- Rotation towards affected side with axial compression→closes down foramen
- Reproduces symptoms
- Specific Dermatome





Myelopathy

- **Symptoms:** abnormal/unsteady gait, decreased hand dexterity (e.g. buttons/ hand-writing changes), bowel/bladder incontinence, wasting of hand muscles
- **Physical Exam:** decreased sensation below level of cord compression, decreased muscle strength in one or more extremities, increased (hyperactive) reflexes
  - **Abnormal reflexes:** Babinski, clonus, L'hermitte's, Hoffman

Physical Exam Findings

Reflex Testing

- Hyperreflexia
- Abnormal reflexes

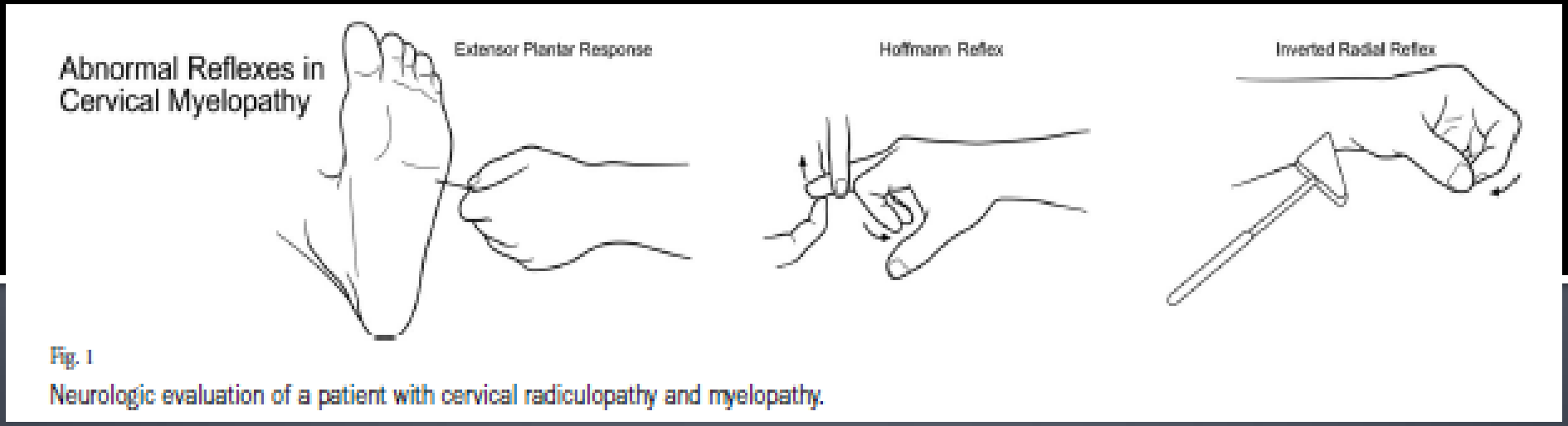


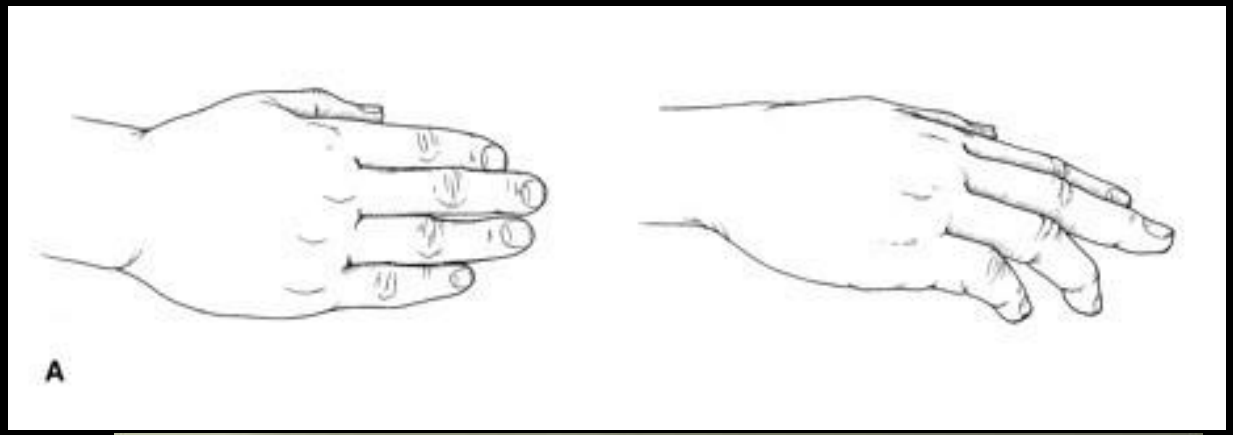
Fig. 1

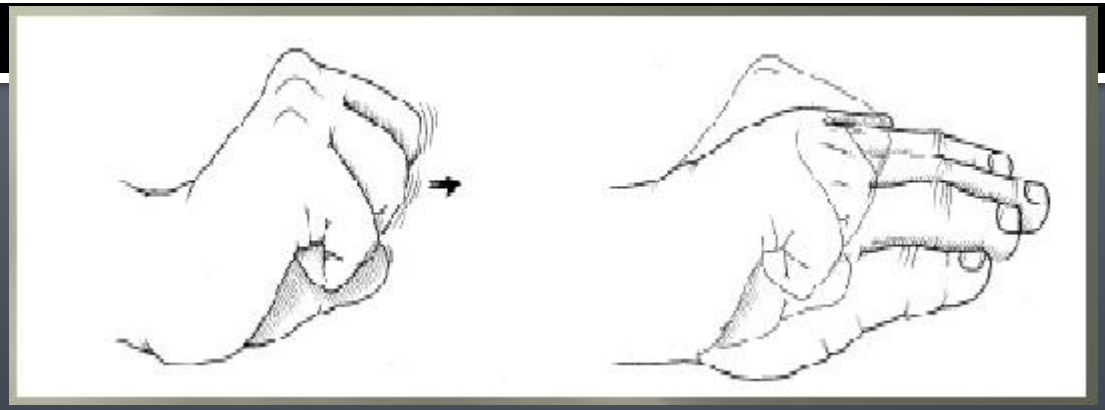
Neurologic evaluation of a patient with cervical radiculopathy and myelopathy.

Physical Exam Findings

Myelopathic Hand

- Myelopathic hand: loss of dexterity, diffuse numbness, intrinsic wasting, inability to grasp and release the fist, finger escape sign



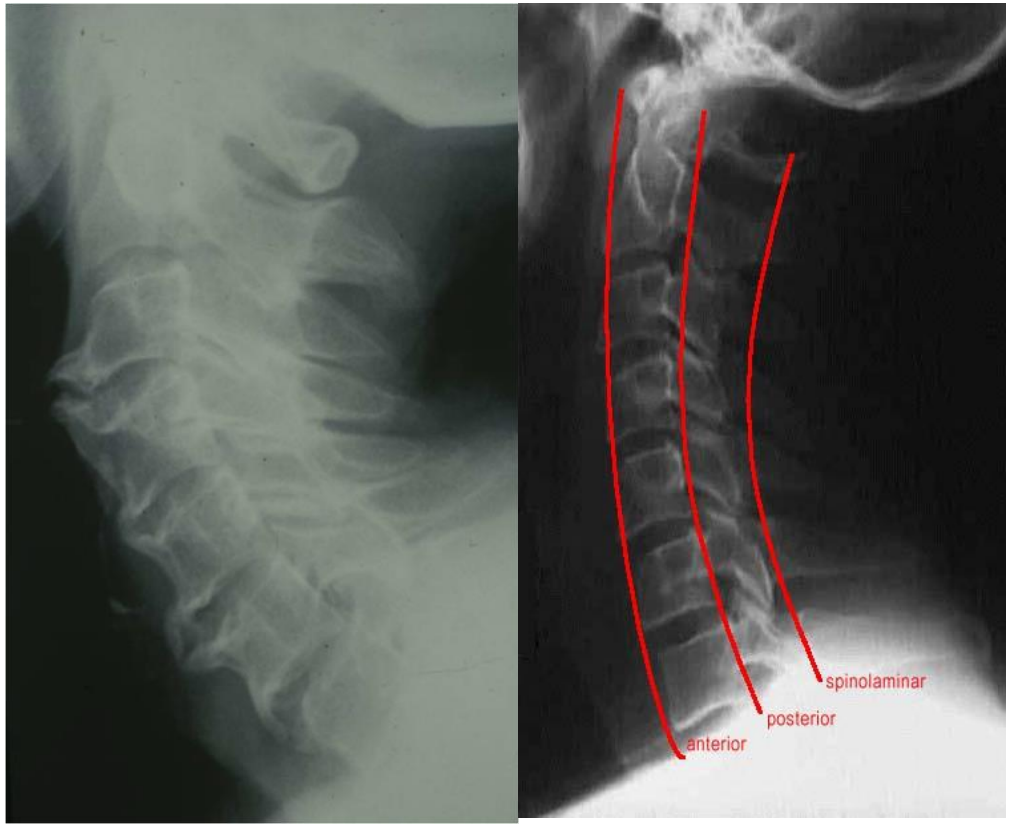


Workup for Cervical Spine Disorders

- Plain radiographs
  - AP
  - Lateral
  - Obliques x2
  - Open mouth
  - Flexion/extension views

Plain Radiographs

- Xrays helpful for demonstrating:
  - Bone Spurs
  - Disc Degeneration
  - Bony Alignment
  - Congenital anomalies
  - Evidence of trauma/ tumors



MRI

- Useful for assessing soft tissues
  - Intervetebral disc
  - Spinal cord (myelomalacia)
  - Nerve root
  - Tumors
  - Helps determine number of spinal levels involved

Workup for Cervical Spine Disorders

- **EMG/Nerve conduction study**: Allows differentiation of lesions of cervical spine vs. peripheral nerve compression, plexopathy, neuropathy
- **Myelogram-CT**: If MRI cannot be done (e.g. pacemaker/ previous hardware) then a M-CT can be helpful in determining the number of involved levels

TREATMENT

Radiculopathy: Nonoperative Treatment

- **Radiculopathy**
  - Most treated conservatively for minimum of 6-12 weeks
  - Medical management: Narcotics, muscle relaxants, oral steroids, NSAIDs
  - PT: Education, strengthening, traction, passive modalities
  - Epidural steroid injections

Radiculopathy: Operative Treatment

- **Surgical indications**:
  - Failure of 6-12 weeks of nonoperative care
  - Initial profound motor deficit
  - Progressive motor deficit during nonoperative treatment
  - Unremitting/ disabling pain

Myelopathy: Treatment

- **Surgical Indications**:
  - Significant initial neurological loss
  - Progressive neurological dysfunction
  - Aggressive approach is needed: timing is critical–better results with less neurological deficit and shorter duration
  - Epidural steroids are contraindicated

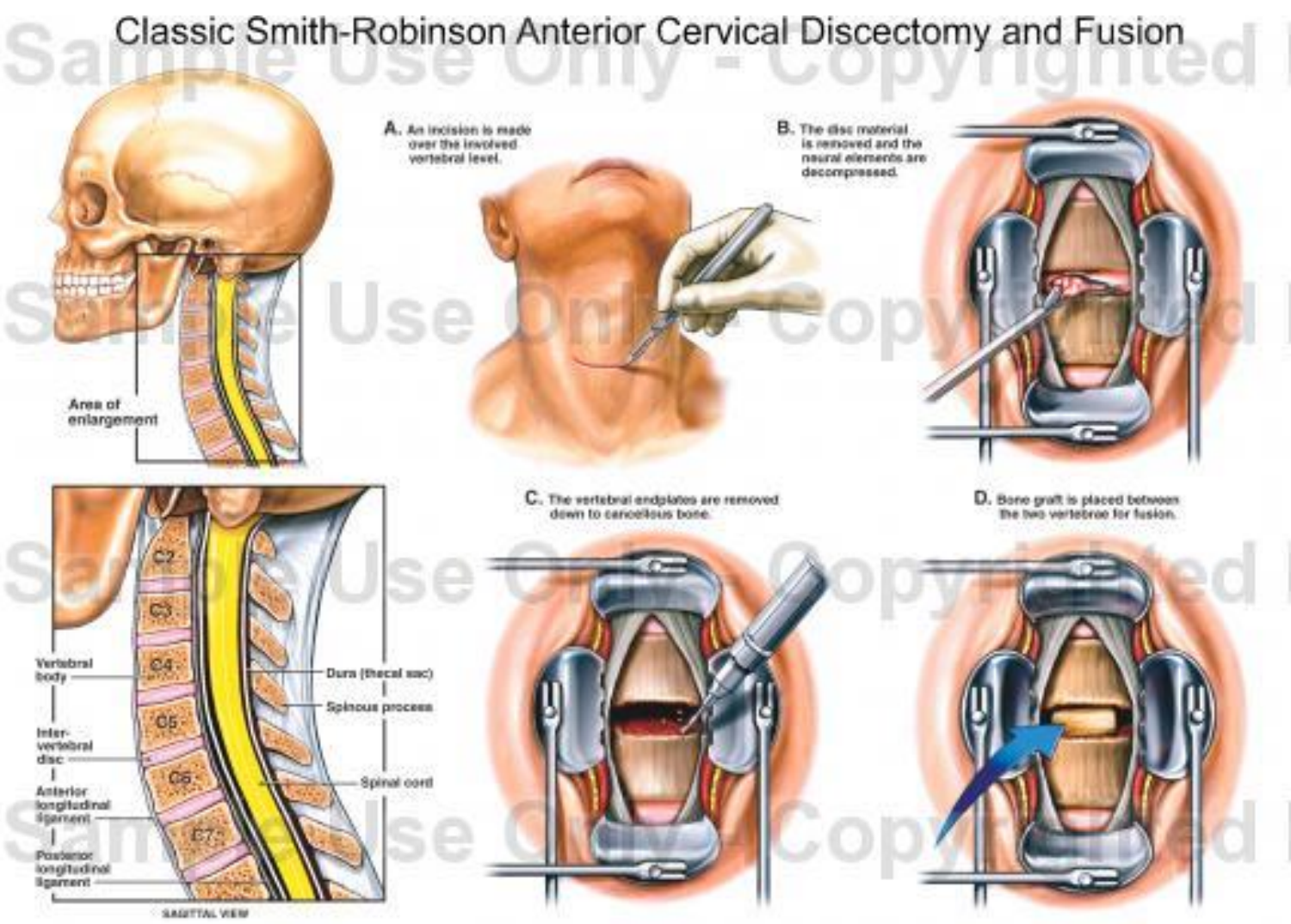
Cervical Spine Disorders: Anterior Surgery

- Indicated for radiculopathy or myelopathy due to disc herniation or stenosis
- Can approach from C2/3 disc space to C7/T1 disc space
- Can address up to 3 levels of pathology
- Indicated for kyphosis
- Corpectomy (removal of vertebral body): indicated when compression is behind the vertebral body

Cervical Spine Disorders: Anterior Surgery

- Perform diskectomy, removal of osteophytes, corpectomy for adequate decompression
- Perform fusion for stability and to restore alignment
- Bone grafts: autograft (ICBG) vs allograft
- Instrumentation: increases fusion rate and maintains alignment

ACDF


Classic Smith-Robinson Anterior Cervical Discectomy and Fusion
Area of enlargement
A. An incision is made over the involved vertebral level.
B. The disc material is removed and the neural elements are decompressed.
C. The vertebral endplates are removed down to cancellous bone.
D. Bone graft is placed between the two vertebrae for fusion.
C2
C3
C4
C5
C6
C7
Vertebral body
Inter-vertebral disc
Anterior longitudinal ligament
Posterior longitudinal ligament
Dura (thecal sac)
Spinous process
Spinal cord
SAGITTAL VIEW

Cervical Spine Disorders: Anterior Surgery

Disc Replacement for Cervical Spine

- FDA approved for single or two-level of radiculopathy secondary to disc herniation or stenosis
- Alternative to fusion for 1-2 level disease
- Advantage: maintaining of motion; theoretically prevents adjacent level problems

Disc Replacement

- Allows motion at the level of the disc instead of a fusion
- Theoretically better motion with lesser chance of adjacent level degeneration

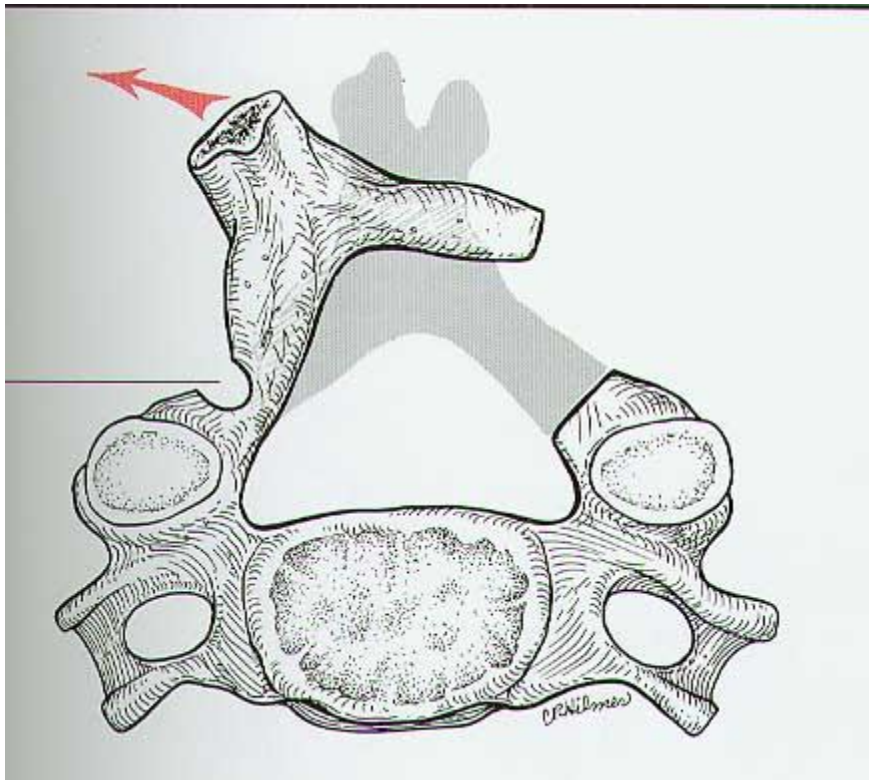
Posterior Surgery Indications

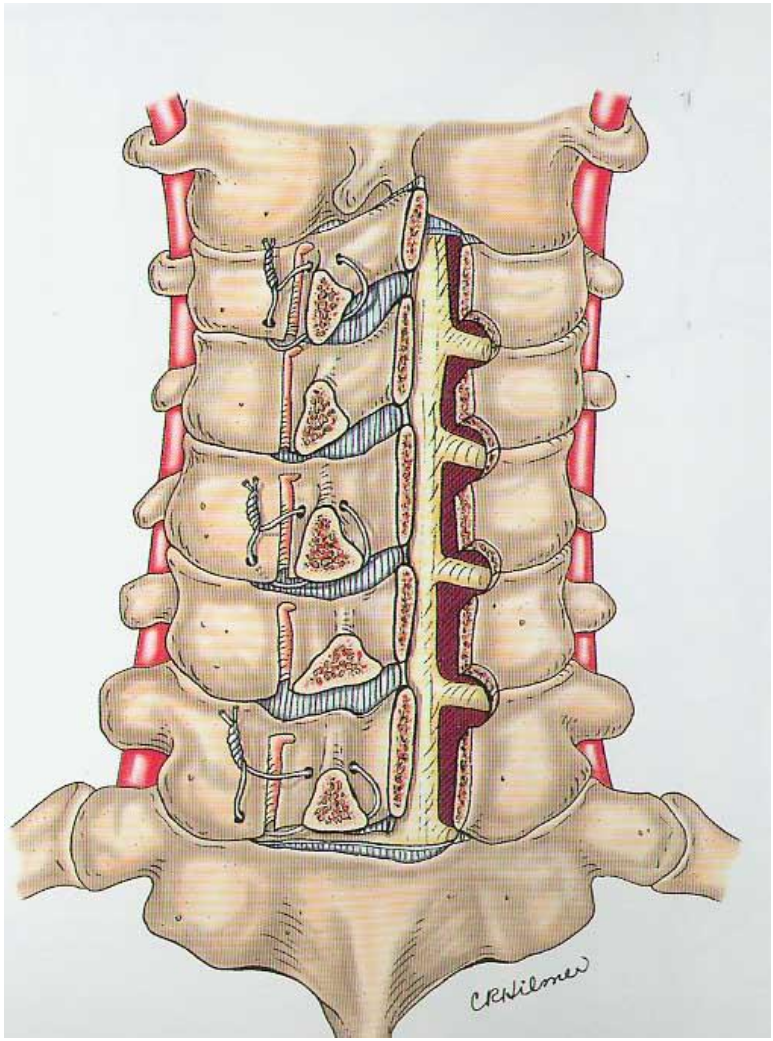
- **Laminoplasty**-myelopathy
- **Laminectomy and Fusion**-myelopathy
- **Foraminotomy**-radiculopathy

Cervical Spine Disorders: Posterior Surgery

- Procedure: Laminoplasty
  - Indicated for myelopathy due to stenosis (3+ levels)
  - Normal cervical alignment (lordosis) must be present
  - Neck pain is a contra-indication
  - Advantage: no fusion (shorter recovery)

Laminoplasty





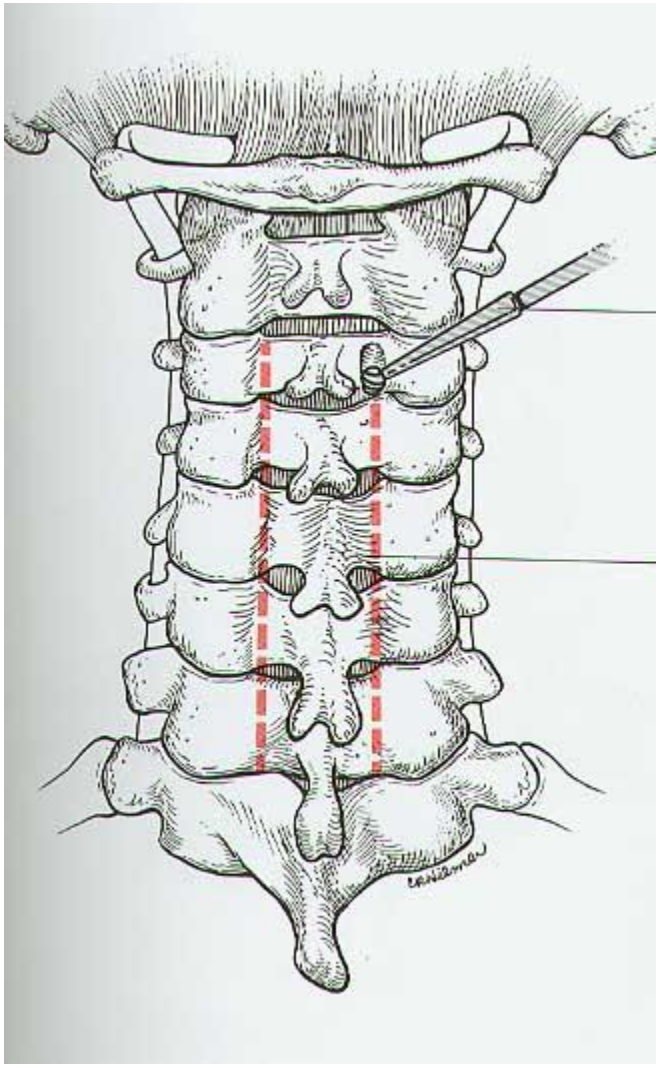
Laminoplasty

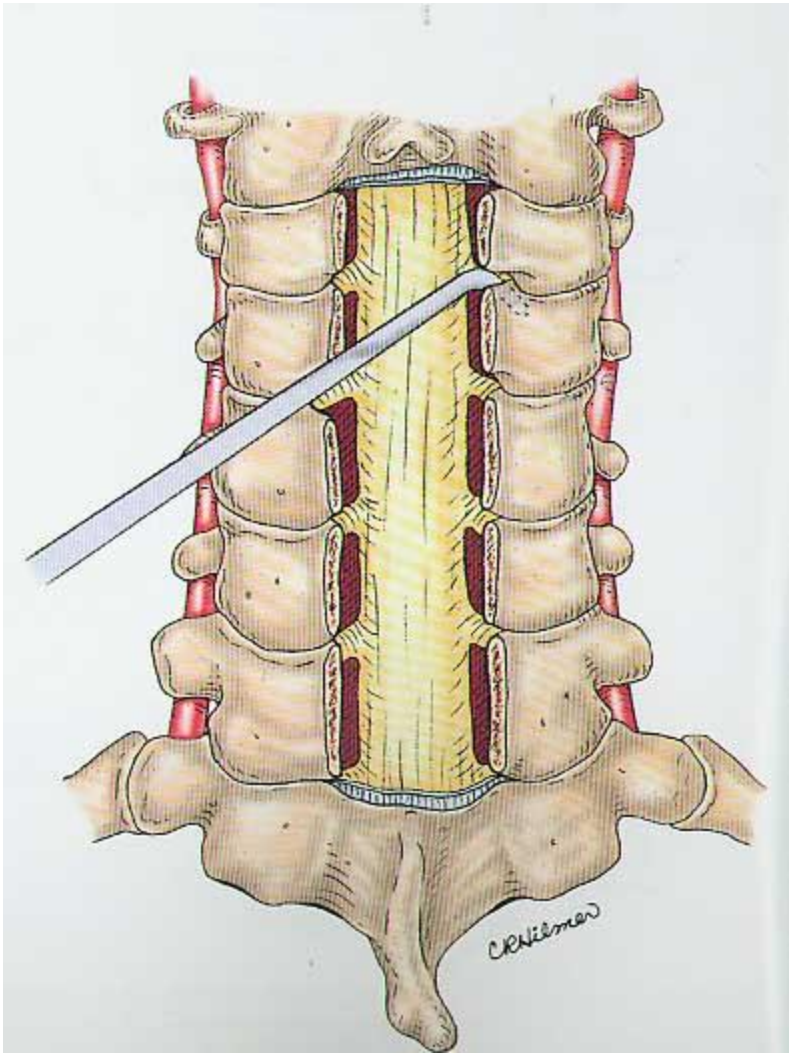
- Small plates are used to keep the canal open

Laminectomy+Fusion

- Spinal cord is decompressed, and screws/rods placed to stabilize the spine
- Used for >3 levels of compression
- Can decompress/ stabilize from occiput to T-spine

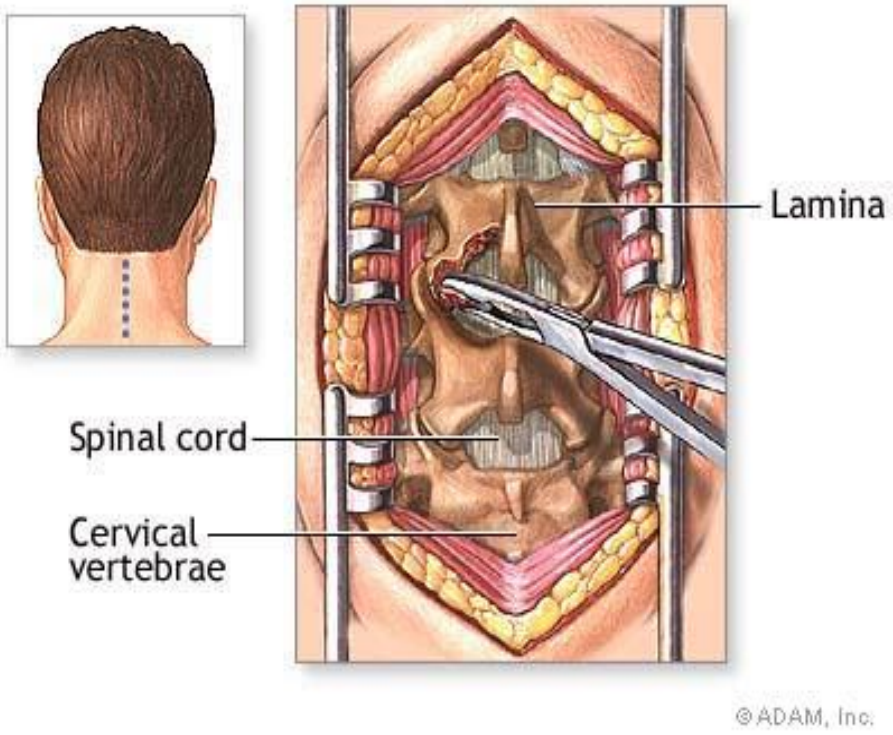
Laminectomy-fusion





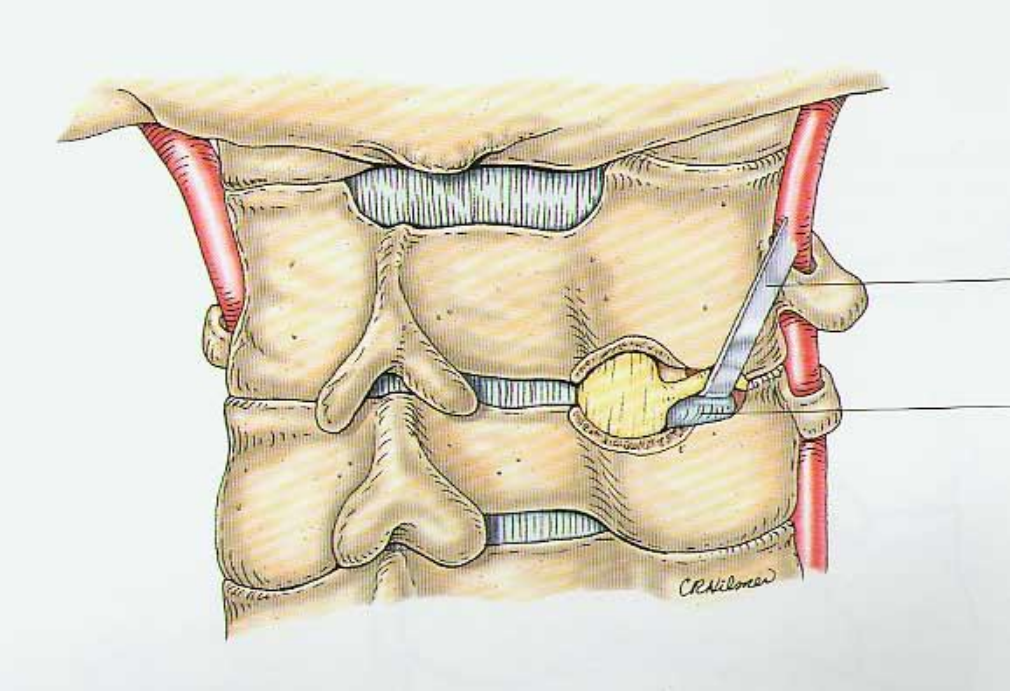
Foraminotomy

- Used to decompress single or multiple levels where **radiculopathy** (not myelopathy) is the primary consideration
- Nerve decompressed through a small bony window



Foraminotomy

- Used when minimal neck pain is present (no need for fusion)



Other Surgical Options

- Indications for Combined Anterior and Posterior Surgery
  - When both anterior and posterior compression is present
  - When added stability (through posterior fixation) is needed in addition to the anterior surgery
  - When fixed kyphosis is present

- Surgical Cases

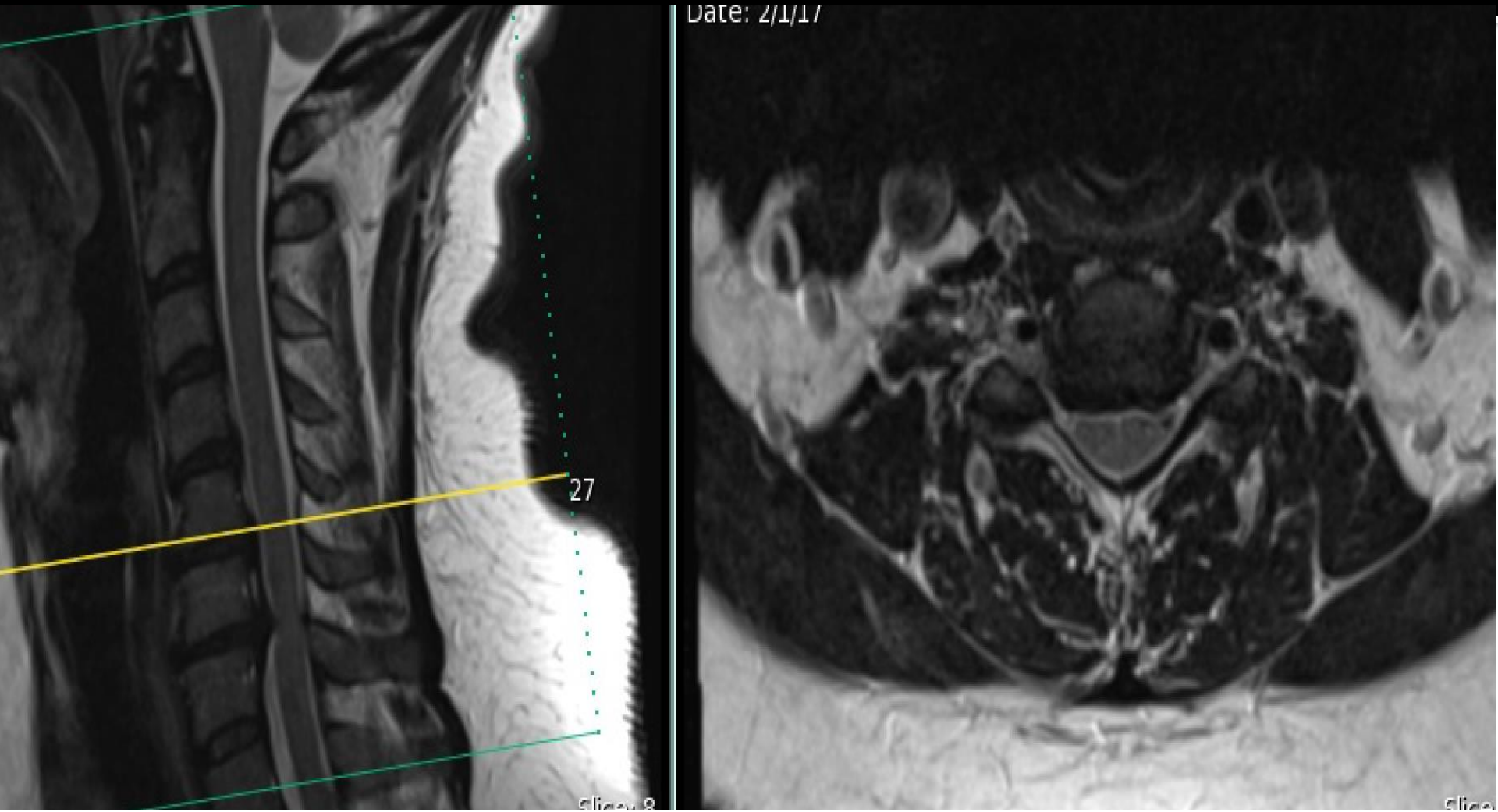
HPI: 50F right hand dominant, 1 year neck pain, right arm radicular pain to digits 1-3, 6 months clumsiness/reduced dexterity right hand. 4+/5 right biceps/wrist extensors +hoffmans

Sx refractory to physical therapy, epidural injection

Clinical Impression: Right C6, C7 radiculopathy, early myelopathy


NE CERVICAL ROUTINE MIN 4 VWS-MXR/XR SPINE CERVICAL RO
/18


Series: SPINE CERVICAL ROUTINE MIN 4 VWS-MXR/XR SPINE CERVICAL
Date: 3/28/18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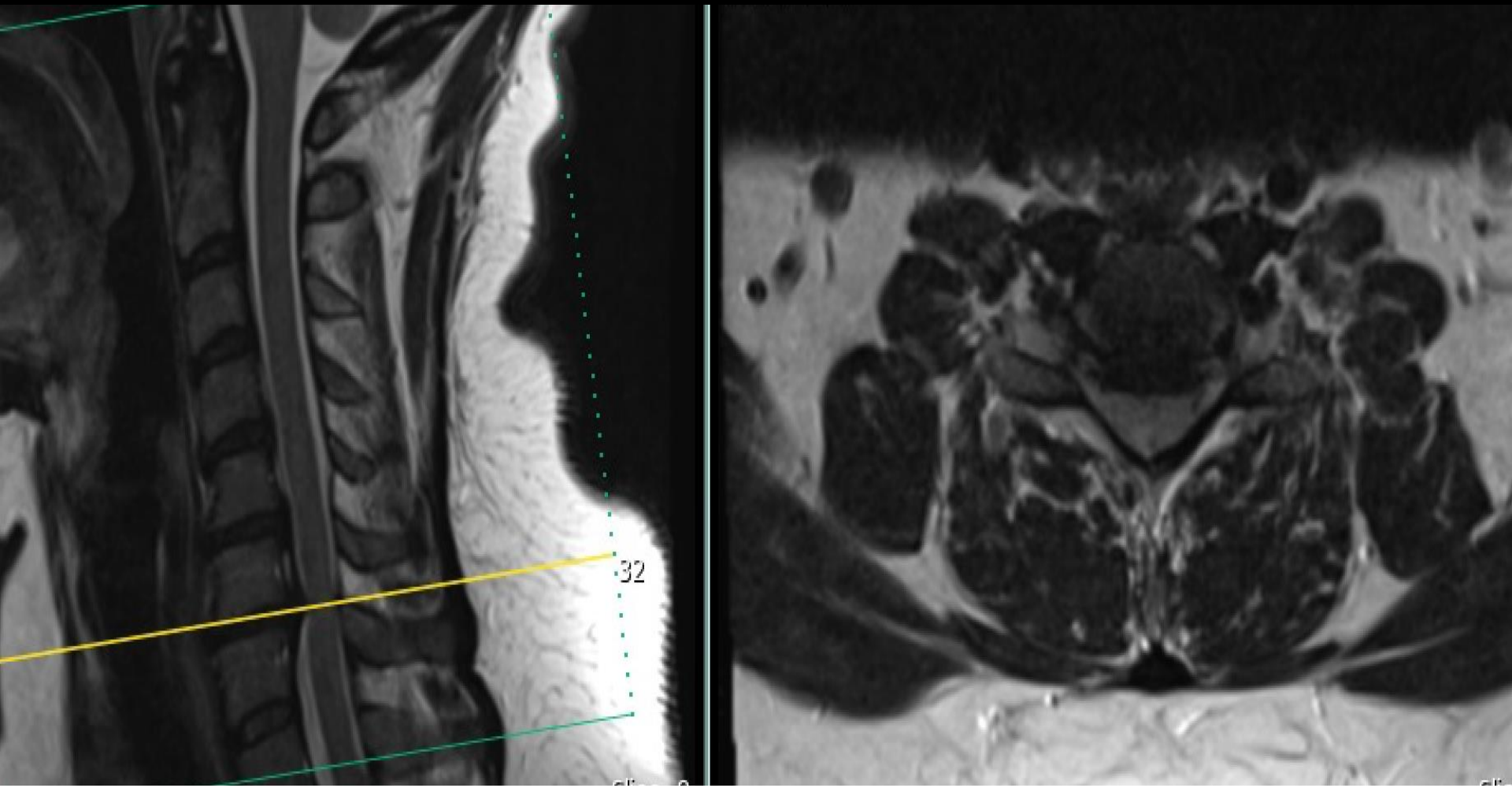

32

Clinical Impression: C6/7 radiculopathy, early myelopathy

Diagnosis: C5/6, C6/7 degenerative disc disease, loss lordosis, C5/6 disc osteophyte complex R>L foraminal stenosis, C6/7 spinal cord compression, bilateral foraminal stenosis

Procedure: Anterior Cervical Discectomy and Fusion C5/6 C6/7

Postop

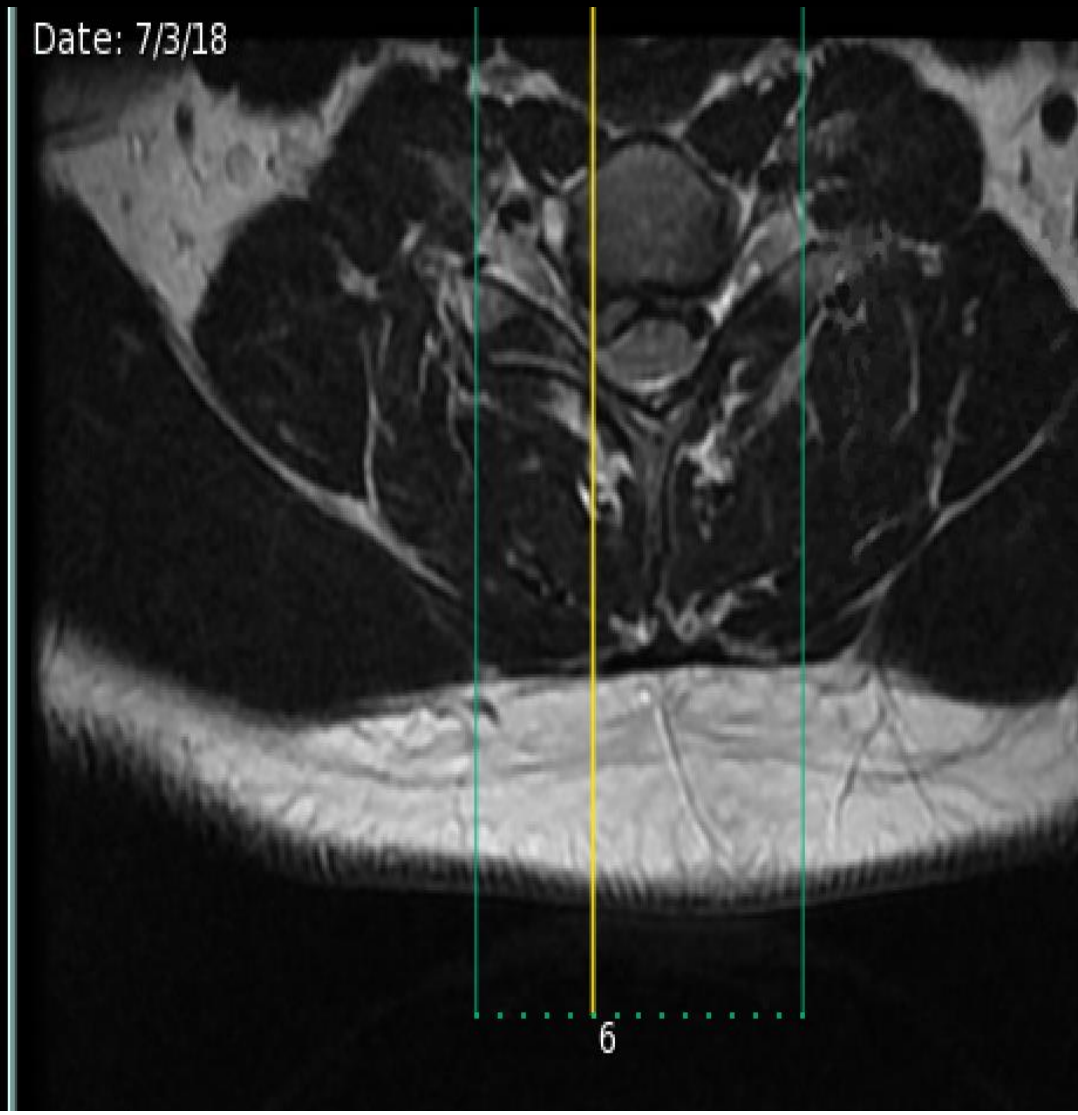
HPI: 29M Paramedic presents with 5 months right arm radiculopathy to digits 2-3, 4/5 right strength right triceps/wrist extension, decreased sensation C7. No Upper motor findings

Sx refractory to NSAIDs, therapy, injection.

Clinical Impression: Right C7 radiculopathy


L
MY
Slice: 1
Image: 1/1


L
MY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6

Clinical Impression: Right C7 radiculopathy

Diagnosis: Large extruded right C6/7 disc herniation, compression right C7 root

Procedure: C6/7 Cervical Disc Arthroplasty

Postop

Hx: 65M with several months neck pain and unsteadiness on his feet. He has had several falls recently, has had to ambulate with walker for past 3 weeks. Was referred by neurologist.

PMH: Rheumatoid arthritis on methotrexate, prednisone

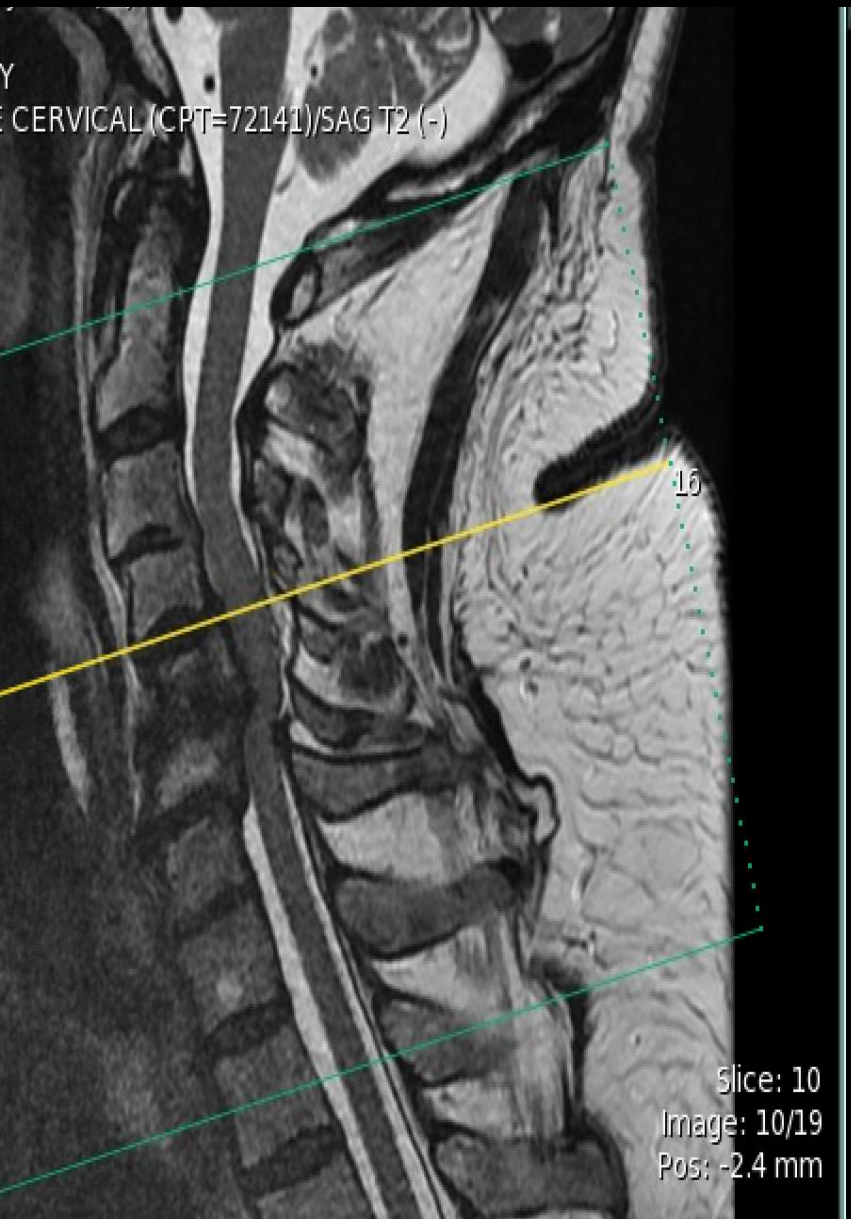
Exam: Wide based, shuffling gait

5/5 strength bilateral upper/lower extremities

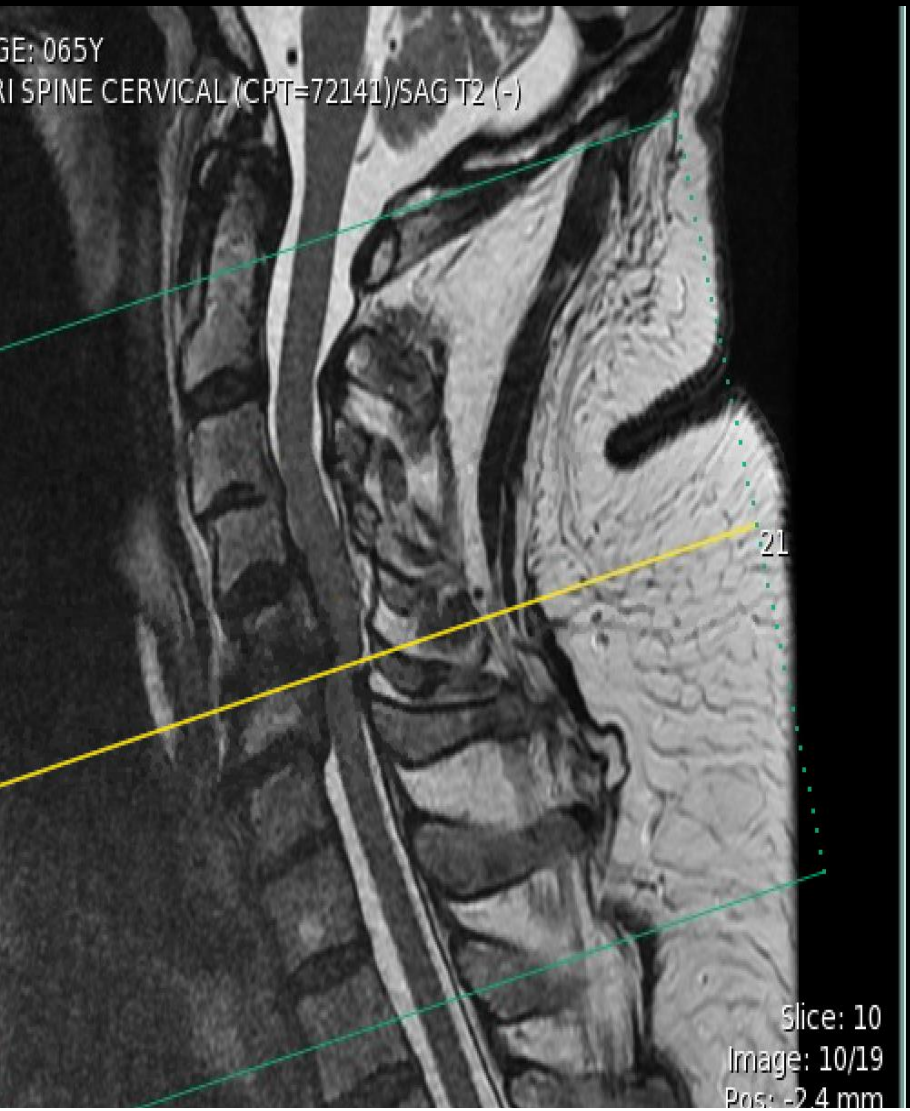
3+ triceps/brachioradialis/patellar reflexes, +hoffmans sign


7/53, AGE: 065Y
AY CERVICAL SPINE, MIN 4V/C Spine AP (-)
9
L
RQ
Slice: 9
Image: 1/1


BIRTH: 12/17/53, AGE: 065Y
Series: X-RAY CERVICAL SPINE, MIN 4V/C Spine LAT (-)
Date: 1/9/19
RQ
Slice:
Image: 1


Y
E CERVICAL (CPT=72141)/SAG T2 (-)
16
Slice: 10
Image: 10/19
Pos: -2.4 mm


ID: 1051119
BIRTH: 12/17/53, AGE: 065Y
Series: 3504119 MRI SPINE CERVICAL (CPT=72141)/AX T2 MIDC2-MIDT2 (-)
Date: 12/19/18


GE: 065Y
RI SPINE CERVICAL (CPT=72141)/SAG T2 (-)
21
Slice: 10
Image: 10/19


BIRTH: 12/17/53, AGE: 065Y
Series: 3504119 MRI SPINE CERVICAL (CPT=72141)/AX T2 MIDC2-MIDT2 (-)
Date: 12/19/18

- **Clinical Impression:** 65M history rheumatoid arthritis presents with neck, pain, symptoms of myelopathy

- **Diagnosis:** Severe central stenosis C4/5, C5/6, kyphosis compression by C5 body

- **Procedure:** C5 corpectomy, anterior fusion


Y
PINE, 2 OR 3V/C Spine LAT (-)
Slice: 4
Image: 1/1

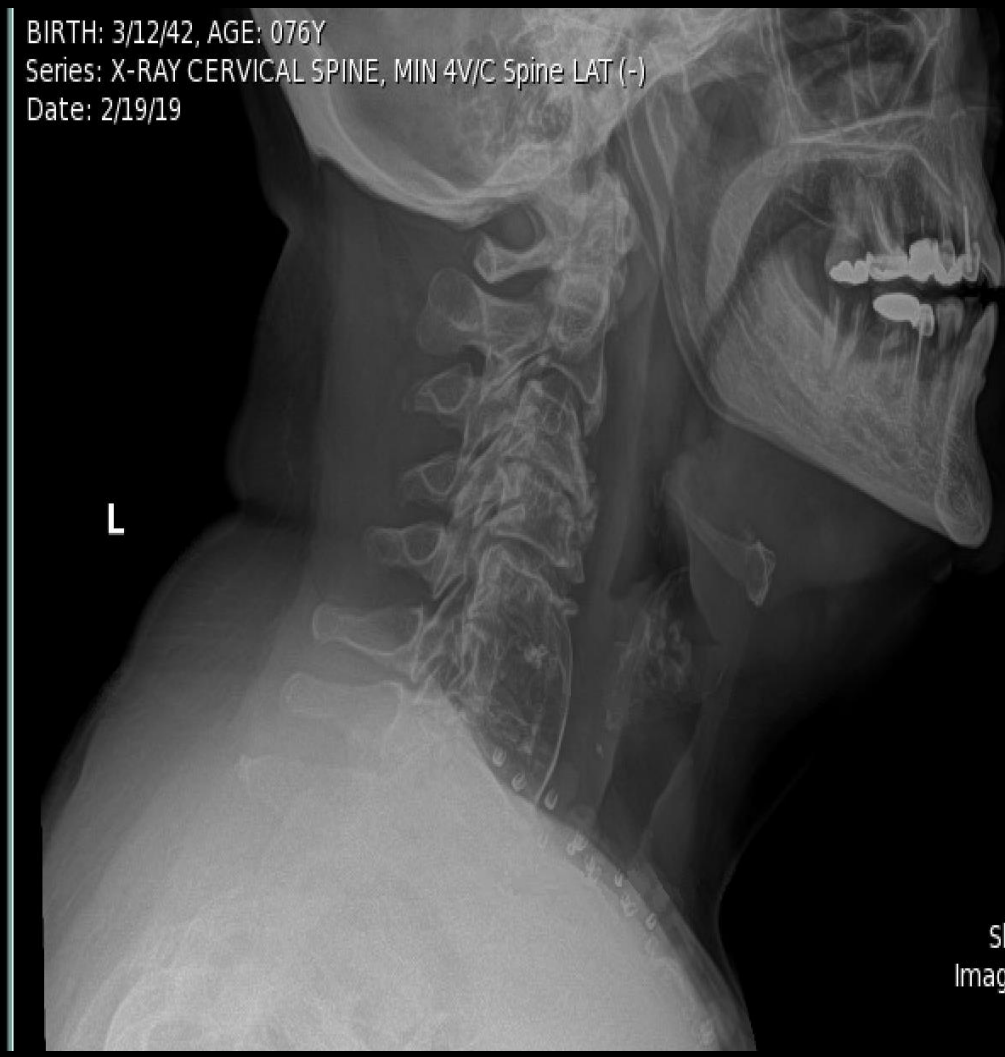

ID: 1051119
BIRTH: 12/17/53, AGE: 065Y
Series: X-RAY CERVICAL SPINE, 2 OR 3V/C Spine AP (-)
Date: 3/4/19
L

HPI: 76F presents with neck and right > left arm pain worsening over the past year and a half. Pain radiates to her hand, third digit. Difficulty with hand dexterity and balance.
Treatment: PT, epidural steroid injection

Exam: 4+/5 right triceps otherwise full strength bilateral upper and lower extremities, normal sensation, hyperreflexia bil lower extremities, positive hoffmans

Clinical Impression: C7 radiculopathy, myelopathy


/42, AGE: 076Y
AY CERVICAL SPINE, MIN 4V/C Spine AP (-)
19
L
Slice: 1
Image: 1/1


BIRTH: 3/12/42, AGE: 076Y
Series: X-RAY CERVICAL SPINE, MIN 4V/C Spine LAT (-)
Date: 2/19/19
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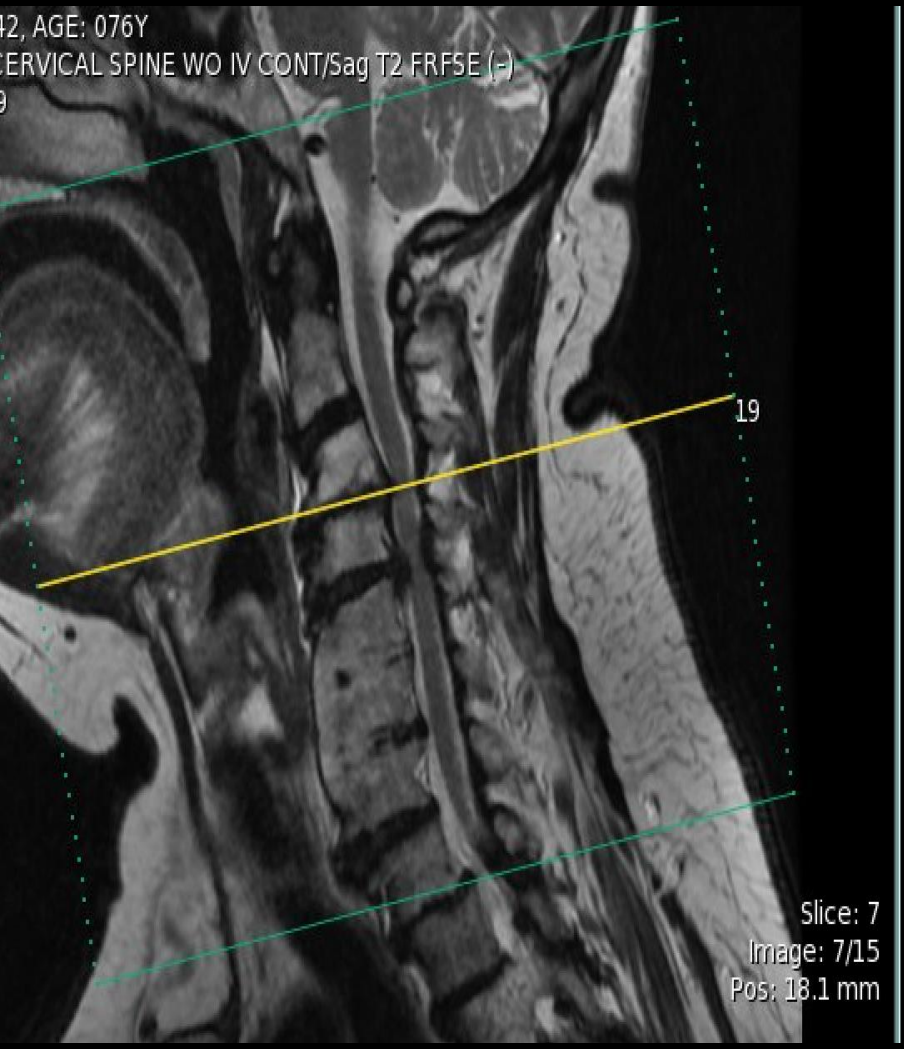

42, AGE: 076Y
CERVICAL SPINE WO IV CONT/Sag T2 FRFSE (-)
9
19
Slice: 7
Image: 7/15
Pos: 18.1 mm


BIRTH: 3/12/42, AGE: 076Y
Series: MRI CERVICAL SPINE WO IV CONT/Ax T2 (-)
Date: 2/14/19
Slice: 1
Image: 19/3
Pos: -2.5 m

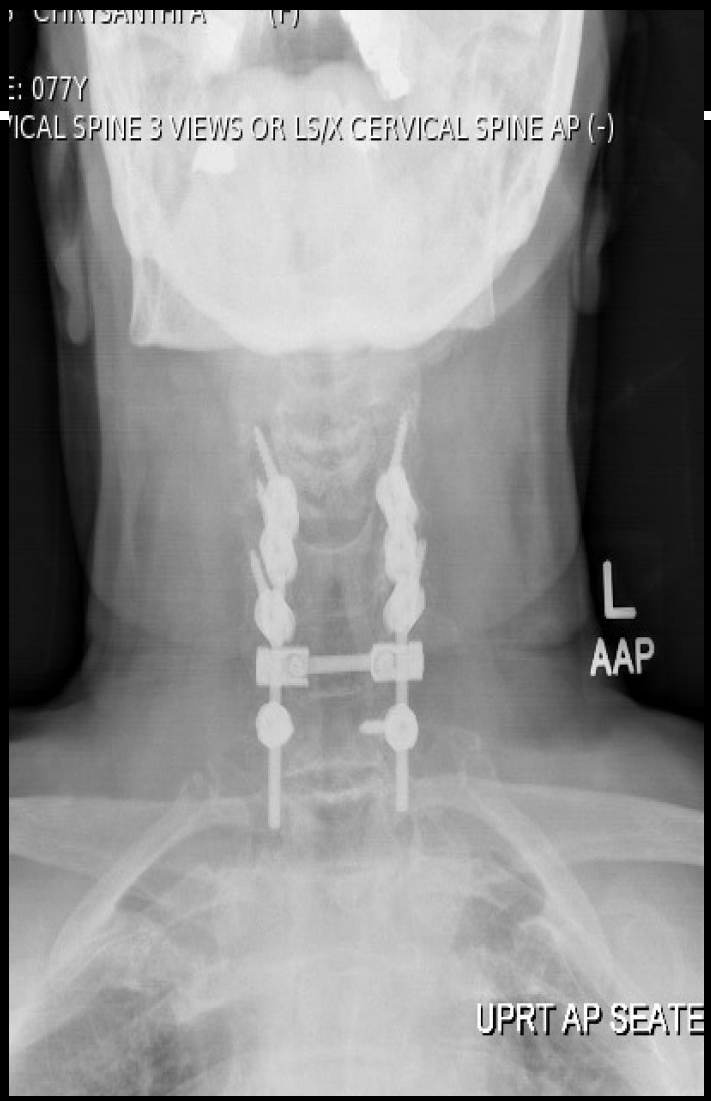

75
12/42, AGE: 076Y
RI CERVICAL SPINE WO IV CONT/Sag T2 FRFSE (-)
4/19
23
Slice: 7
Image: 7/15
Pos: 18.1 mm


ID: 1405775
BIRTH: 3/12/42, AGE: 076Y
Series: MRI CERVICAL SPINE WO IV CONT/Ax T2 (-)
Date: 2/14/19
Sl
Image
Pos: -18

Clinical Impression: C7 radiculopathy, myelopathy

Diagnosis: C3/4 C4/5 central stenosis with cord compression, C6/7 Foraminal Stenosis, C5-7 autofusion

Surgery: C3-6 laminectomy, C3-7 fusion


E: 077Y
ICAL SPINE 3 VIEWS OR LS/X CERVICAL SPINE AP (-)
L
AAP
UPRT AP SEATE

Conclusion

- Disc herniation or stenosis can cause radiculopathy or myelopathy
- Anterior or posterior approaches are determined by number of levels, alignment and radiculopathy vs. myelopathy
- Results better in radiculopathy because of cord involvement in myelopathy

Thank You!