



# Pain in the Butt: Lumbar Spine Review & Updates

*Chairperson:*

**Chadi Tannoury, MD, FAOA, FAAOS**

Medical Director of Orthopaedic Clinic,  
Associate Professor of Orthopaedic Surgery,  
Director of Spine Research,  
Co-Director of Clinical Spine Fellowship,  
Boston Medical Center

**Tuesday, March 26<sup>th</sup>, 2024**

**2:25-3:15pm**



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**Work Related Injuries  
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# **Common Lumbar Pathologies and Treatment Options**

Jason Pittman, MD, PhD, FAAOS  
Instructor of Orthopedic Surgery  
Beth Israel Deaconess Medical Center

# Epidemiology of low back pain

World Health Organization

- Affected 619 million people globally in 2020
  - Expected to grow to 843 million by 2050
- The single leading cause of worldwide disability
- Non-specific low back pain makes up about 90% of cases
- Estimated to cost \$100-200 billion per year in the US

# Disclosures

- DePuy/Synthes (Consultant)
- BrainLab (Consultant)
- ZSFab (Consultant)
- ROM Tech (Stock)

<https://www.who.int/news-room/fact-sheets/detail/low-back-pain>

# Definition of Chronicity

World Health Organization

- Acute: Less than 6 weeks
- Sub-Acute: 6-12 weeks
- Chronic: Greater than 12 weeks

# Common Back Injuries

- Lumbar (Low back) strains and sprains
- Bulging or herniated (slipped) discs
- Radiculopathy (pinched nerves)
- Vertebral fractures



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# Lumbar Strains and Sprains

Non-specific back pain

# Lumbar Strains and Sprains

- Causes
  - Lifting an object is the most commonly recalled event
  - Up to 30% of patients will not remember a specific event
- Evaluation of acute symptoms in the absence of red flags
  - No labs
  - No imaging



# Lumbar Strains and Sprains

## Treatment

- Acute Symptoms
  - Non-steroidal anti-inflammatories (NSAIDs)
  - Muscle relaxants
  - Physical therapy
  - Massage
  - Heat therapy
  - Manipulation
  - Acupuncture

# Lumbar Strains and Sprains

## Treatment

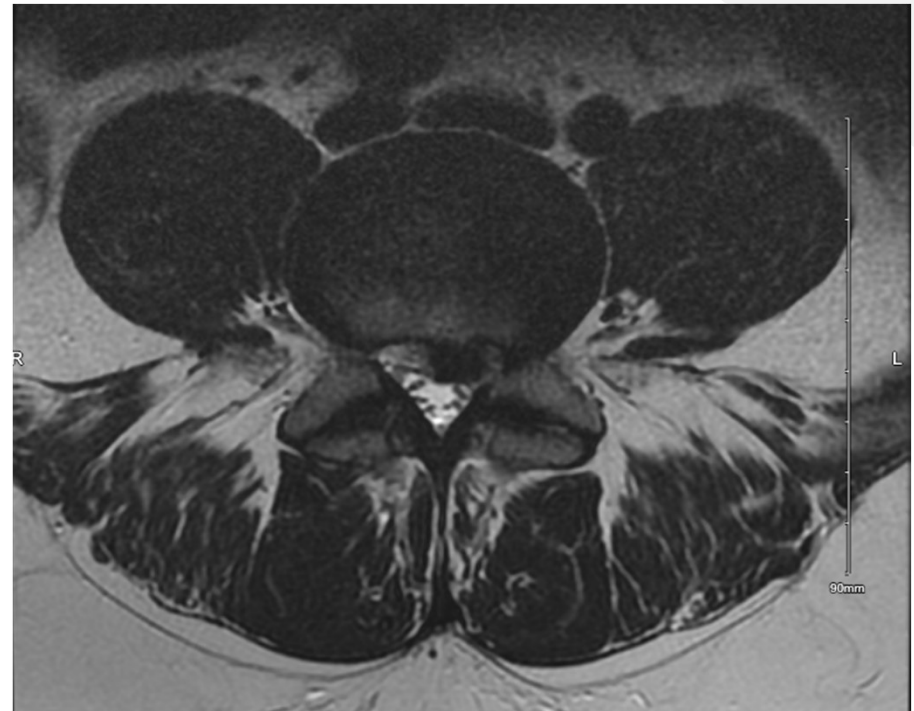
- Chronic Symptoms
  - NSAIDs
  - Opioids only if all other therapies fail (use opioid risk tool)
  - Exercise
  - Physical therapy
  - Multi-disciplinary rehabilitation
  - Manipulation
  - Acupuncture
  - Psychotherapy



# Bulging or Herniated Discs

# Bulging or Herniated Disc

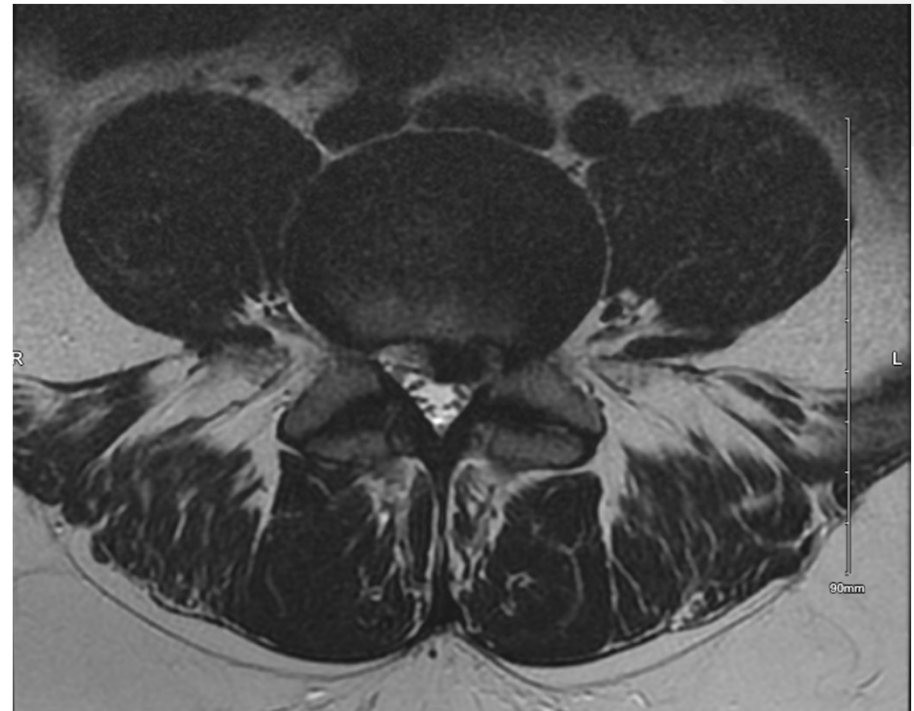
- 5-20 cases per 1000 adults
- Most significant among 30–50 year-olds
- Can cause pain which radiates down the leg
- Can cause weakness along the affected nerve
- 95% chance of herniated discs occurring at either L4/L5 or L5/S1



# Bulging or Herniated Disc

## Treatment

- Acute Symptoms
  - NSAIDs
  - Physical therapy after 3 weeks of symptoms
  - Opioids (use opioid risk tool)
  - Epidural steroid injections
- Failure of conservative measures or neurologic deficits warrant surgical evaluation





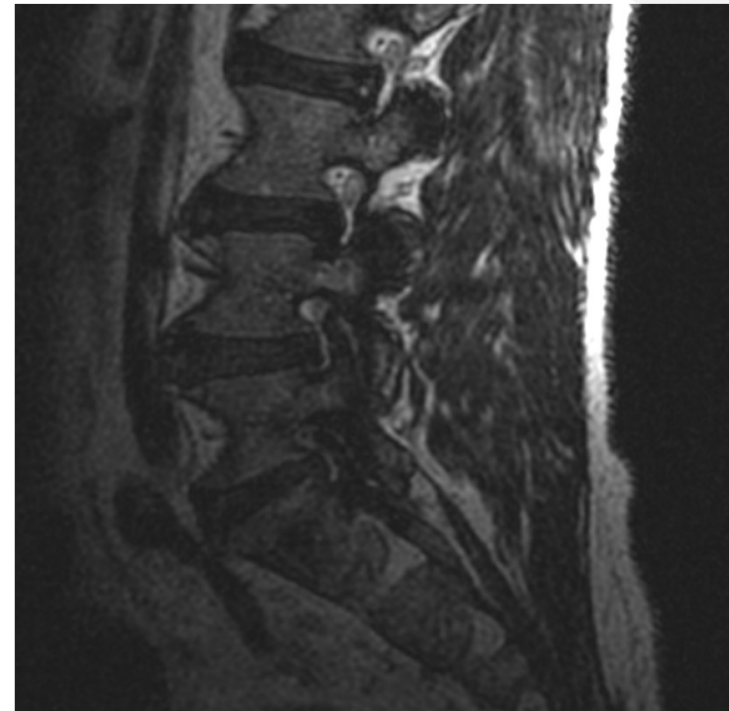
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# Radiculopathy

# Radiculopathy

A “Pinched” nerve

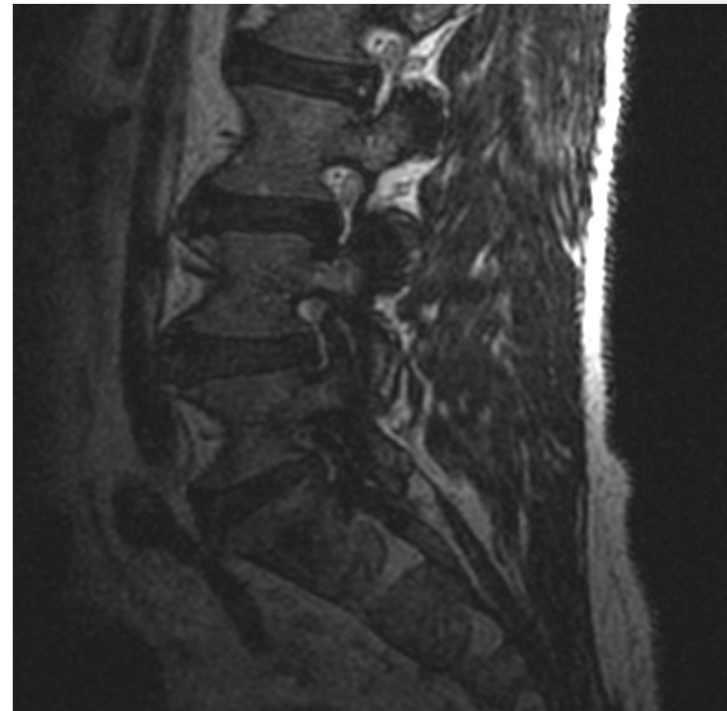
- Pain caused by the irritation or compression of a lumbar nerve root
- Causes:
  - Lumbar disc herniation
  - Lumbar degeneration
  - Foraminal stenosis
- 12-40% of patients with low back pain will also have radiculopathy



# Radiculopathy

## Treatment

- Initial treatment
  - NSAIDs
  - GABA analogues (Gabapentin, Pregabalin)
  - Oral steroids
  - Physical therapy
  - Chiropractic care
  - Acupuncture
  - Epidural steroid injections
- Surgical decompression with possible fusion







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# **Vertebral Fractures**

# Vertebral Compression Fractures

- Osteoporosis is the most common precipitating factor
- Trauma is the second most common
- Affect 1.5 million Americans annually
  - 10.7 per 1000 women
  - 5.7 per 1000 men







# Vertebral Compression Fractures

## Treatment

- Initial treatment focuses on improving pain and functional status
  - NSAIDs
  - Opioids (use opioid risk tool)
  - Physical therapy
  - Bracing for comfort
- Vertebroplasty is considered for patients with persistent pain despite conservative treatment



## Key Takeaways

- The majority of back pain is non-specific and benefits from early intervention
  - Physical therapy and NSAIDs are the foundation of early treatment
  - Red flag symptoms such as weakness, numbness or intractable pain warrant urgent and possibly surgical evaluation
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# **EMG/NCS Studies:** When Are They Really Needed?

Dr. Stefan C. Muzin, MD

Physiatrist/Interventional Spine

Medical Director, ForHealth Consulting  
at UMass Chan Medical School

# What's an EMG/NCS

Extension of the clinical evaluation focusing on the peripheral nervous system.

- Nerve conduction study (NCS) is a measurement of the amount and speed of conduction of an electrical impulse through a nerve. You are stimulating peripheral nerves (i.e., median, peroneal, etc).
- Electromyography (EMG) measures muscle response or electrical activity in response to nerve stimulation. Needle electrodes inserted into the muscle. Muscle does not normally produce electrical signals during rest.

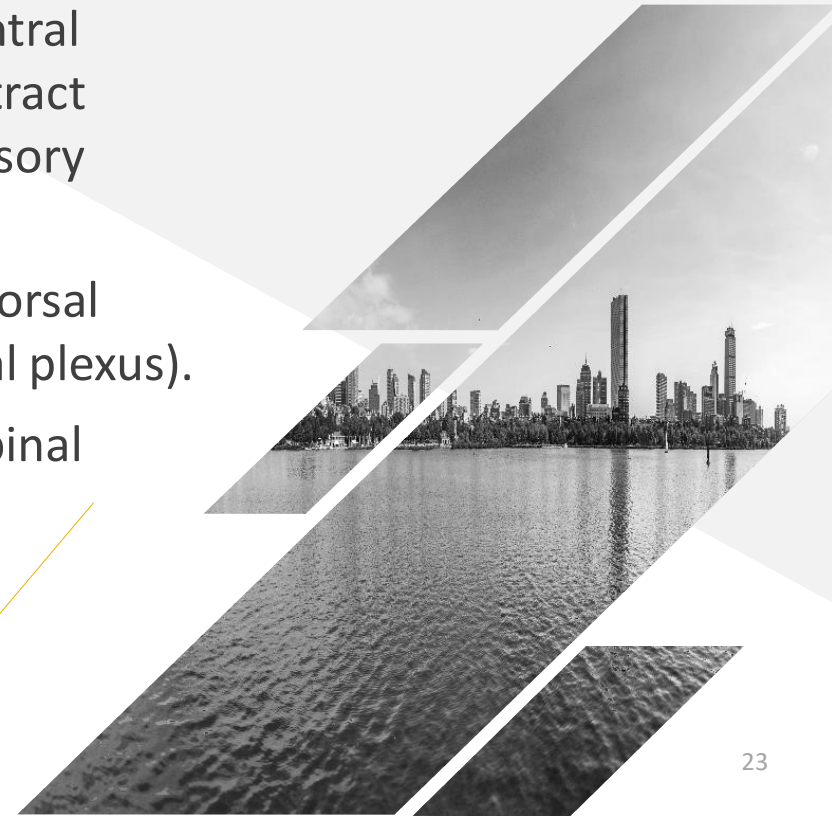


# Anatomical Review

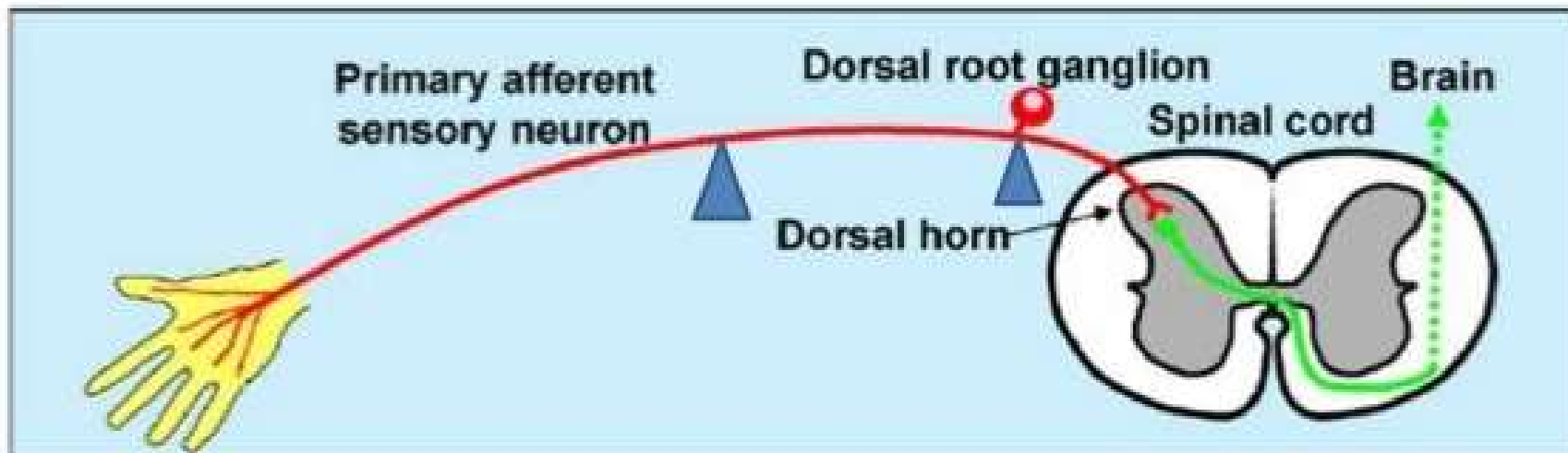
Spinal nerve roots exit the spinal cord as dorsal and ventral nerve roots, carrying sensory and motor axons. As the tract moves distally, the roots merge to become a mixed sensory and motor nerve.

The mixed motor and sensory nerve divide again into dorsal rami (paraspinal muscles) and ventral rami (lumbosacral plexus).

The cell body of sensory fibers resides outside of the spinal cord, within the dorsal root ganglia.



- No lesion → Normal SNAP
- Pre Ganglionic (DRG) → Normal SNAP  
(*Avulsion BPI*)
- Post Ganglionic (DRG) → Abnormal SNAP  
(*Traction or compression injuries*)





# EMG/NCS Concepts in Radiculopathy

Lesion occurring in the spine/spinal cord (pre-ganglionic).

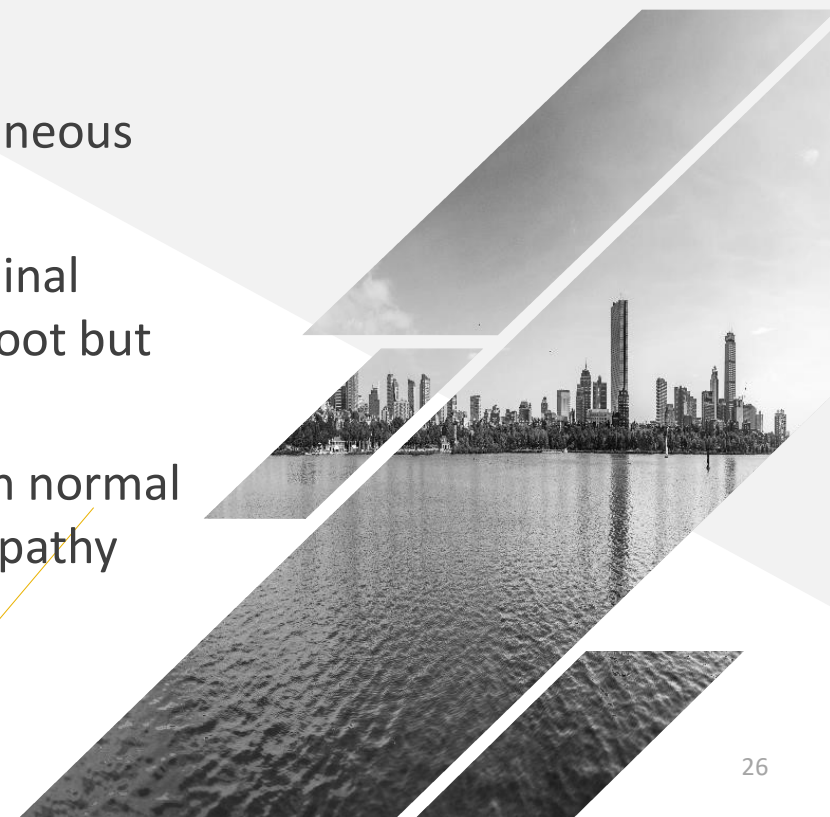
Each peripheral nerve is innervated by 2 or more spine levels (i.e., peroneal nerve L4-S2, tibial nerve L4-S3).

Sensory (SNAP): Typically normal in radiculopathy as lesion is proximal to the dorsal root ganglia (DRG).

Motor (CMAP): Innervation from more than one nerve roots. Unlikely to be abnormal in isolated radiculopathy.

# Needle EMG in Radiculopathy

- More useful than NCS for diagnosing
- Positive sharp waves and or fibrillations indicate spontaneous activity
- Perform the EMG on at least three muscles; one paraspinal muscle and two limb muscles supplied by same nerve root but innervated by different peripheral nerves.
- Spontaneous activity found in all muscles sampled (with normal SNAP and CMAP findings) support diagnosis of radiculopathy
- Paraspinal muscles useful in differentiating between radiculopathy and plexopathy



# Indications for EMG/NCS

- Patients who present with sensory and motor signs and symptoms in an extremity without imaging studies to explain the pathology
- As a tool when for important clinical decisions
- Can be useful in providing information of timing (acute, subacute, chronic) lesion
- Not for routine/classical clinical presentations



# Limitations of EMG/NCS

- Provider/user dependent
- Provider bias
- Paraspinal muscles difficult to differentiate
- Does not provide information on etiology of lesion (i.e., structural, inflammatory, infectious, etc.)
- Caution require for interpretation in lumbar spine (i.e., anatomical anomalies, 4 or 6 lumbar vertebrae)



## Contraindications (relative)

- Uncontrolled bleeding disorder or on anticoagulants
- Areas of active skin infections such as cellulitis, lymphedema
- Nerve conduction studies are contraindicated in patients with cardiac defibrillators. For patients with cardiac pacemakers, advised that stimulation not be performed directly over the implant.



## Case Presentation

47 year old male lifted a heavy box 6 weeks ago, and since then onset of low back pain radiating down the left posterolateral thigh, calf, and dorsal foot with numbness in the left big toe.

Examination reveals 4/5 weakness left gluteus medius, tibialis anterior and posterior, and extensor hallicus, + left straight leg raising maneuver at 45°, and decreased sensation left L5 dermatomal distribution. MRI left spine reveals left L4-5 HNP compressing the left L5 nerve root.

Is an EMG/NCS needed? Why or why not?





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# Latest Technology In Spinal Cord Stimulation

**Eduard Vaynberg MD**

Director of Pain Management  
Boston Medical Center

Disclosure: Member of Medtronic Speaker Bureau

# Disclosure

- Medtronic Speaker Bureau

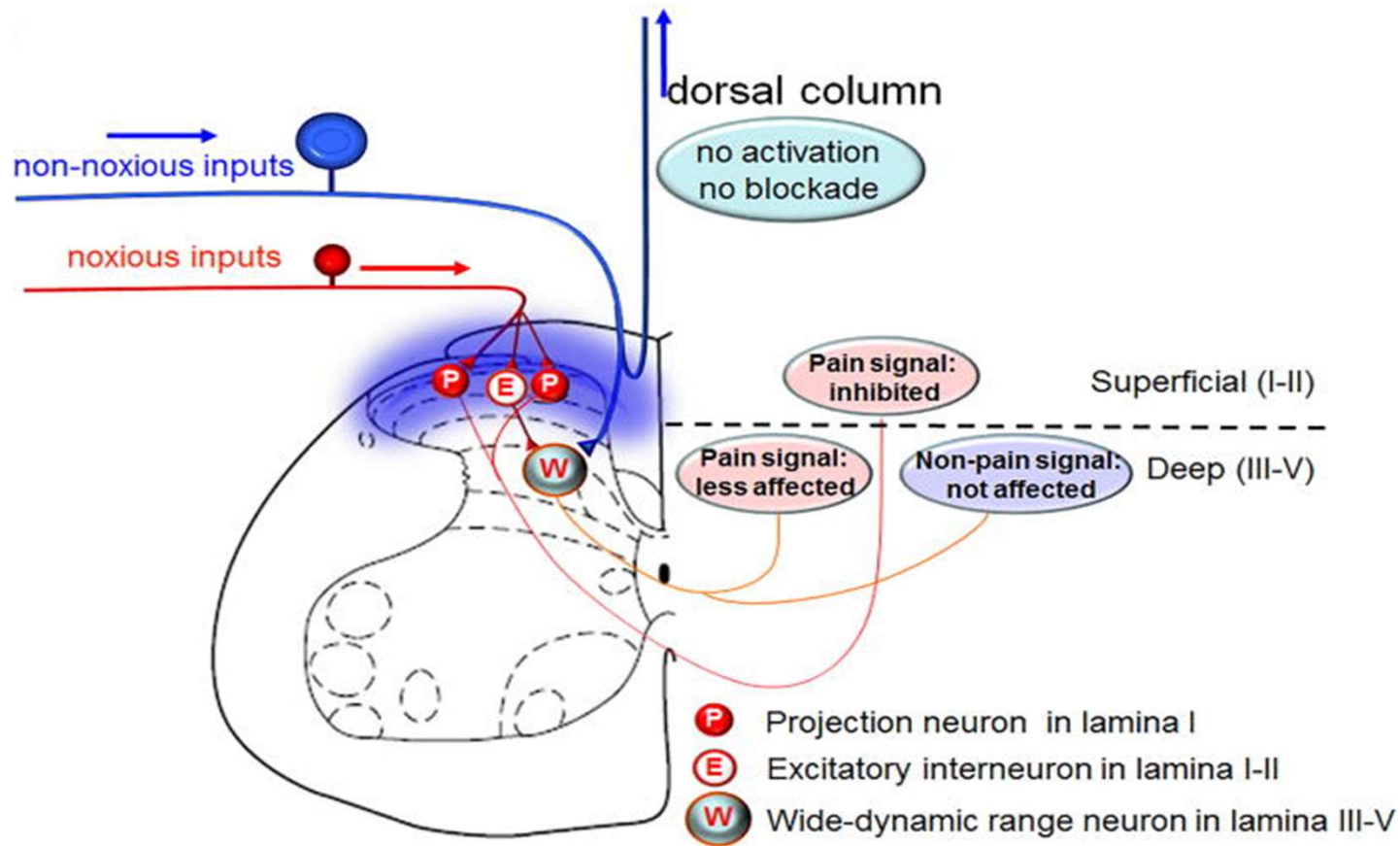




# Mechanism of Action

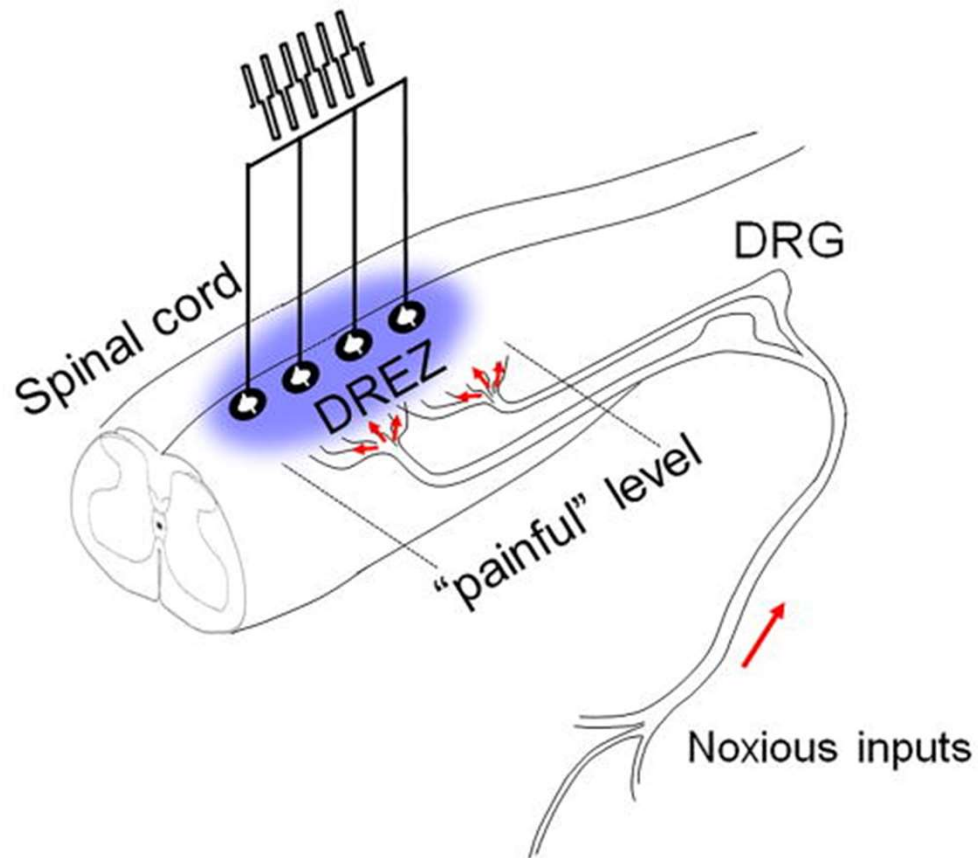
- Direct application of scientific theory to medical practice
- Gate control pain transmission theory by Melzack and Wall 1965
- Input of peripheral pain fibers could be manipulated by external electric field (stimulation) applied to the spinal cord to “close the gate” of the pain transmission
- First stimulator implanted in 1967

# Traditional Low Frequency Stimulation



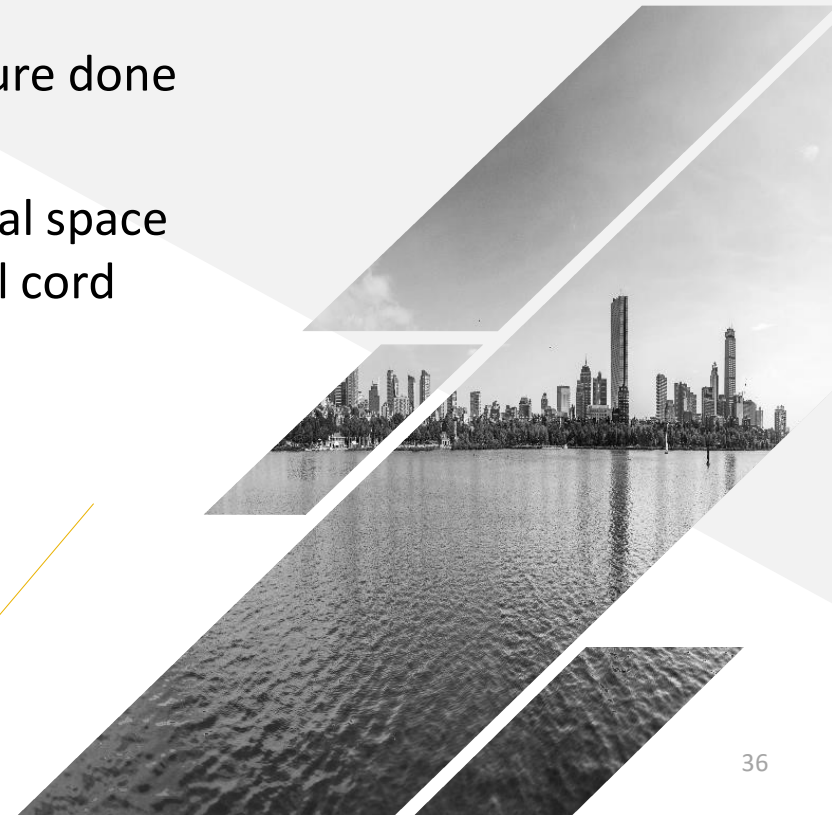
# High Frequency Stimulation

Paresthesia-free HF-SCS



# Technique of Implantation

- Percutaneous fluoroscopy guided outpatient procedure done under conscious sedation
- Placement of an electrode array (leads) in the epidural space on top of the carefully selected segment of the spinal cord
- Tunneling of the wires
- Connecting wires to the computer/pulse generator



# Indications for Spinal Cord Stimulation

- Continuing severe pain and functional dysfunction despite maximized medications, failed injection therapies and failed surgeries
- Pain in the location amenable to stimulation: extremities, lower back, failed back surgery syndrome and complex regional pain syndrome I and II (RSD)
- No untreated psychopathology
- No coagulopathies or epidural lesions

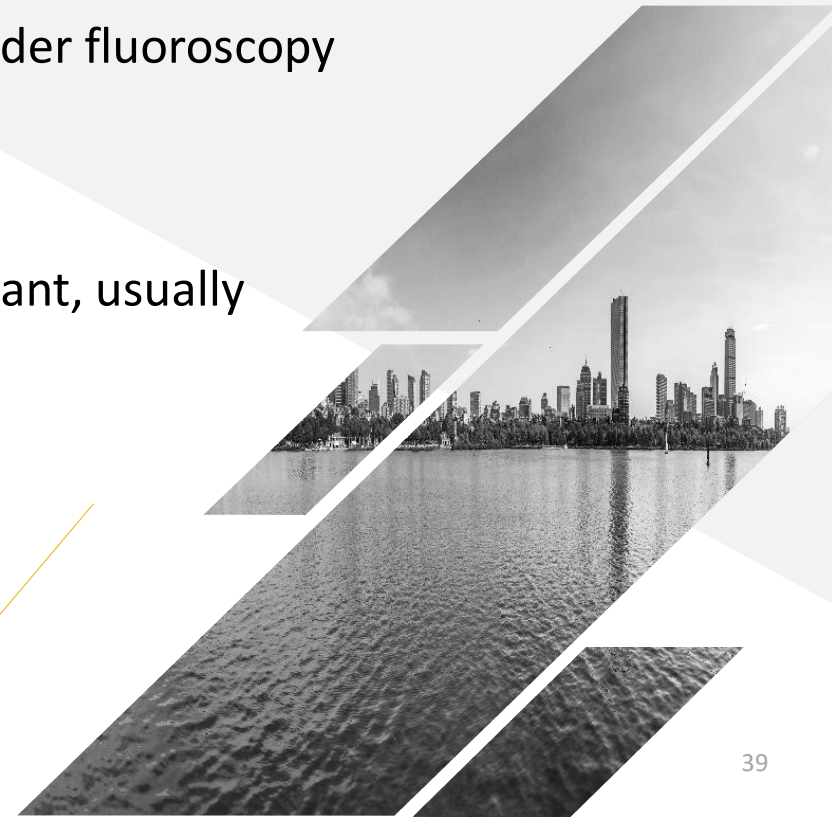
# Patient Selection Process

- Initial evaluation discussing pros and cons of therapy
- Psychiatric clearance
- Appropriate imaging: MRIs are needed to evaluate patency of the epidural space for the lead implantation (rule out spinal stenosis, tumors, etc.)
  - Upper extremity and neck pain: cervical and thoracic MRIs
  - Lower extremity pain and lower back pain: lumbar and thoracic MRIs
- Re-evaluation of the patient with MRI results
- Trial
- Implantation



# Trial and Implantation

- Percutaneous trial is an outpatient procedure done under fluoroscopy
- Patient uses external device for 3-7 days
- Removal of the percutaneous lead takes 5 minutes
- If adequate pain control achieved: proceed to full implant, usually quick surgery



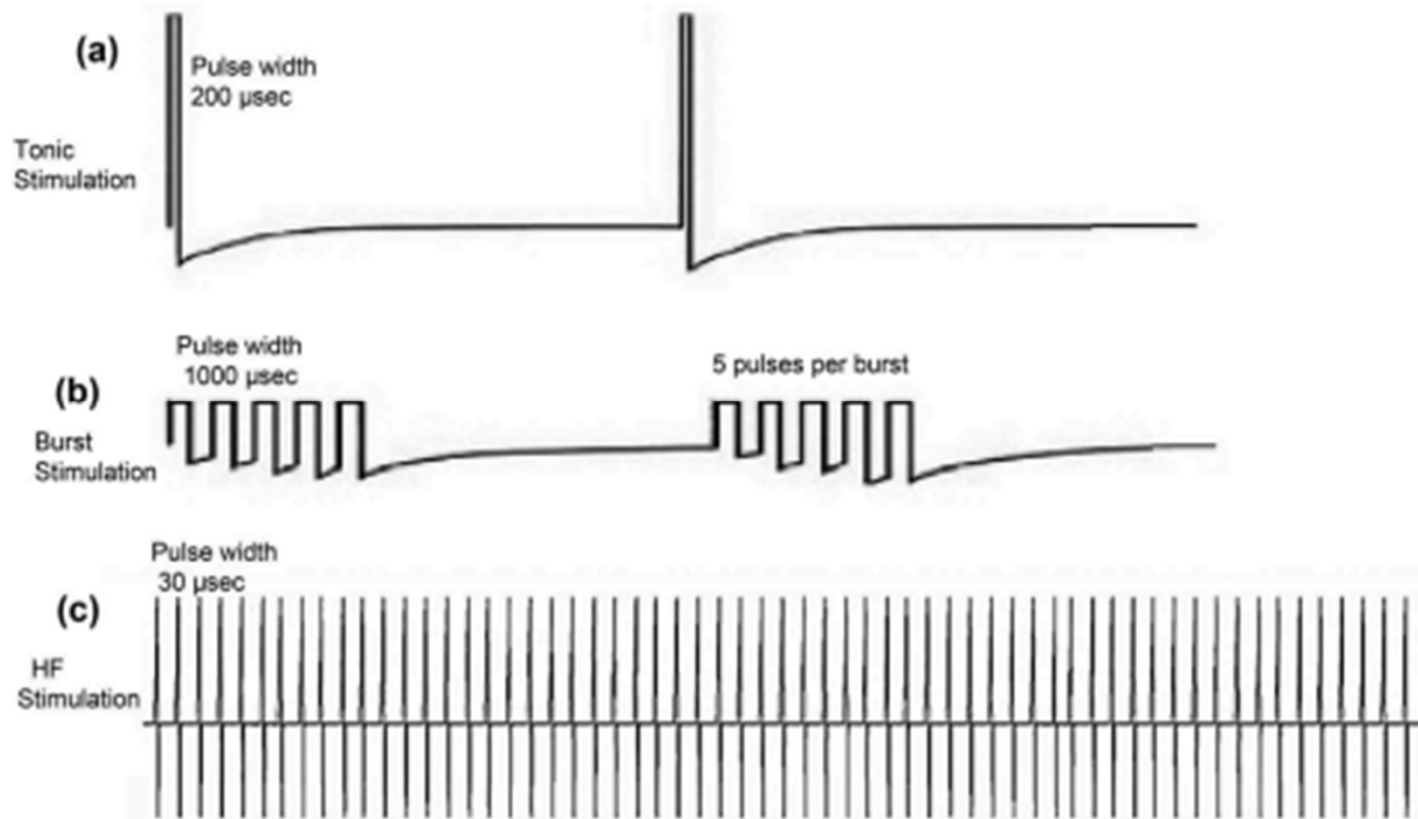
# New Paradigms in Stimulation

- Combination therapies availability: multiple options available at the same time with one device
- Treating electrical current as medication: ability to vary dose, frequency, and speed of administration
- New stimulation algorithms without paresthesia: targeting dorsal horns and ganglions
- Automation of waveforms: variety of algorithms mentioned above are automatically rotated in a preprogrammed sequenced optimized for a particular patient
- Program usage and activity reports availability
- Full MRI compatibility





# New Paradigms in Stimulation





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## **Case Discussion**

**Chadi Tannoury, MD**

Associate Professor

Medical Director, Orthopaedic Clinic

Director, Spine Research

Boston University Medical Center

# Active 76 year old Male with Back-legs Pain

- Current complaints:
  - ✓ 60% LBP + 40% Sciatica
  - ✓ Right sciatica: anterior thigh pain
  - ✓ Left sciatica: posterior calf + foot (plantar & dorsum) pain
- Prior surgeries:
  - ✓ Lumbar laminectomy L5-S1 (2016)
  - ✓ Lumbar laminectomy L4-L5 (2017)
  - ✓ Lumbar laminectomy L3-L4 and Revision Lami L4-L5 (2018)
- Other Treatments:
  - ✓ ESI – Facet Blocks
  - ✓ PT
  - ✓ Oral NSAIDs, Gaba

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# Active 76 year old Male with Back-legs Pain

## Physical Examination

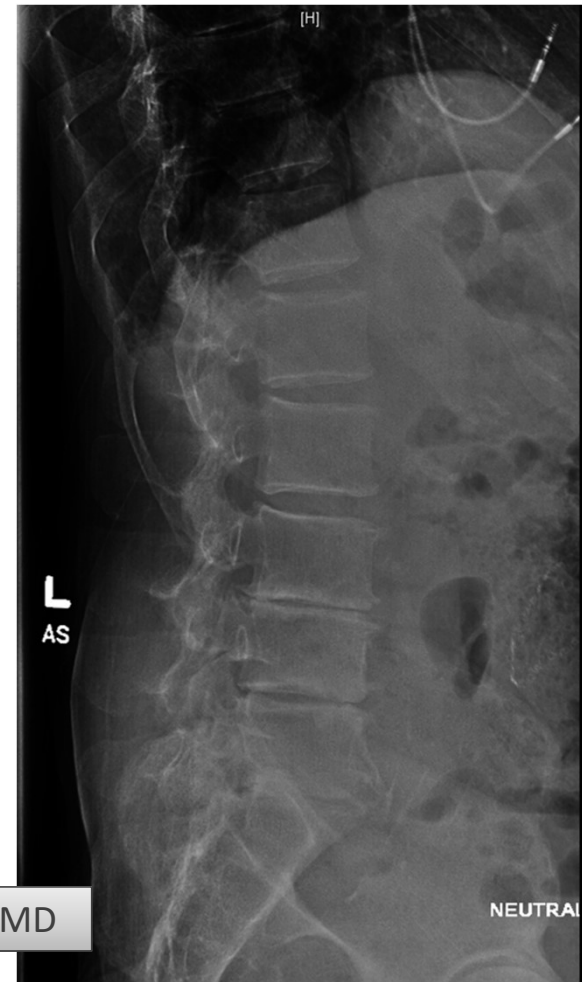
- Loss lumbar lordosis
- Right LE:
  - ✓ Positive Femoral stretch test
  - ✓ 4/5 weakness in IP-Quad
  - ✓ Diminished sensation in L3 dermatome.
- Left LE:
  - ✓ Positive SLR
  - ✓ 3-4/5 weakness in Ehl – Tib Ant, 4/5 weakness in Gastroc
  - ✓ Diminished sensation in L4, L5, and S1 dermatomes.

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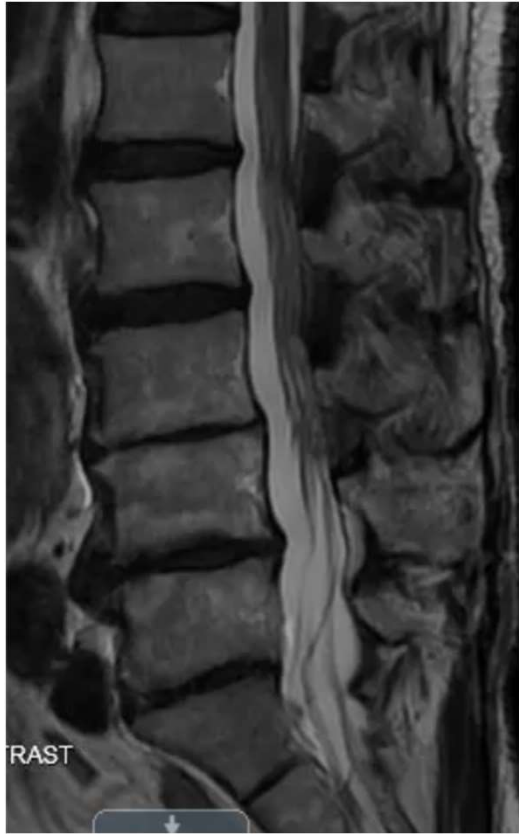
# Imaging

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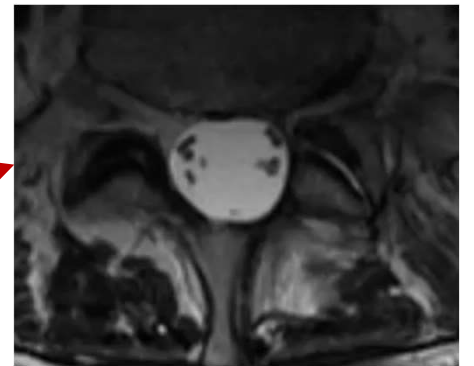
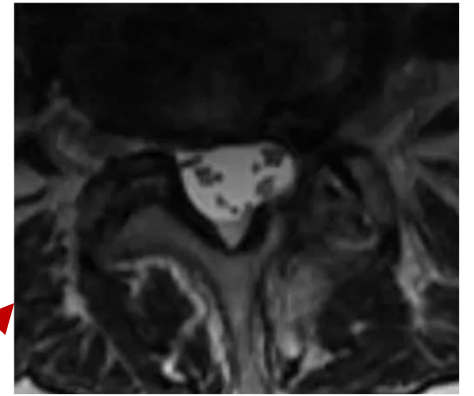
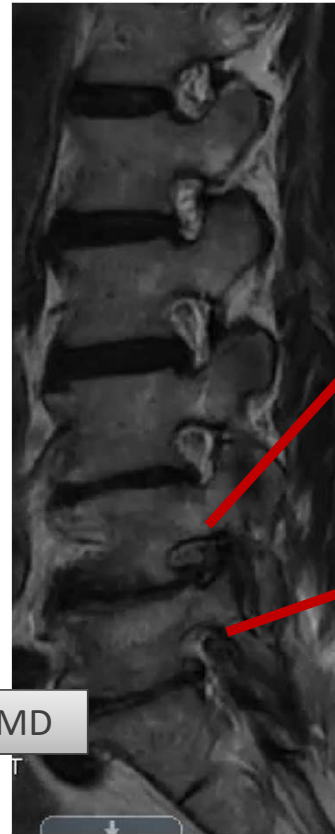
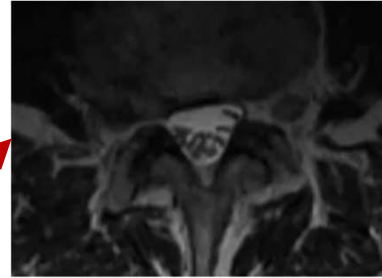
# Standing X-rays



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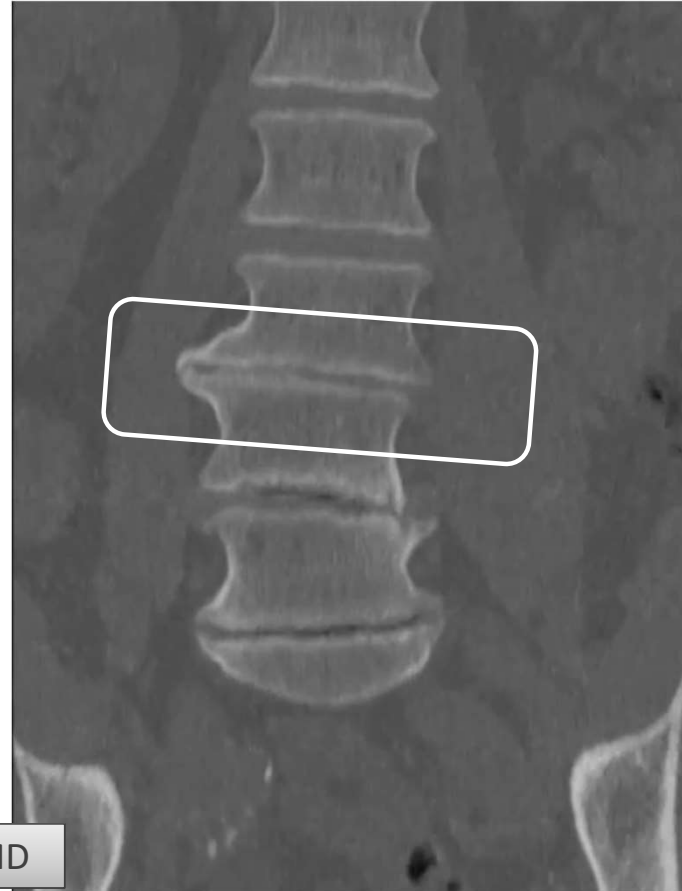


# MRI



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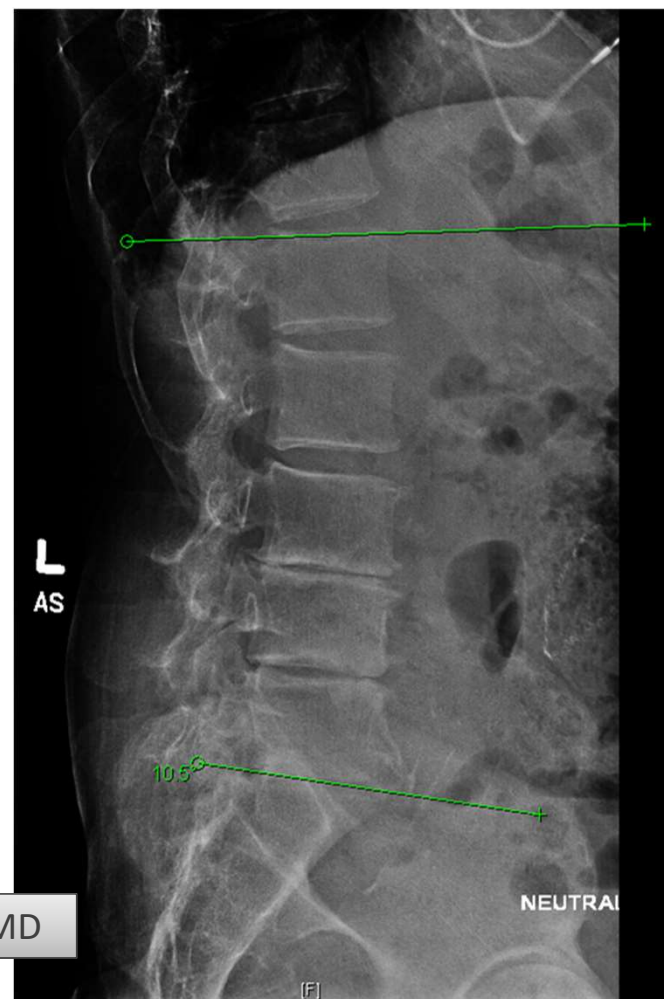
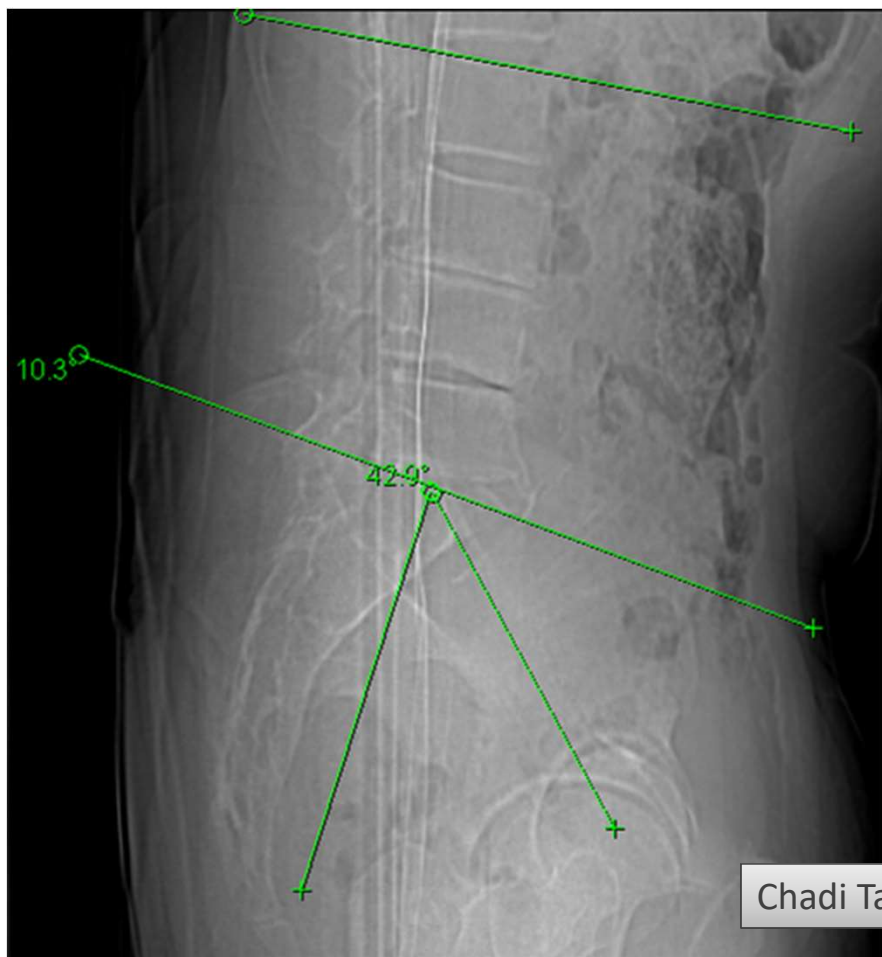
# CT scan



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**PI = 43 degrees vs. LL = 10 degrees (mismatch ~ 33 deg)**



# Imaging Summary – Challenges:

- Narrowing (Residual Stenosis: Foraminal L3-S1)
- Flat Back (Lumbopelvic mismatch: PI-LL = 33 degrees)
- Rigid Spine (Pseudo-Ankylosed: No mobile discs)
- Prior 3 x multiple surgeries (Nerve + Tissue scarring)

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# Treatment Options?

Any role for -

1. Colleen: Additional PT
2. Ed: Additional injections / Alternative Injections – Neuromodulation
3. Stefan: EMG to help with diagnosis
4. Jason: Surgery?
5. Audience: No surgery-Live with it!! (Audience Opinion Poll)
6. Michael: If history of work injury 2015 prior to 1st Surgery 2016; Are current-ongoing treatment compensable?

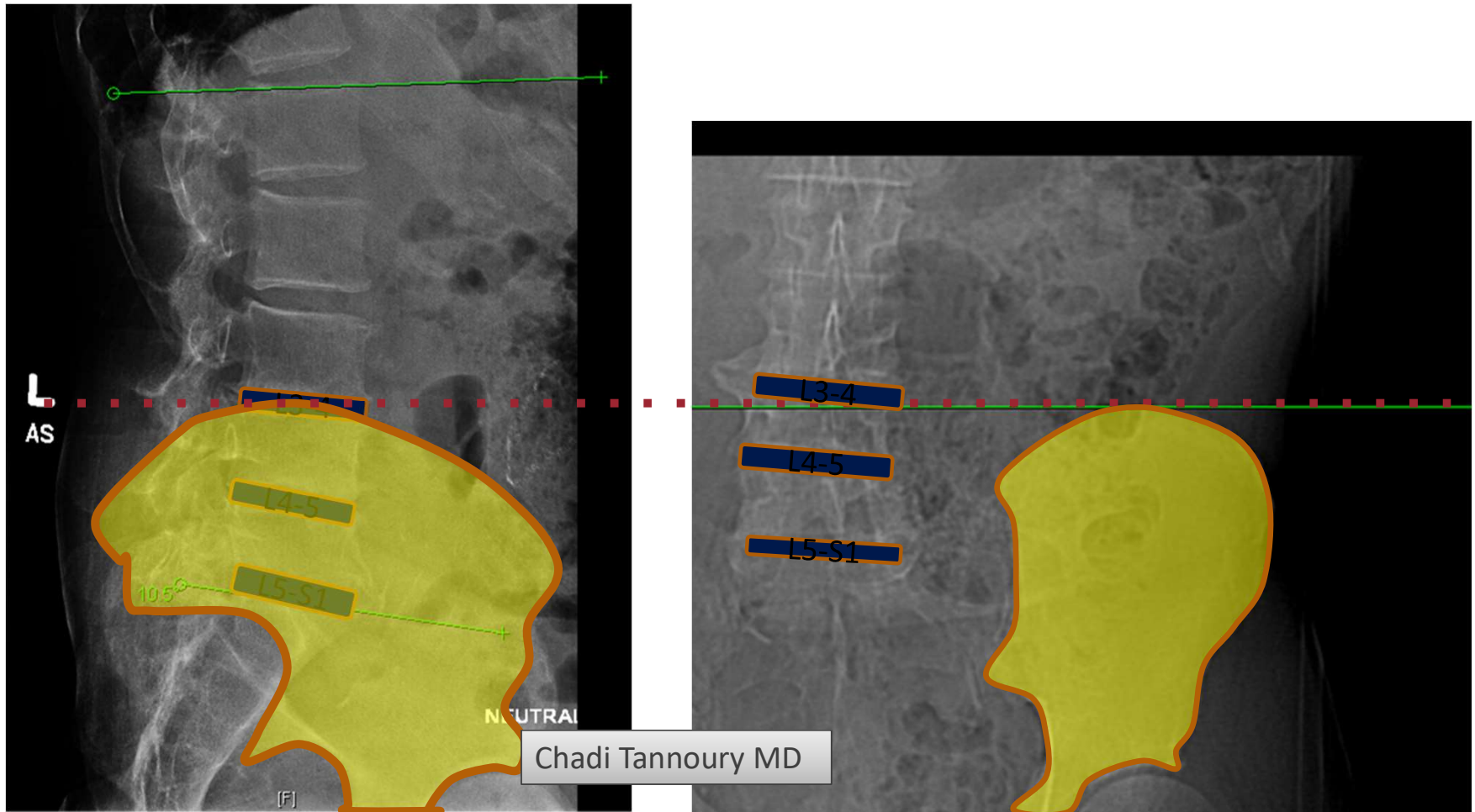
slido



**What treatment option would you choose?**

ⓘ Start presenting to display the poll results on this slide.

# Additional Anatomic - Surgical Considerations



# Surgical Treatment?

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# Surgical Treatment?

- Decompression (revision) vs. Fusion (+ decompression)?

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# Surgical Treatment?

- Decompression (revision) vs. Fusion (+ decompression)?

**Fusion**

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# Surgical Treatment?

- Decompression (revision) vs. Fusion (+ decompression)?

**Fusion: How many Levels?**

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# Surgical Treatment?

- Decompression (revision) vs. Fusion (+ decompression)?
- **Fusion** Technique?
  - ✓ Open standard posterior without bony osteotomy
  - ✓ Open standard posterior with bony osteotomies
  - ✓ Standard ALIF with Posterior fixation
  - ✓ MISS

# Surgical Treatment?

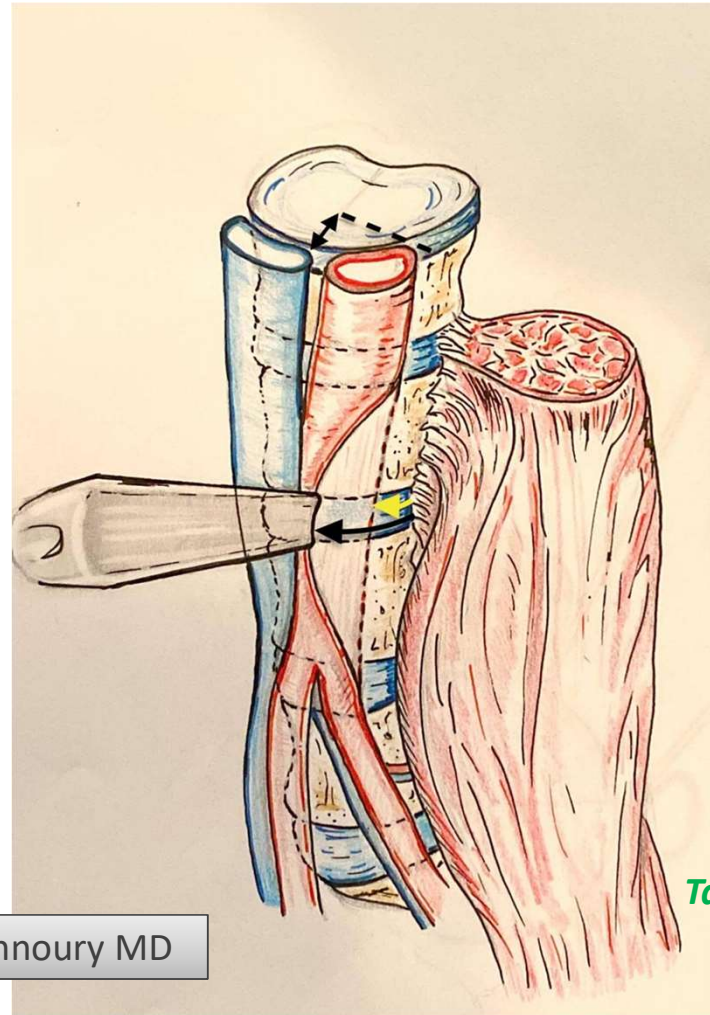
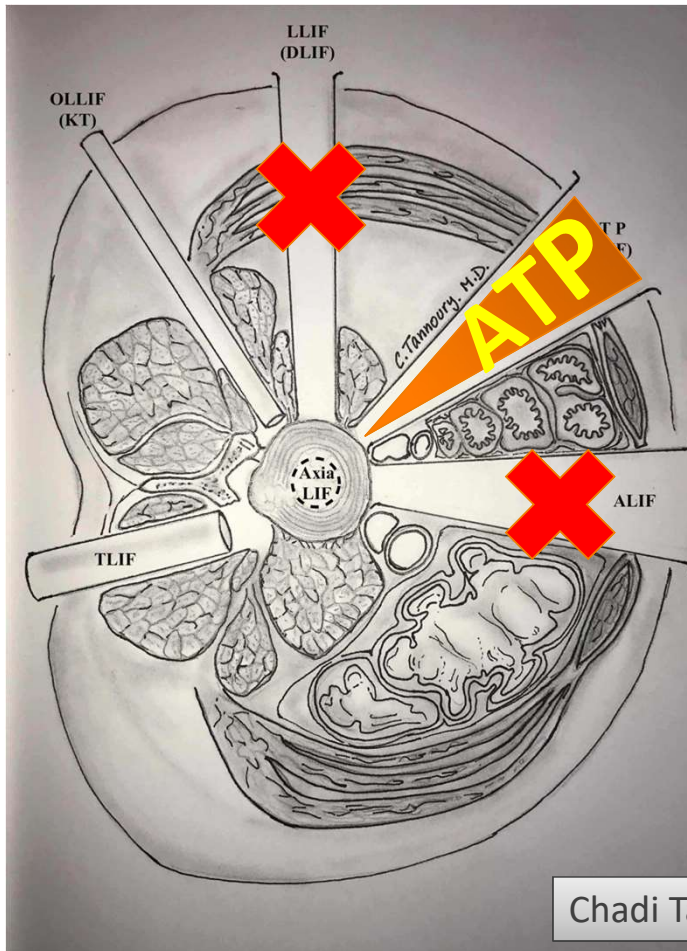
- Decompression (revision) vs. Fusion (+ decompression)?
- **Fusion** Technique?
  - ✓ Open standard posterior without bony osteotomy
  - ✓ Open standard posterior with bony osteotomies
  - ✓ Standard ALIF with Posterior fixation
  - ✓ MISS
- **MISS** Techniques?
  - TLIF (how many levels?)
  - Lateral Transpsoas
  - Anterolateral ATP

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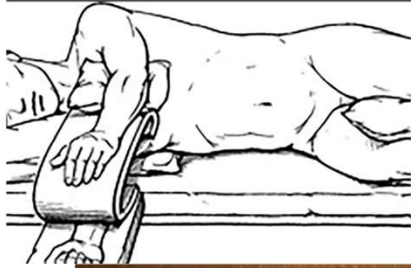
# What Was Done?

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# ATP (AntePsoas) Technique



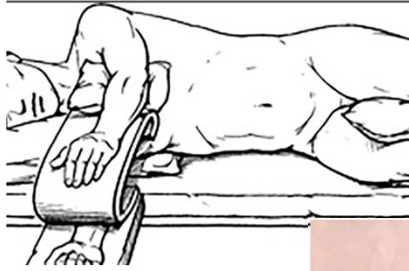
*Tannoury et al, LSRS 2017*  
*Tannoury et al 2018*



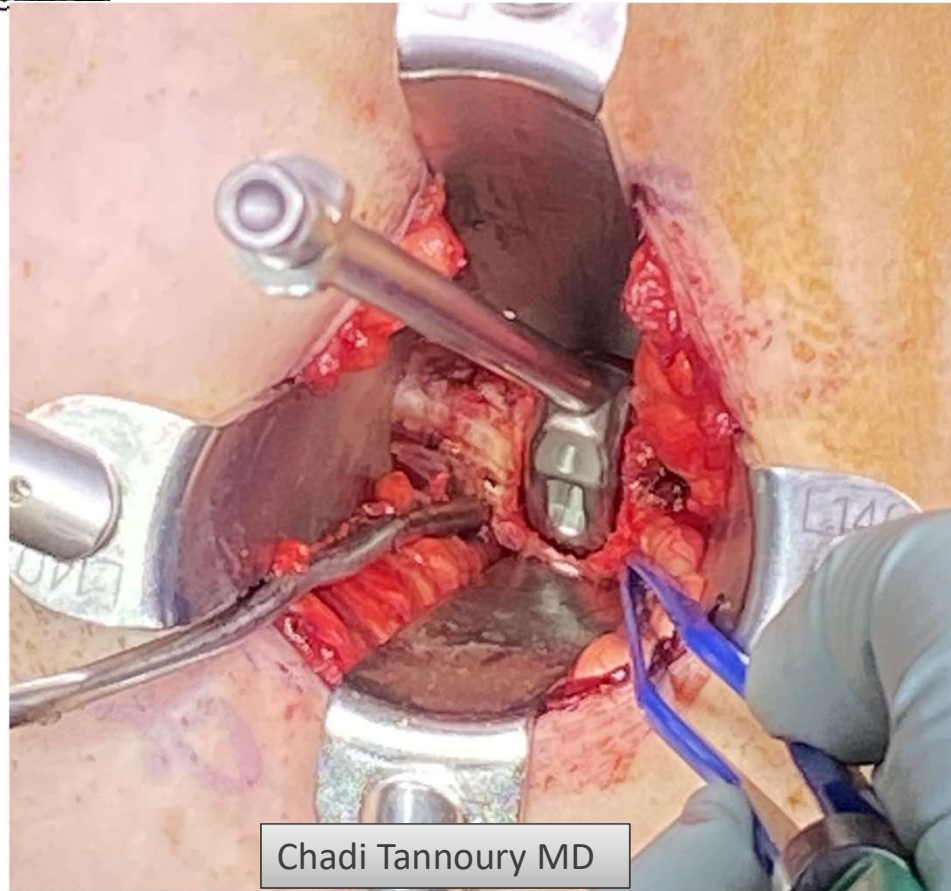
***Wide Exposure=Safe Visualization!***



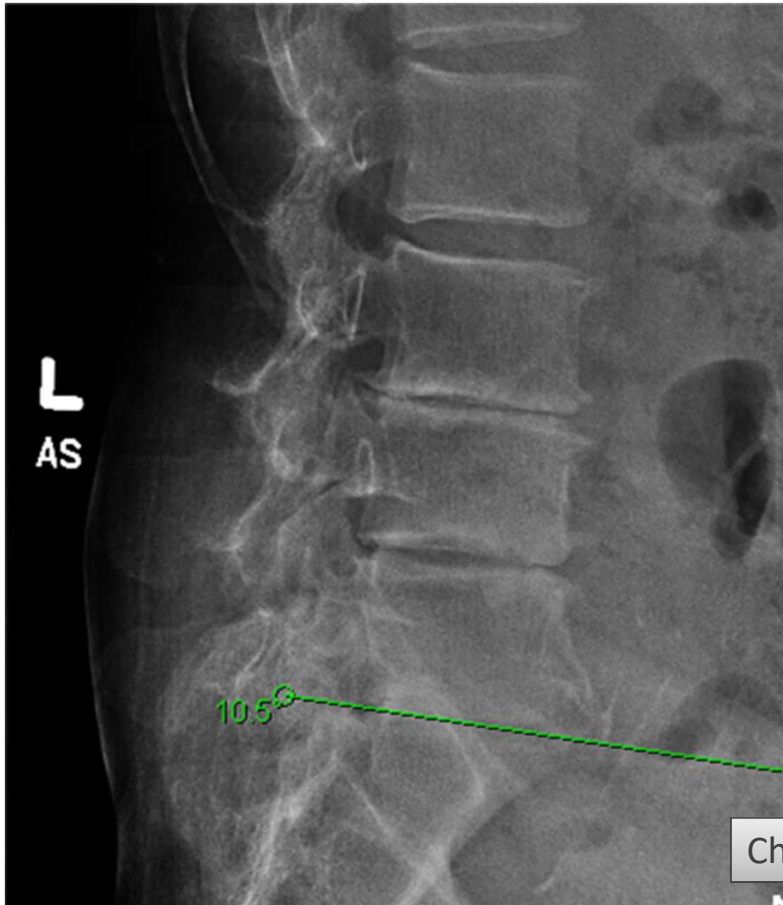
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## ***Full Discectomy & Safe ACR***

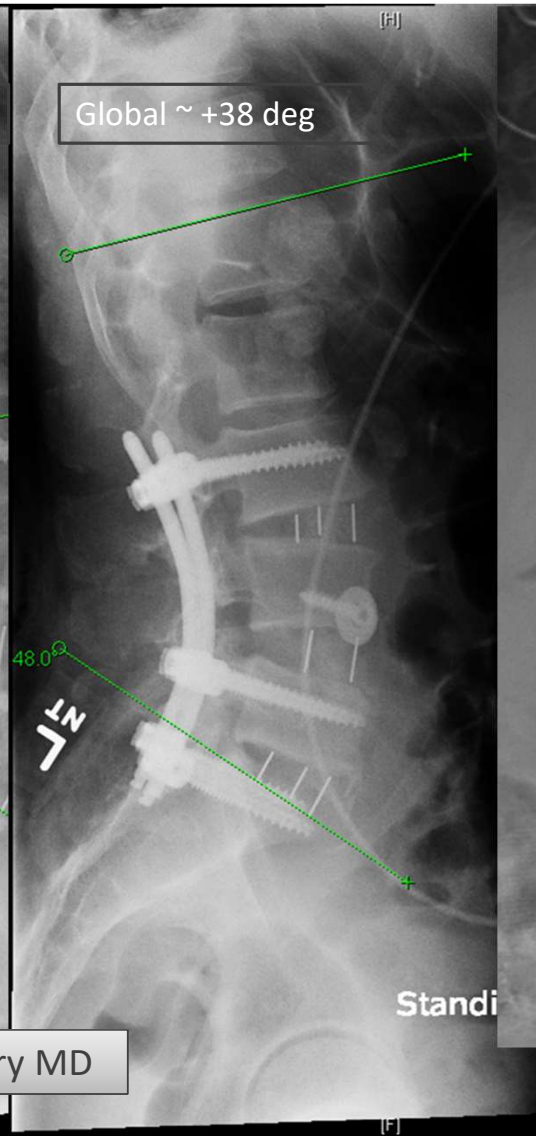
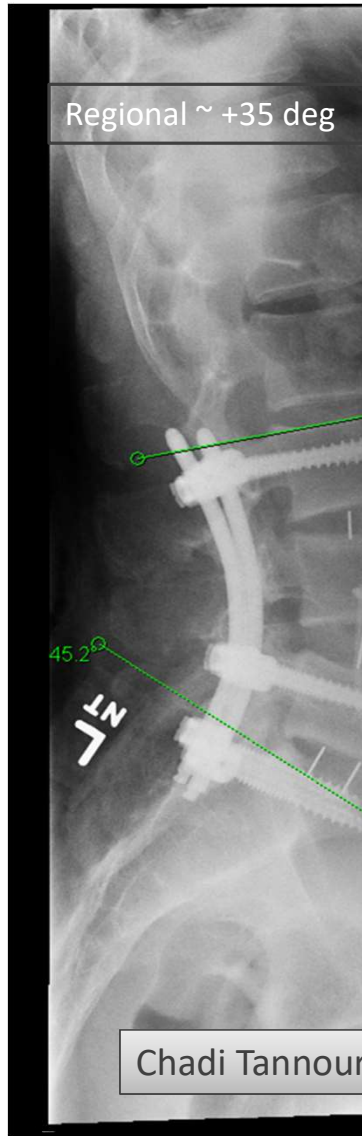
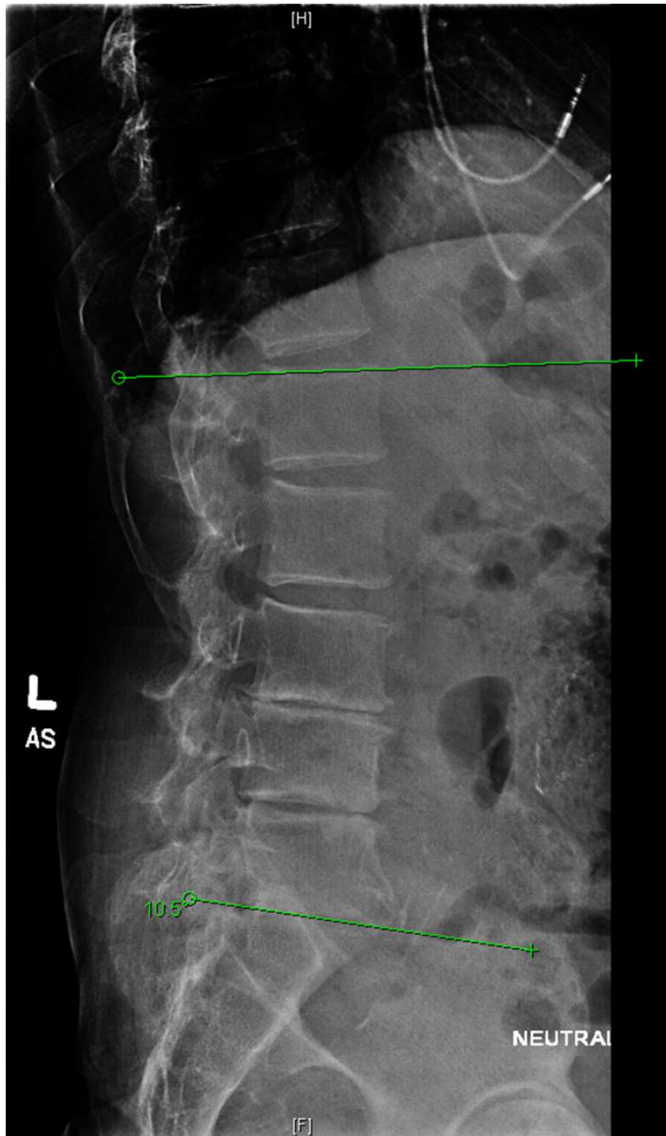


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# Clinical Outcome (2 years Postop) *video\**



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# Stretches



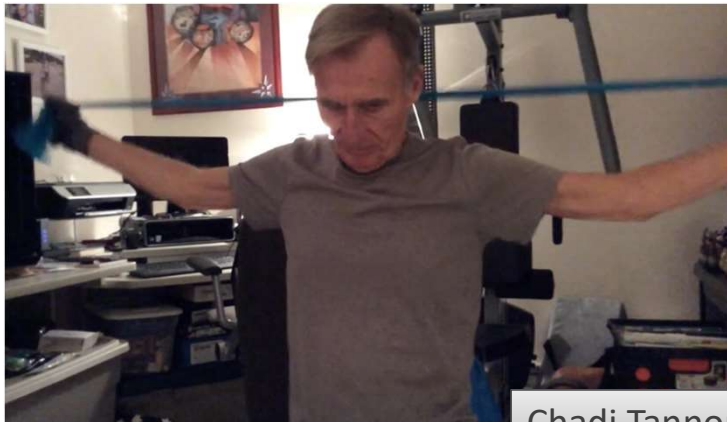
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# Push Ups



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# Resistance Bands



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# Ab's - Core



# Chest Press - Pull Down/Row Machine



## Daily 35 min workout – 2 years Postop *(video\*)*



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# Key take away?

- Lumbar disc disease:
  - ✓ Prevalent
- Understand difference between Back pain + Nerve Pain
  - ✓ Disc degeneration → BP
  - ✓ Stenosis or nerve impingement → Radicular pain
- Physical Examination + Imaging + Diagnostics:
  - ✓ Correlates picture with pathology
- Treatment is broad: conservative to surgical
- Surgery: good outcome in well indicated subjects

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**THANK YOU!**

