Spine 101 - Introduction to Spinal Disorders

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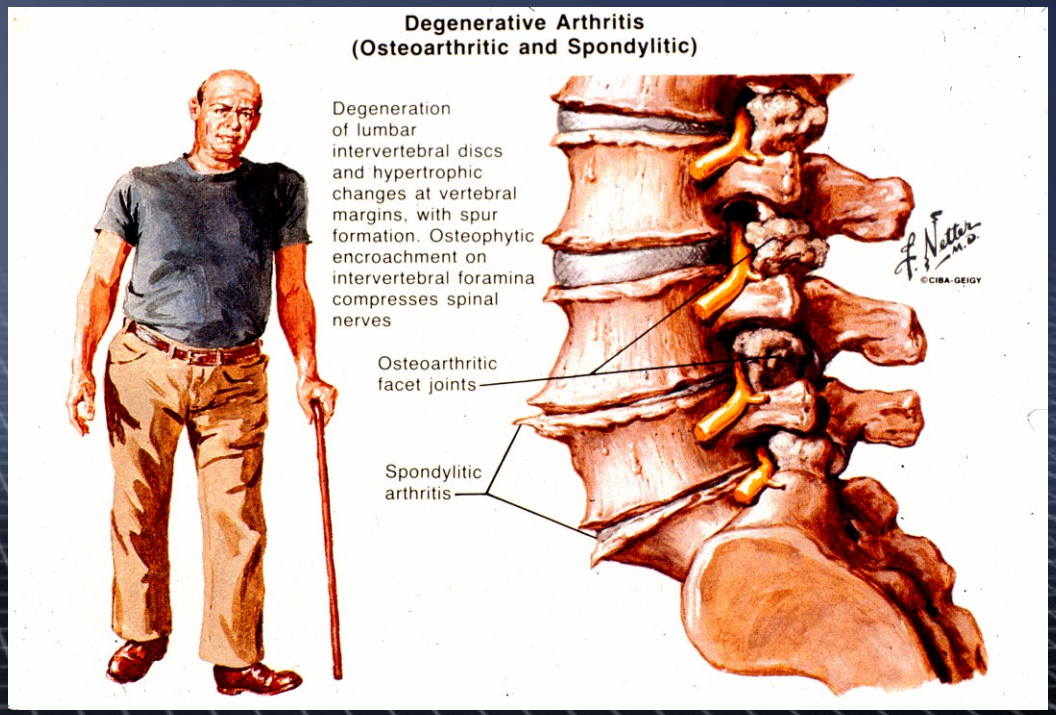
Spinal Disorders

Enormous Health and Economic Interest

- Most common cause of lost work days
- 700,000 spine operations a year in USA
- $50 billion total economic impact



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Epidemiology of Back Pain

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Low Back Pain Epidemiology

- 70-80% of adults in Western cultures will have severe LBP that affects daily activities
- 15-30% prevalence of LBP - peak age 55 - 64
- ~2% surgical

"WHO WAS FIRST?"

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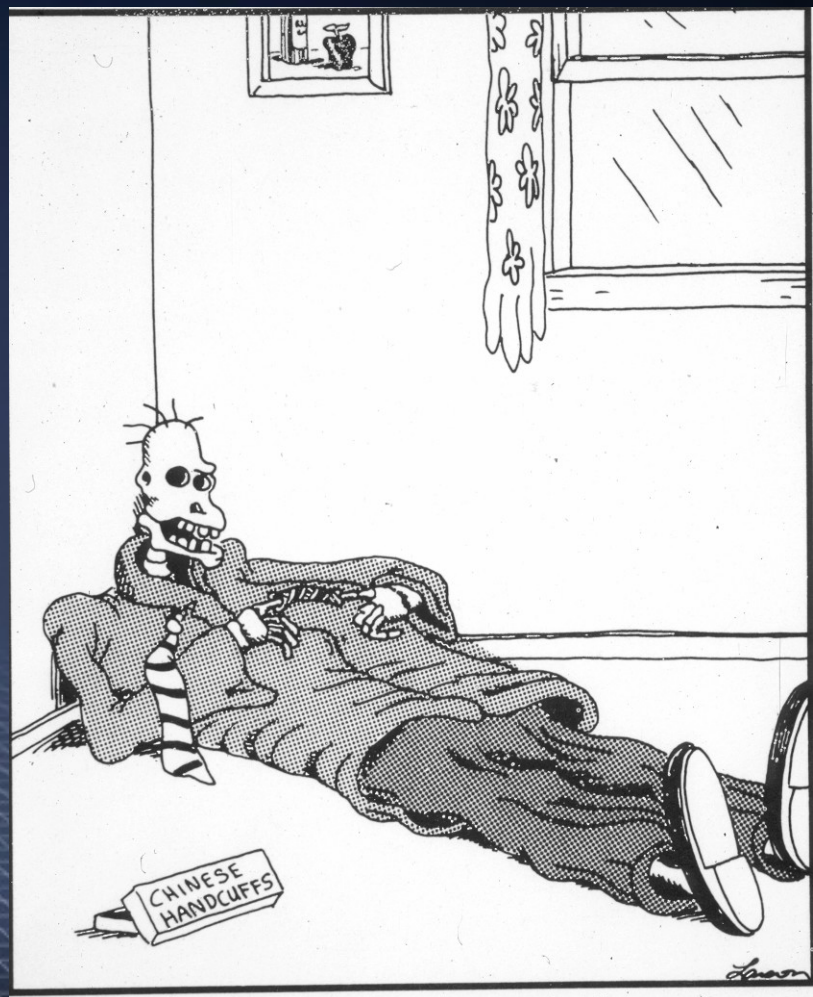
Low Back Pain Epidemiology

- #1 cause of lost work time <45 years
  - ~5 million people/yr
- #1 costliest musculoskeletal disorder
  - ~11 million/yr treated
  - $20-50 billion annually (lost productivity, diagnosis and treatment, litigation, disability)



Houdini's final undoing

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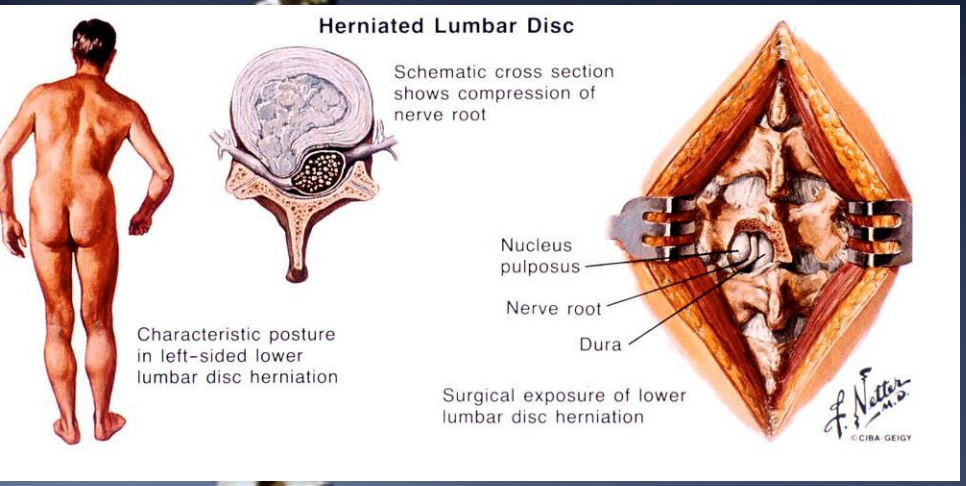
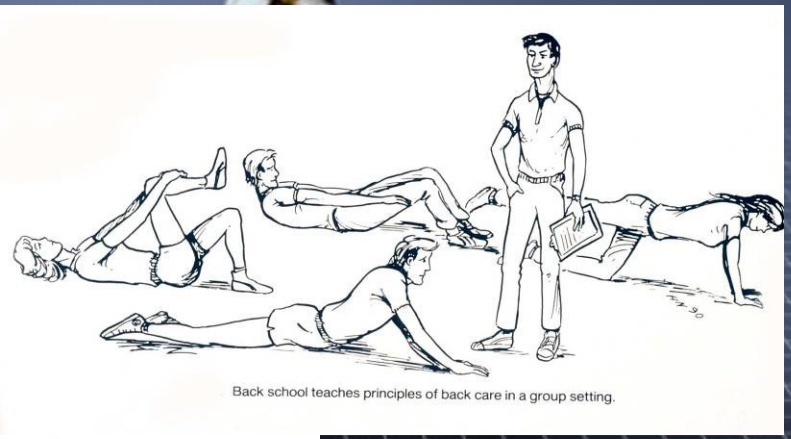
Low Back Pain Epidemiology

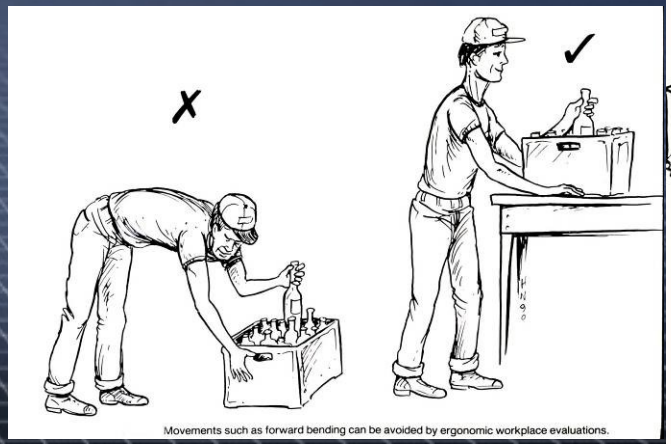
- Only 7% still have disabling LBP after 6 months but these 7% consume 85-90% of $ spent on treatment and compensation

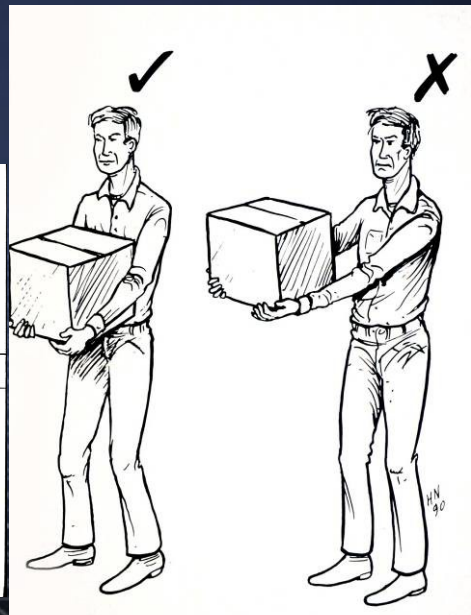
Expansion of Spine Related Specialties

- Physical and Rehabilitative Medicine
- Pain Medicine
- Neuroradiology
- Neurology
- Physical therapy, massage, psychology, acupuncture, chiropractic, etc.




Back school teaches principles of back care in a group setting.


Movements such as forward bending can be avoided by ergonomic workplace evaluations.


The load should be kept close to the body.

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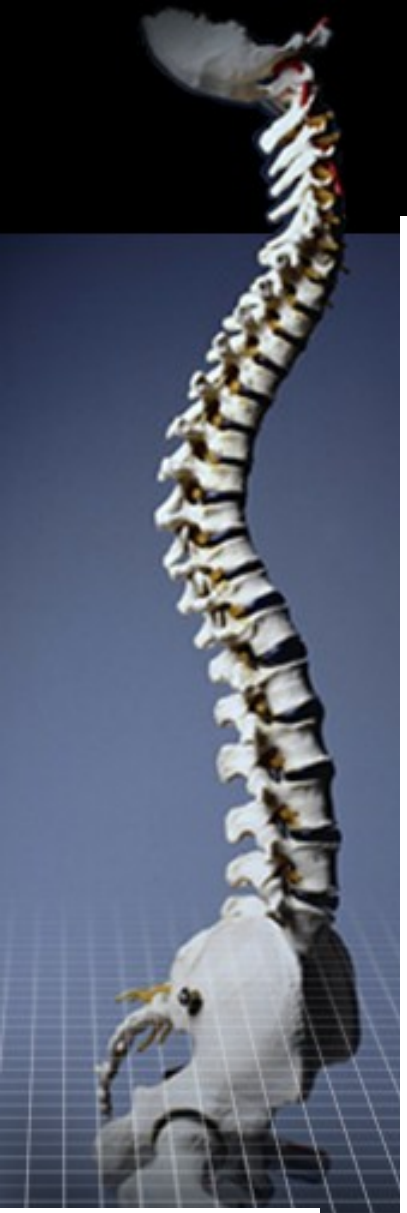
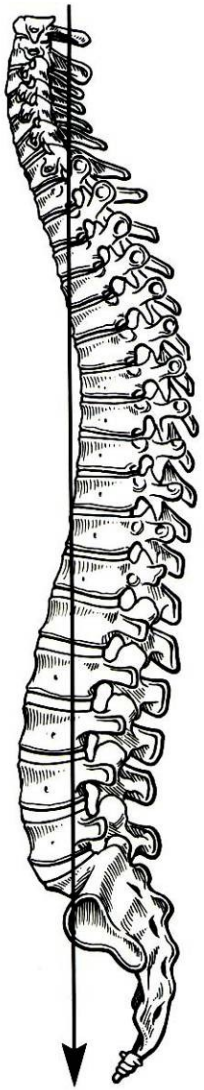
Regional Anatomy





Normal weight-bearing axis.

- Cervical = neck
- Thoracic = chest
- Lumbar = low back
- Sacral = tail bone

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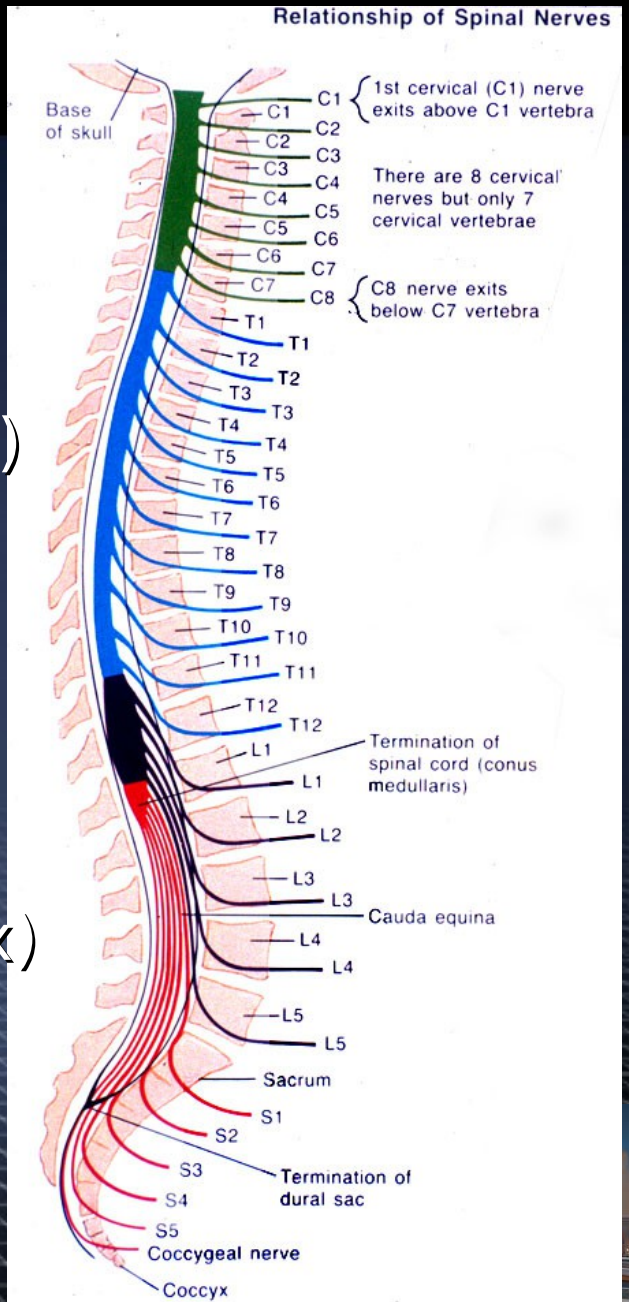
Nerve Anatomy and Function

Cervical (upper extremity)

Thoracic (chest and abdomen)

Lumbar (lower extremity)

Sacral (bowel, bladder, sex)



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Lumbar Vertebral Anatomy

Vertebra

Disc

Nerve

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Causes of Low Back Pain

- Degenerative arthritis
- Trauma
- Normal “wear and

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Mechanical Causes of Low Back Pain

Deterioration of musculoskeletal condition

Good posture
- head erect
- chest high
- abdomen in
- back flat
- buttocks in

Ideal weight

Good muscle tone
- (regular exercise)

Poor posture
- head forward
- chest flat
- abdomen protruding
- swayback
- buttocks protruding

Overweight

Poor muscle tone
- (lack of regular exercise)

Evaluation of symptoms by your doctor – " The History"

- Where, When, What, How?
- How better, how worse, how long?
- Onset, duration, quality, dynamics, patterns, progression?
- Associated leg pain, "sciatica" - must be dermatomal?

Physical Examination

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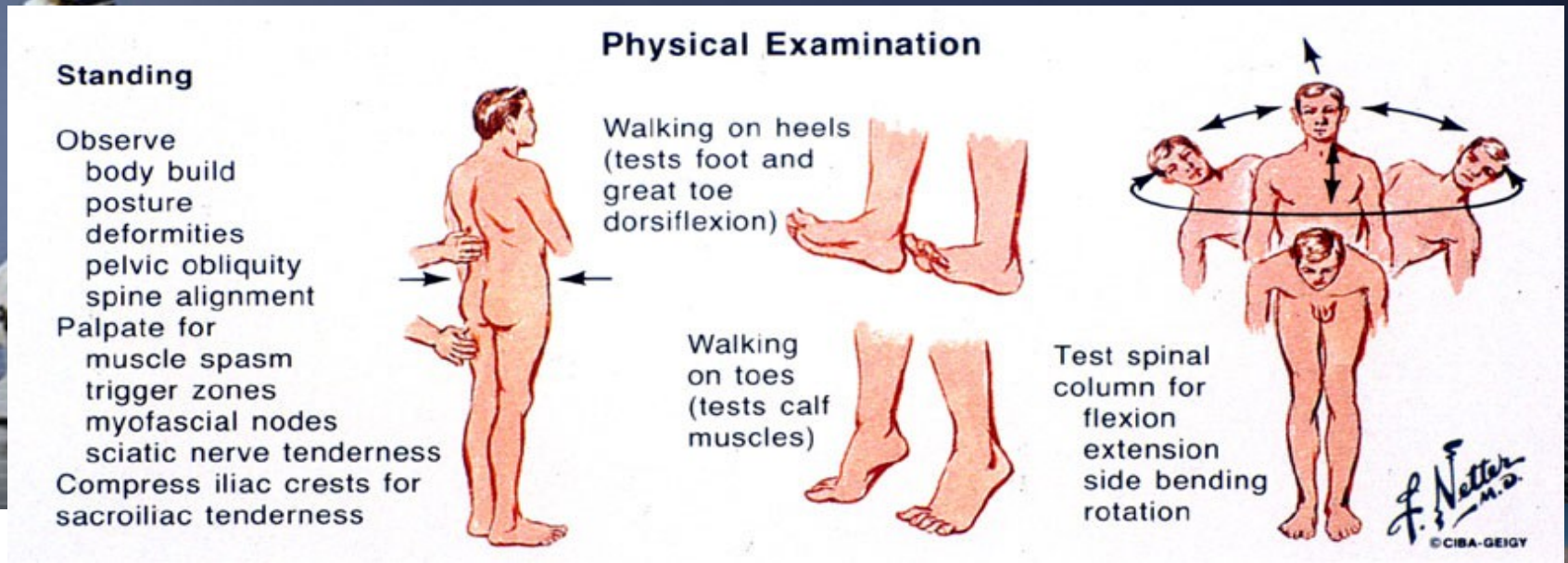
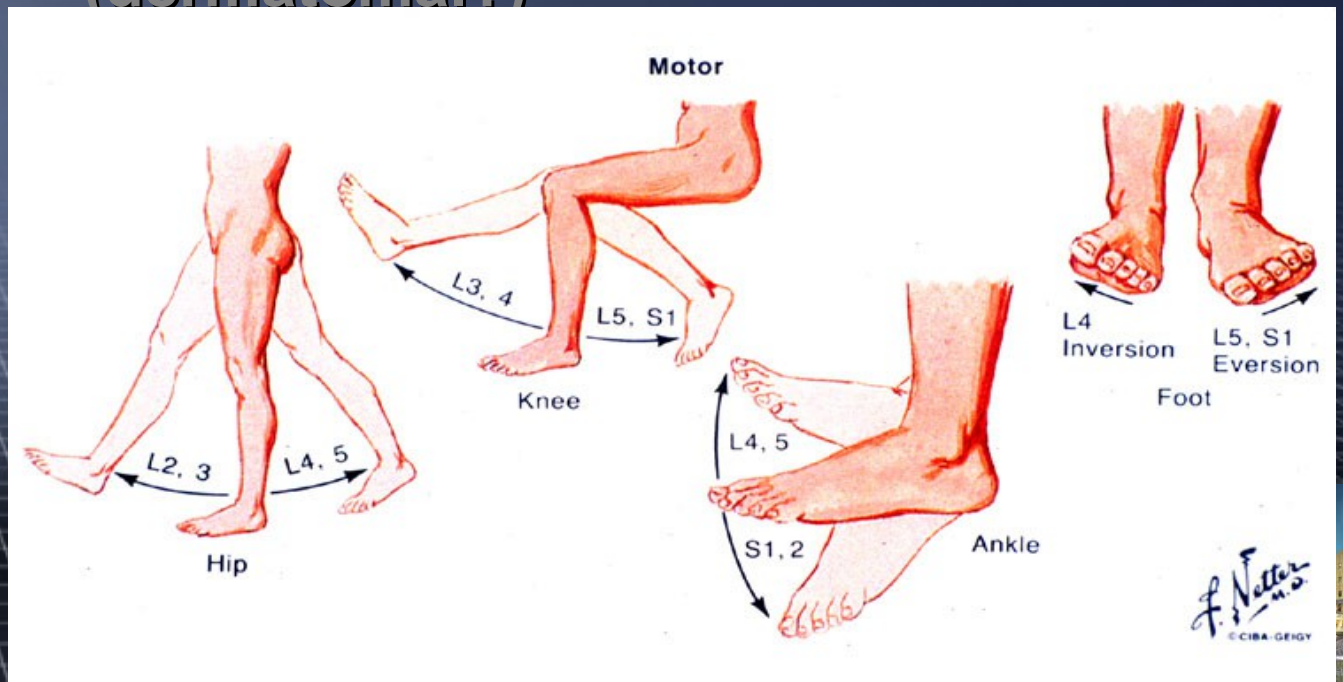
Low Back Examination

- Back inspection
- Alignment, scars/congenital
- Palpation: tenderness, alignment, paraspinous
- Percussion: muscles, sacroiliac, gluteal
- Range of motion



Lower Extremity Neurological Exam

- Neurological
  - Gait: (heel/toe walk)
- Motor: (esp. EHL's, ankles), 0-5 scale
- Sensation: touch, pin/dull (dermatomal?)



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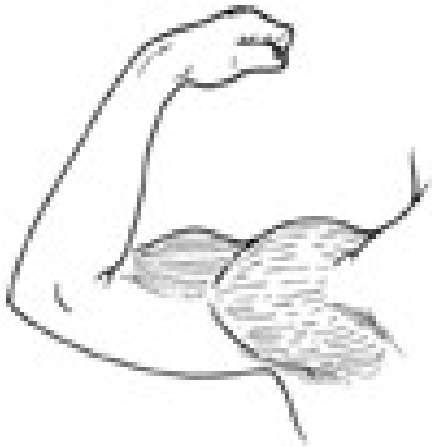


C5 MOTOR
Biceps
Deltoids

C5 SENSATION

C5 REFLEX

FIG. 13 The C5 neurologic level

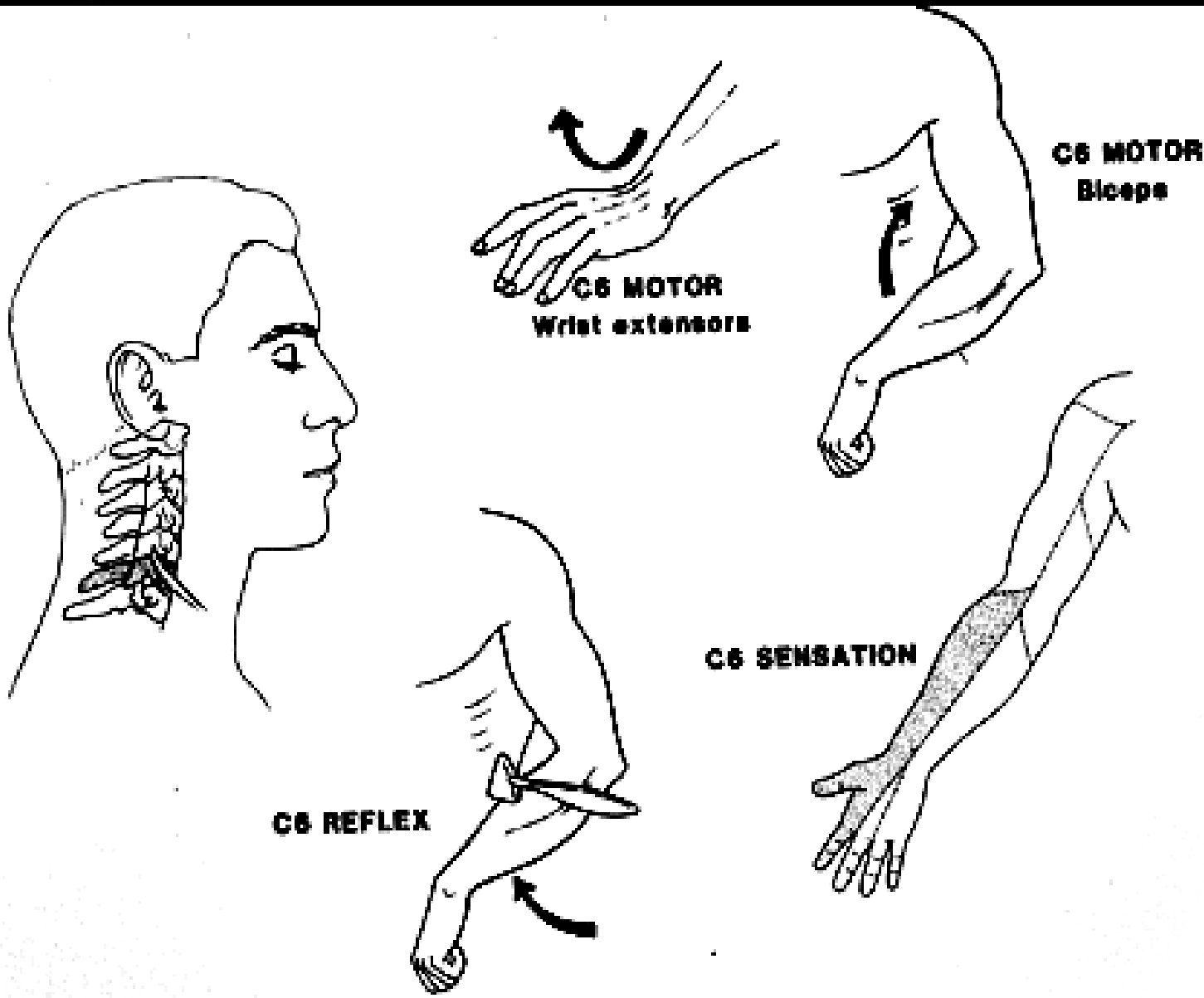
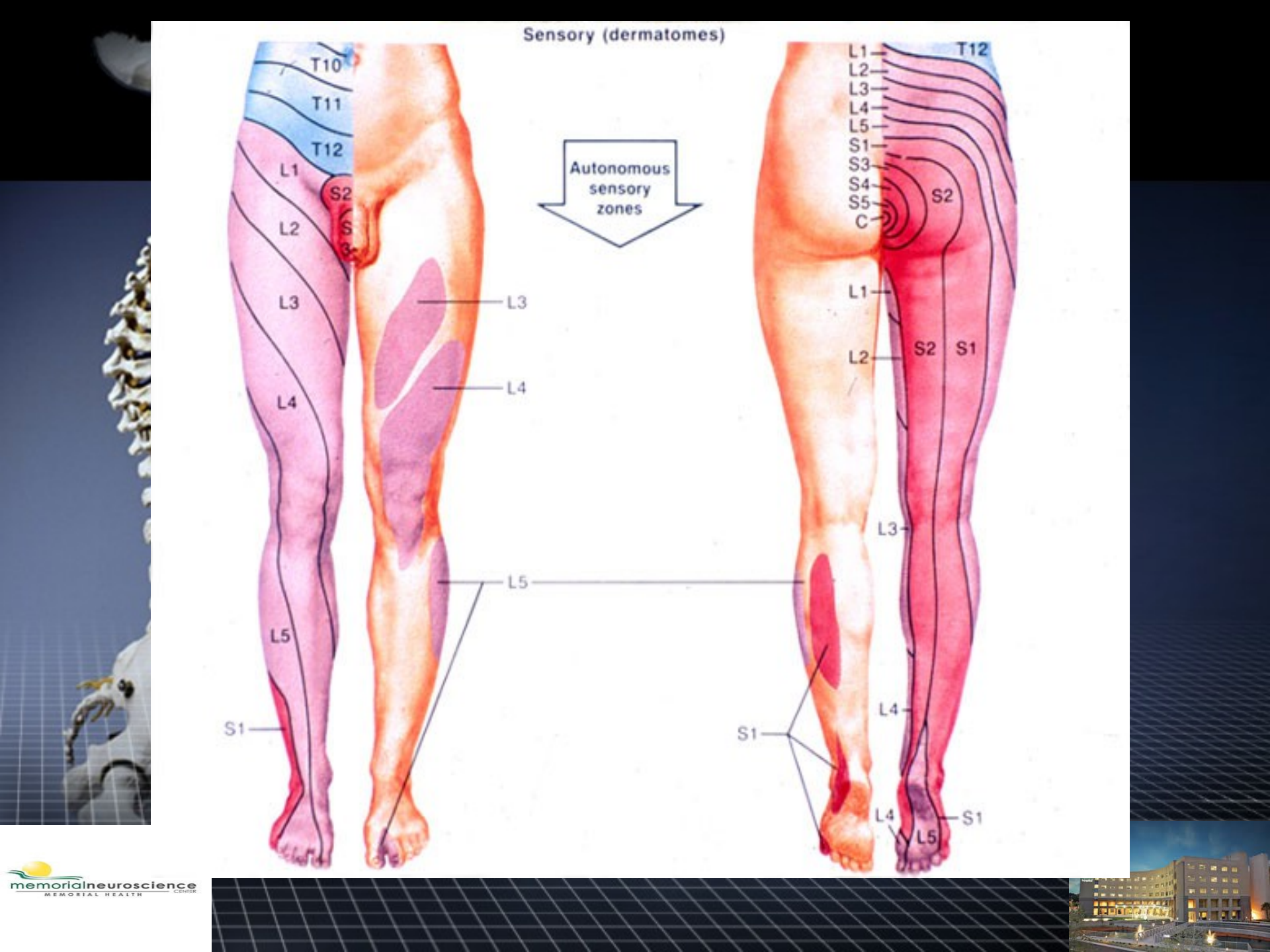


FIG. 14. The C6 neurologic level.


Sensory (dermatomes)
T10
T11
T12
L1
S2
L2
L3
L4
L5
S1
Autonomous sensory zones
L3
L4
L5
L1
T12
L2
L3
L4
L5
S1
S3
S4
S5
C
S2
L1
L2
S2
S1
L3
L4
S1
L4
S1
L5

Upper Extremity Dermatomes

- Regions of the extremity Indicate which nerve
- Pain, numbness, loss of sensation

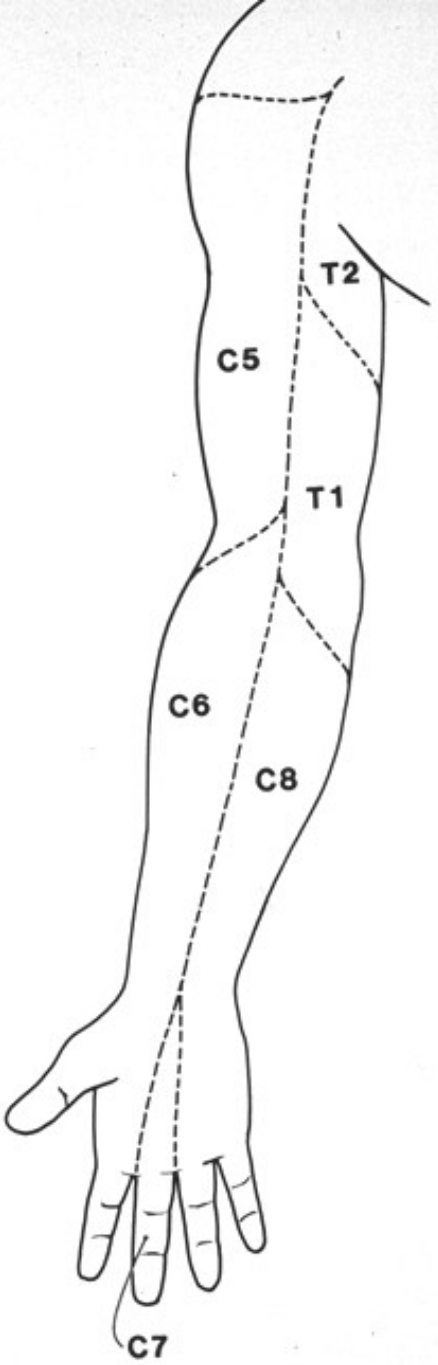


FIG. 1. Dermatomes of the upper extremity.

IMAGING STUDIES

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Plain Xrays

Cervical

Lumbar

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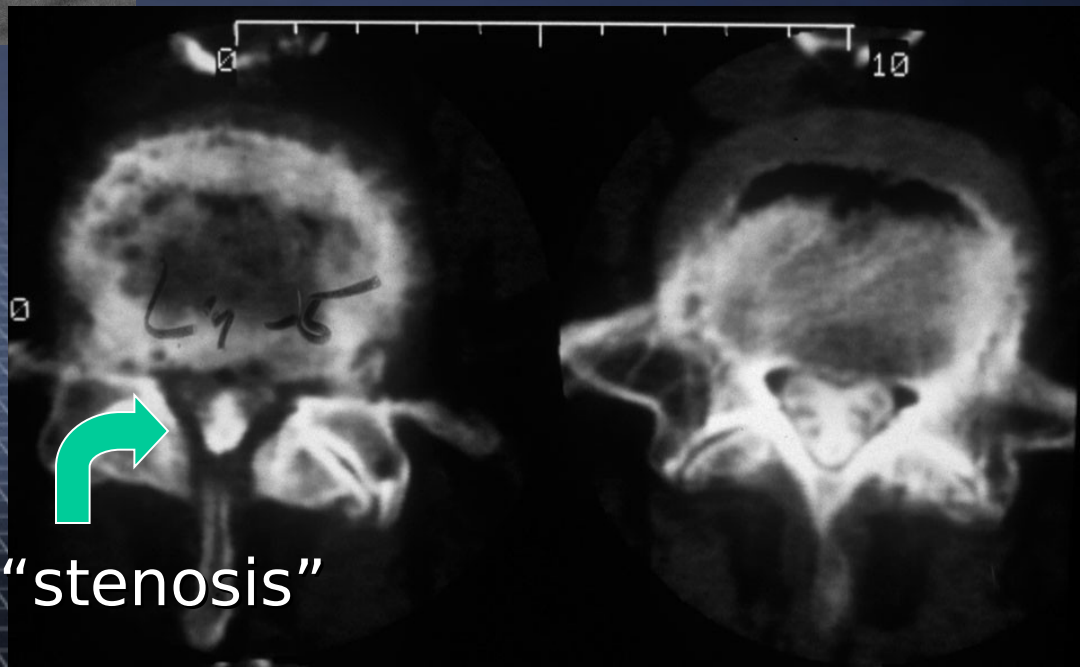
CT

Cervical



Lumbar

"stenosis"

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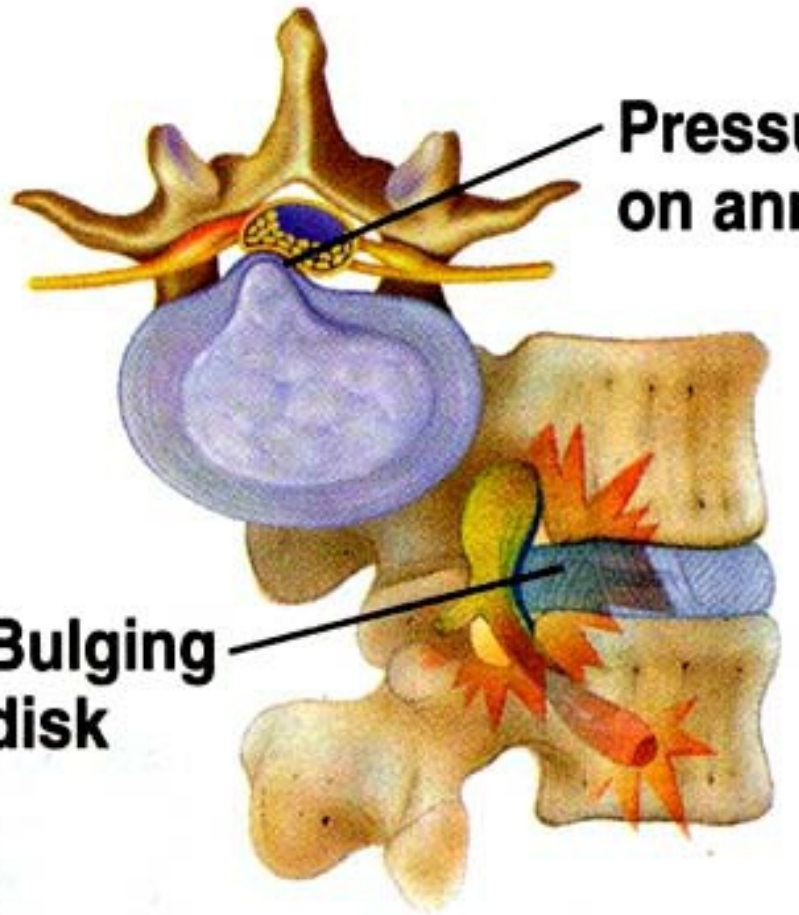
MRI

Cervical

Lumbar



Bulging disk. As a disk wears out, the nucleus begins to bulge into the annulus.

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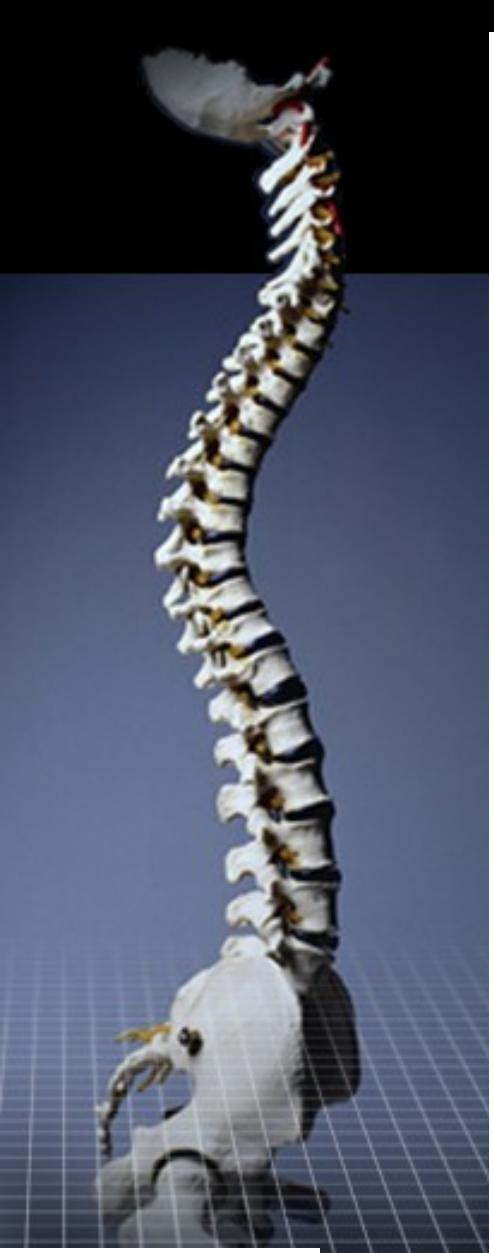

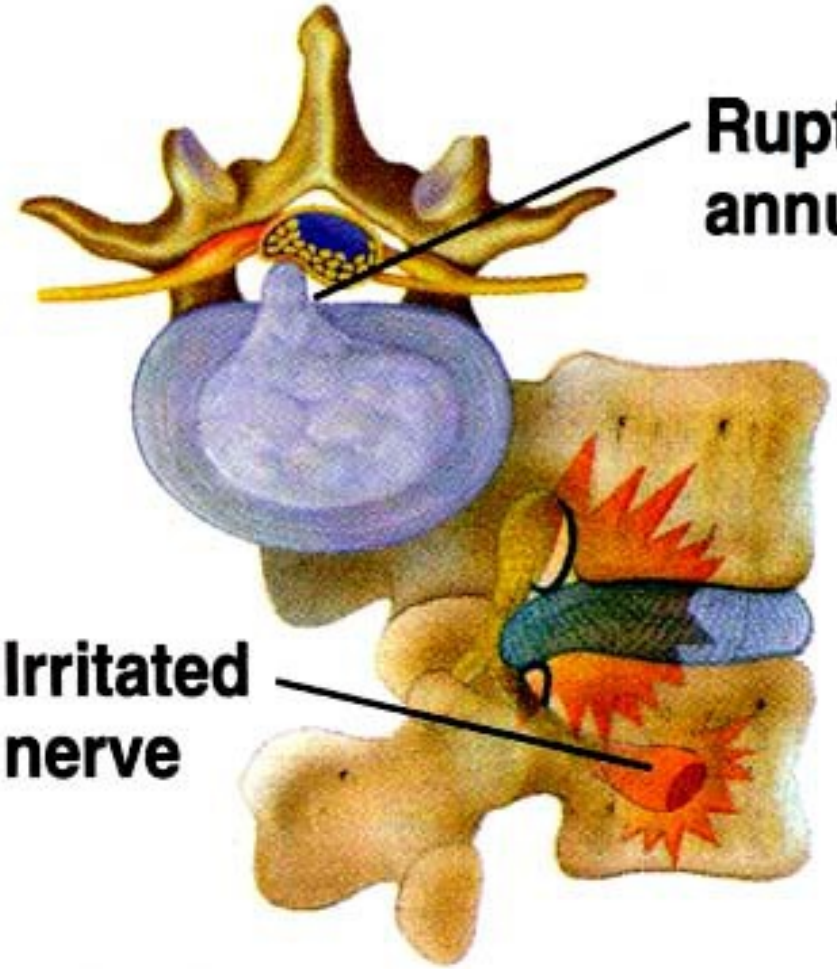

Ruptured disk. As a disk ruptures, its nucleus can squeeze out and irritate a nerve.

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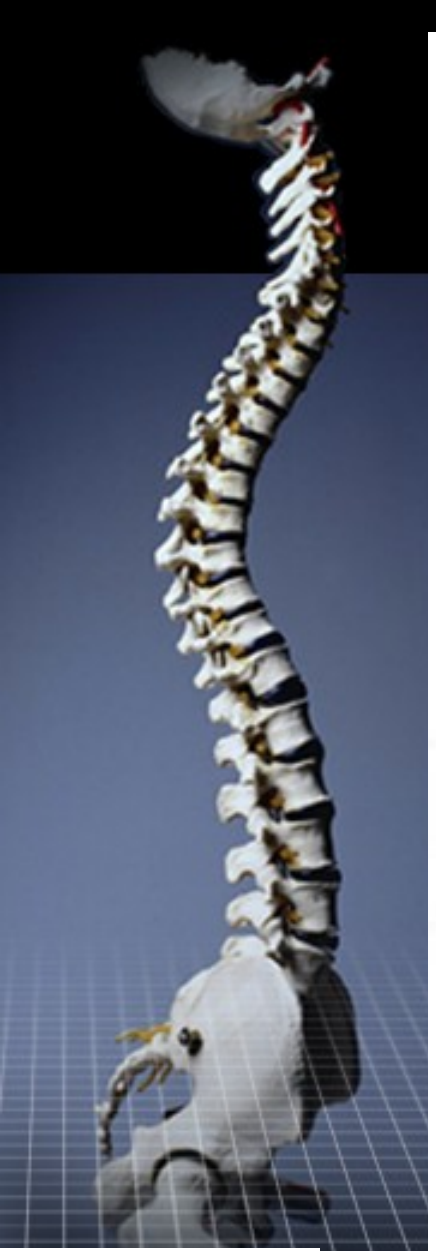

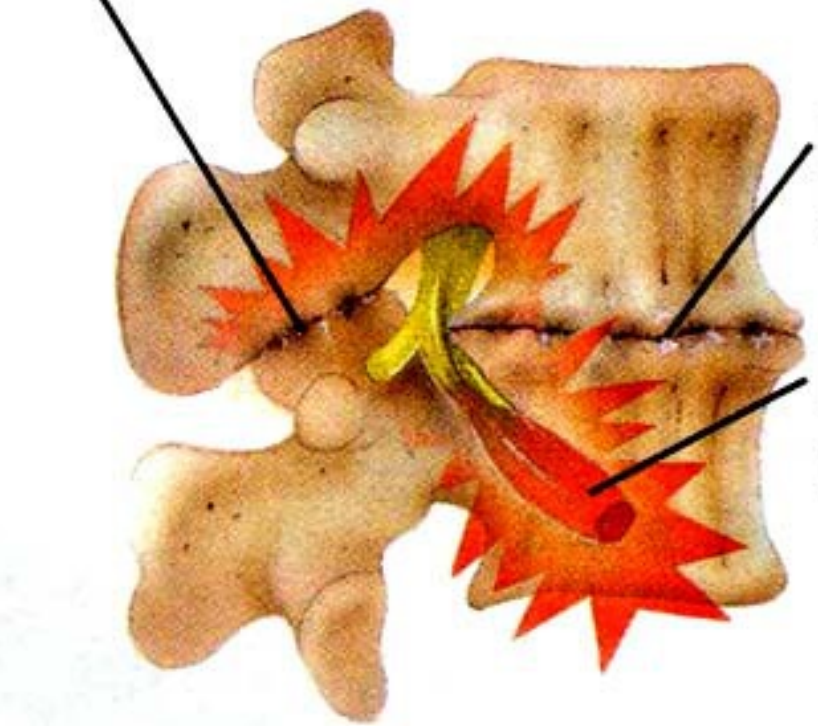

Arthritis. As disks wear out over time, bone spurs form. These growths can irritate nerves and inflame facets.

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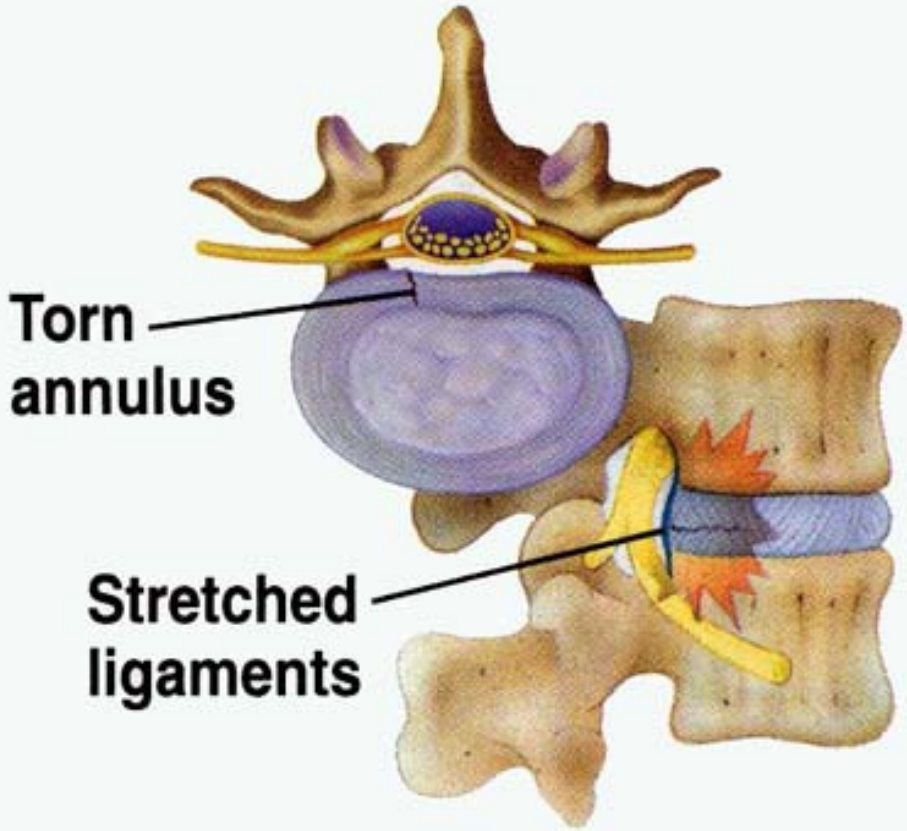

Torn annulus. A sudden movement may cause a tiny tear in an annulus. Nearby ligaments may stretch.

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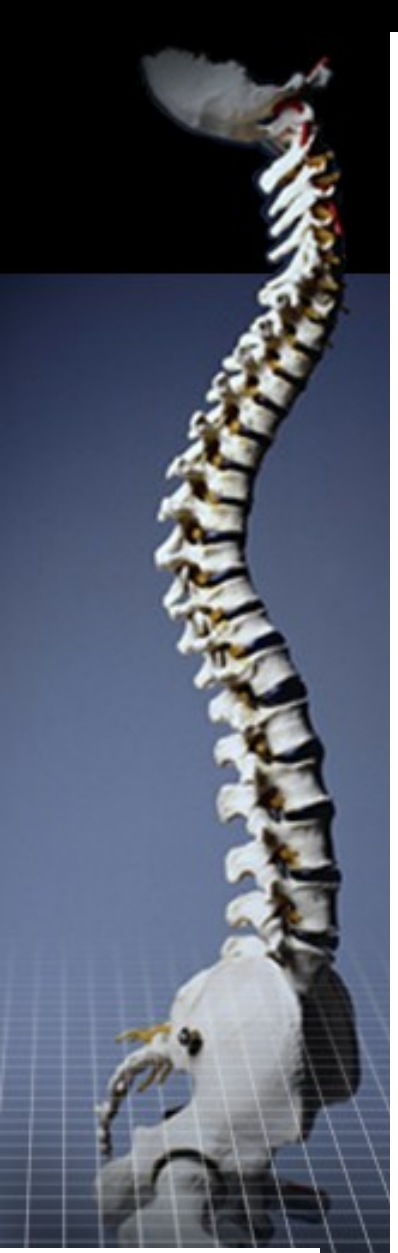
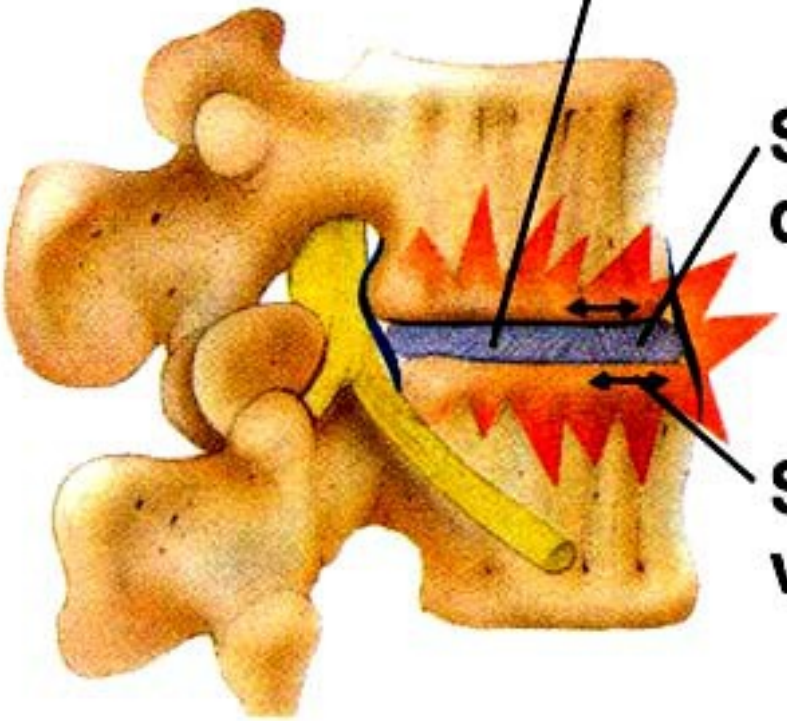
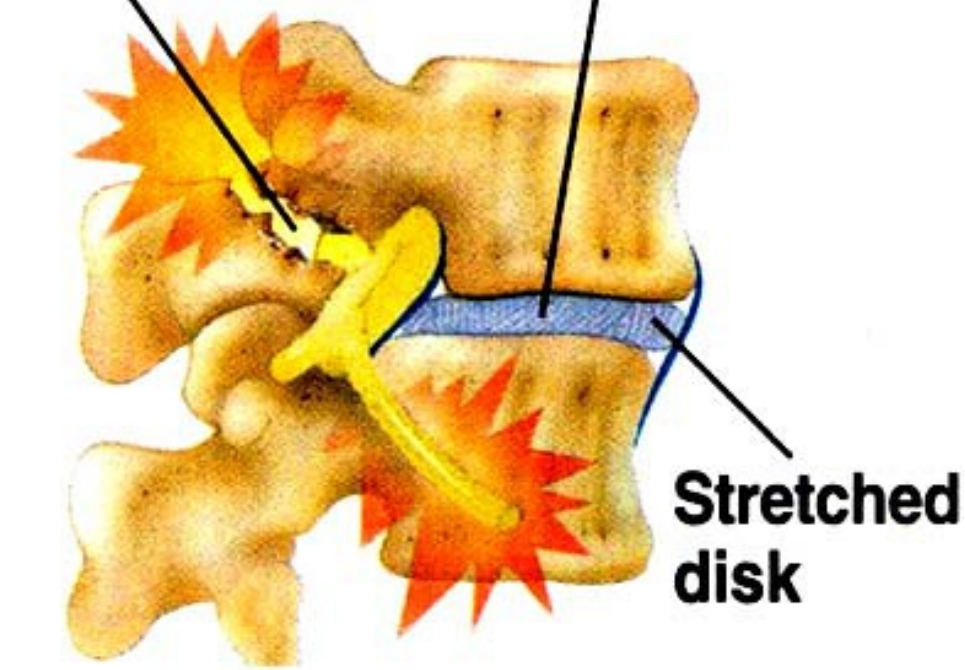




Instability. As a disk stretches, the vertebrae slip back and forth. This can put pressure on the annulus.



Spondylolisthesis. A crack (stress fracture) can develop in a vertebra. This may put pressure on the annulus, stretch the disk, and irritate nerves.

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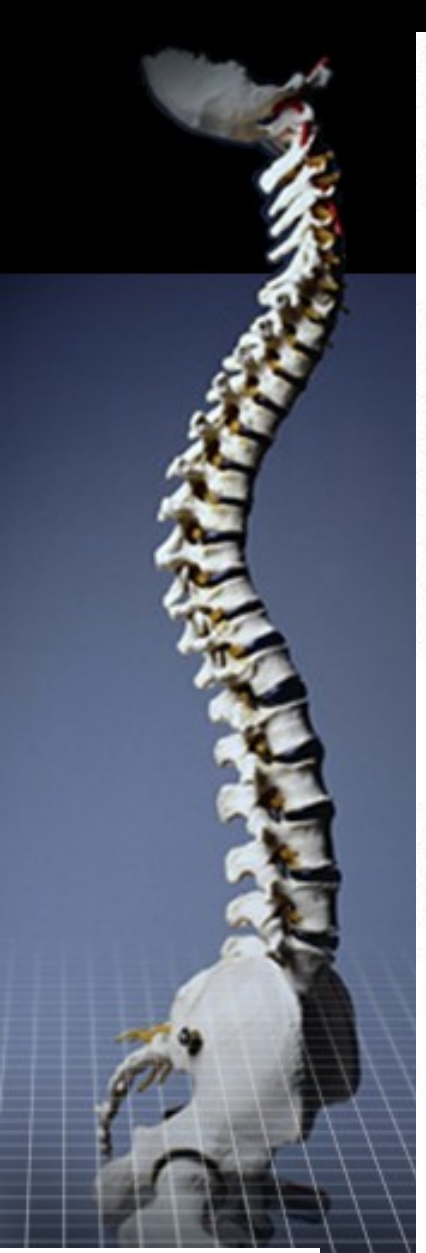
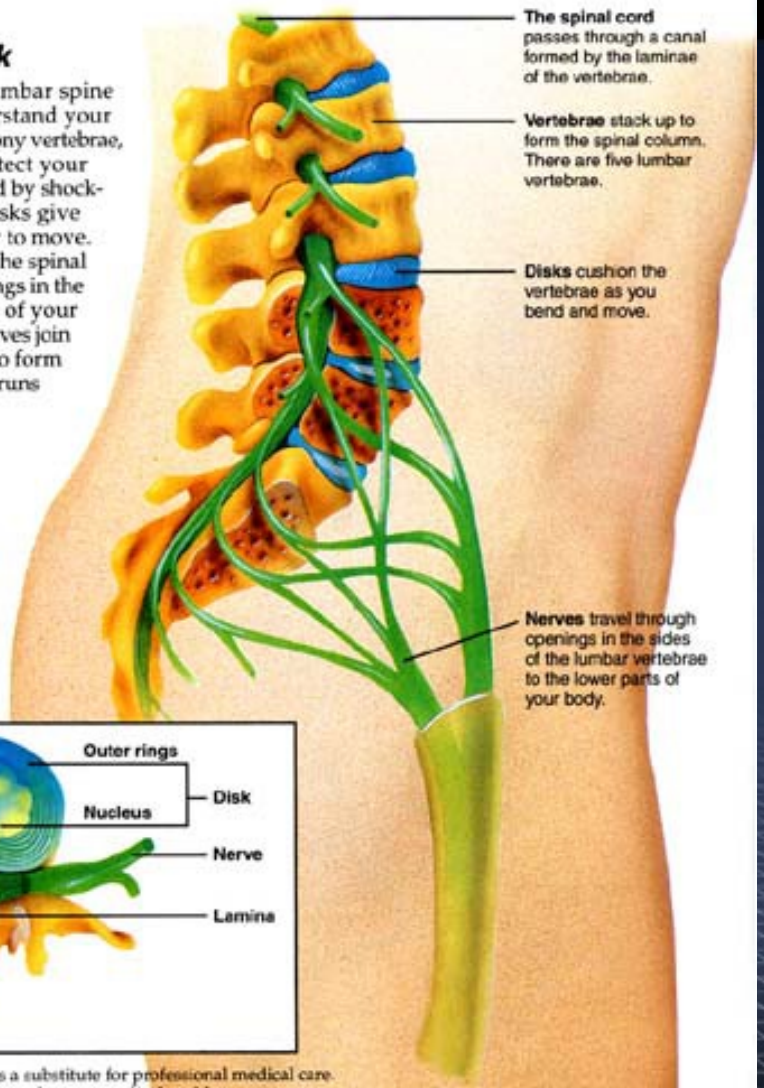


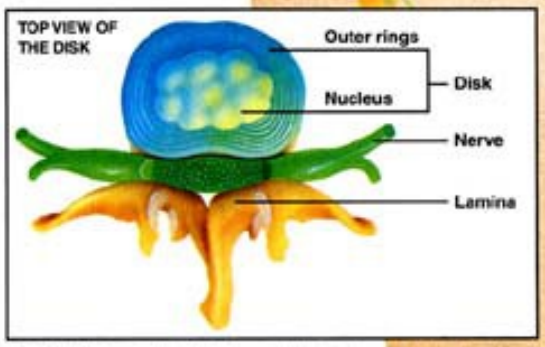
Persistent pain in your low back or leg caused by spinal disk problems can be frustrating because it limits your ability to move and do the things you enjoy. To manage your low back **(lumbar)** problem, you may have followed your doctor's conservative treatment plan—rest, medication, physical therapy, and exercise. But, despite your best efforts, the pain won't go away. Surgery can help relieve your pain by treating your disk problem.

Your Lower Back

Knowing about your lumbar spine makes it easier to understand your low back problem. The bony vertebrae, which encircle and protect your spinal cord, are separated by shock-absorbing disks. The disks give your spine the flexibility to move. Nerves branching from the spinal cord pass through openings in the vertebrae to other parts of your body. Several of these nerves join at the base of the spine to form the sciatic nerve, which runs down your leg.



Each disk has a spongy center (nucleus) surrounded by tough outer rings. Wear and tear, poor posture, and incorrect body movements can weaken the disk.



This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.

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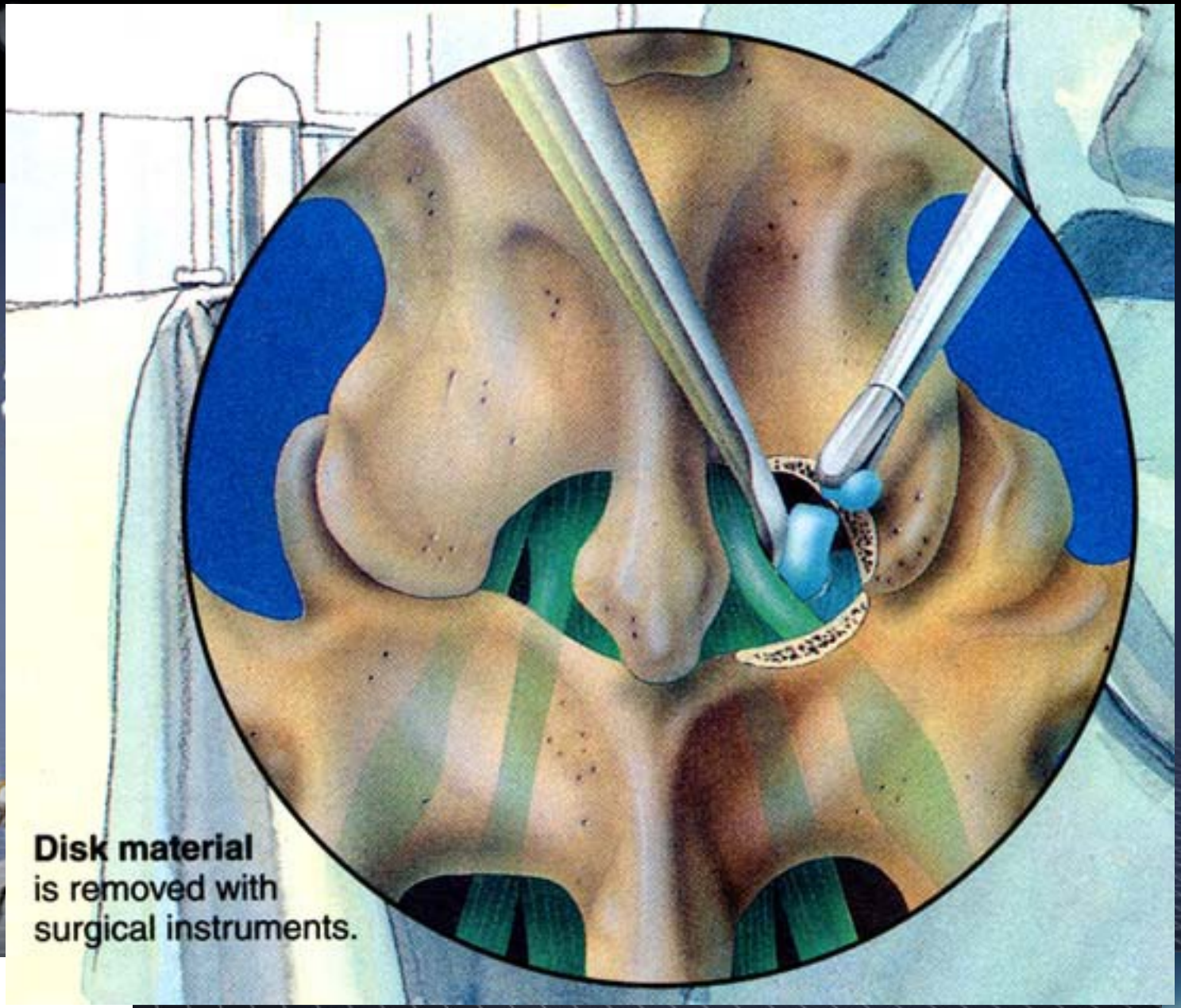
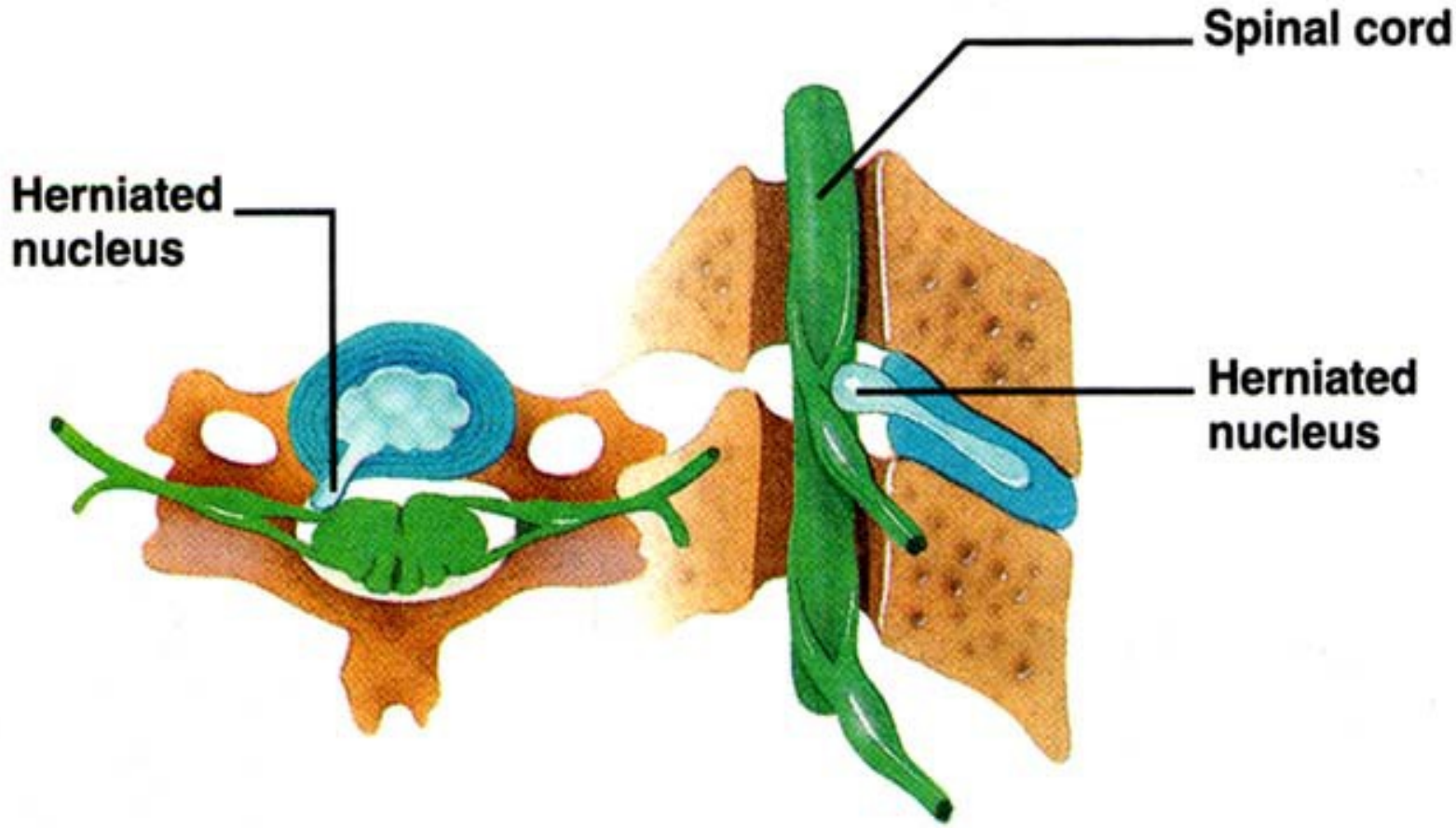

Disk material
is removed with
surgical instruments.



With a herniated disk, the annulus tears or the nucleus bulges through the annulus. The herniated portion of the disk may press on a nearby nerve, resulting in neck pain or pain or weakness in your arm.

Spinal Stenosis

- Arthritic narrowing of the spinal canal
- Facet hypertophy
- Degenerative disc disease

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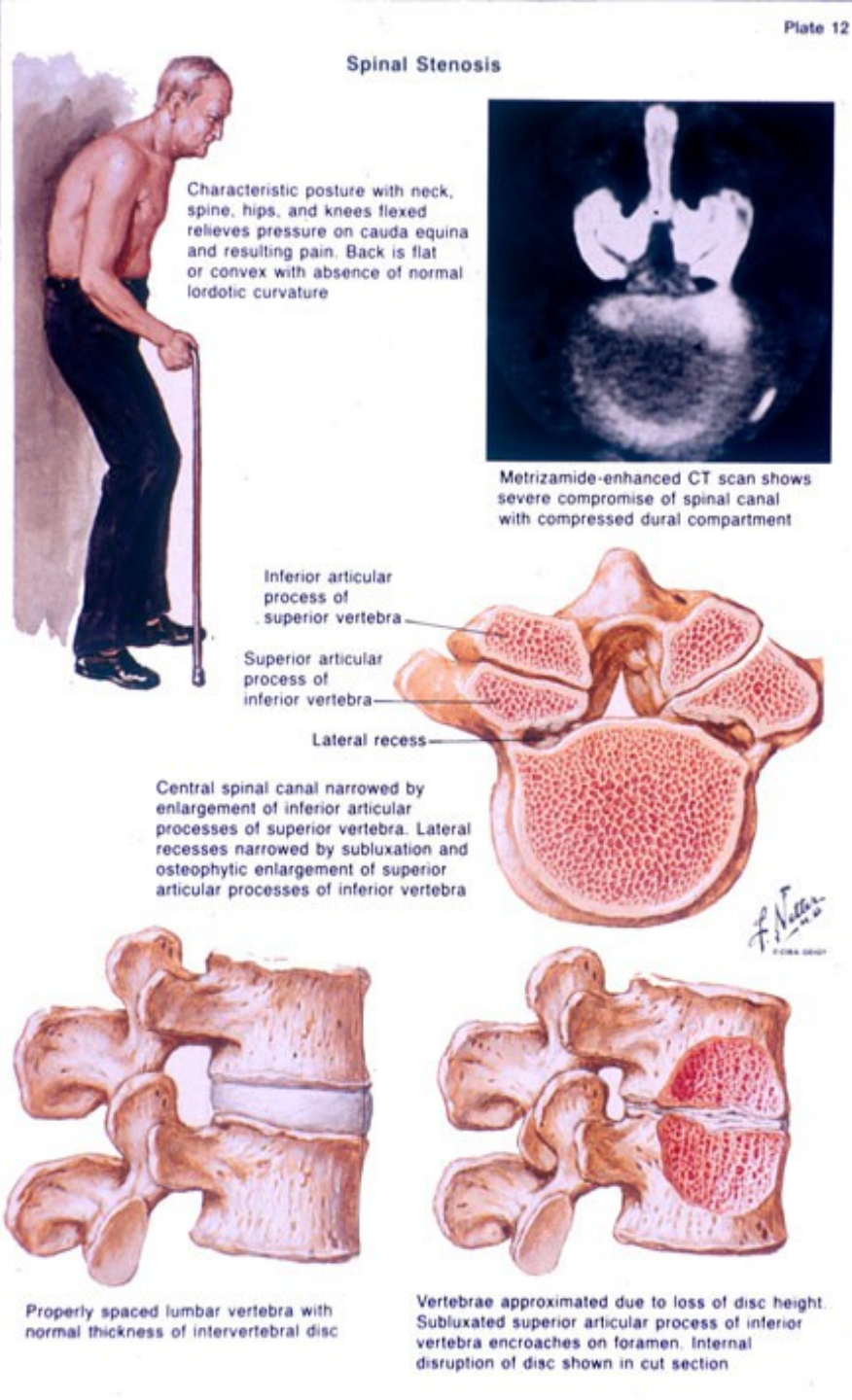
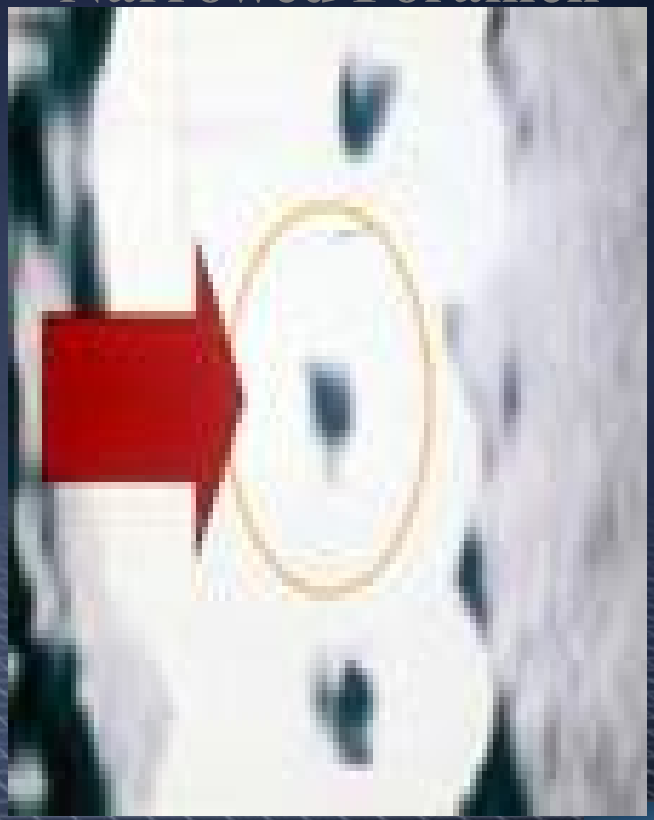


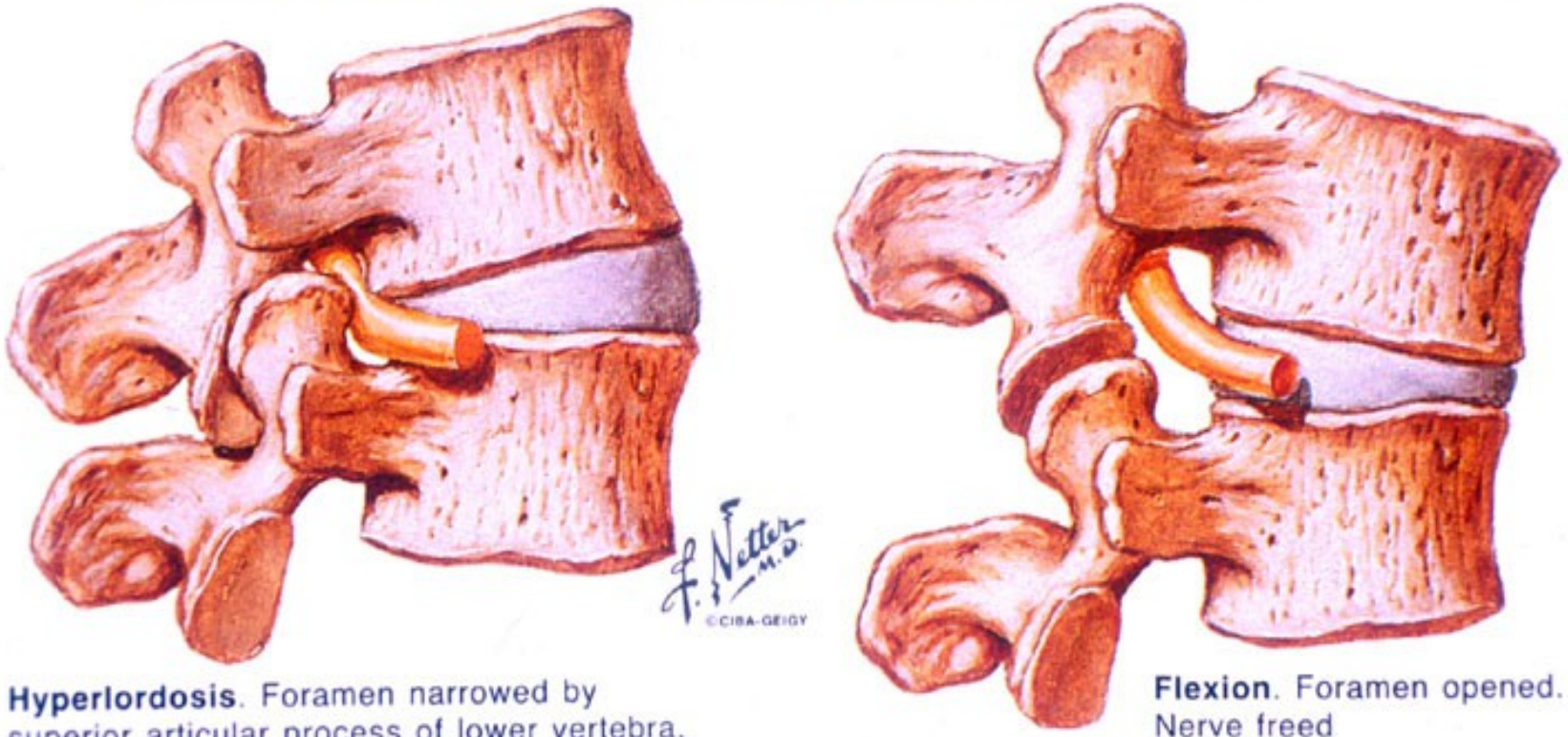
Foraminal Stenosis

Normal Foramen

Narrowed Foramen



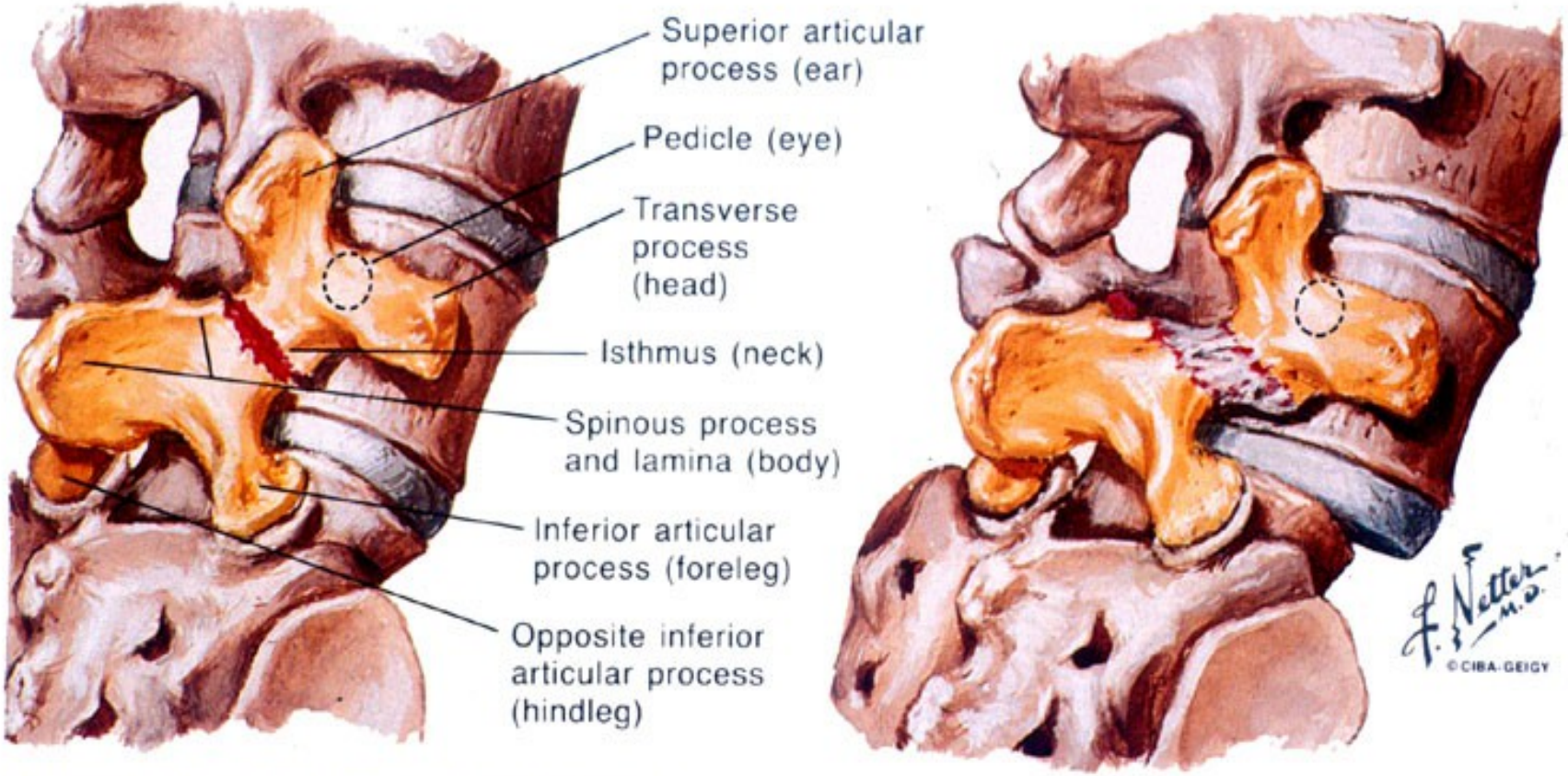
Effects of Lumbar Hyperlordosis and Flexion on Spinal Nerve Roots



Hyperlordosis. Foramen narrowed by superior articular process of lower vertebra. Nerve compressed

Flexion. Foramen opened. Nerve freed

Spondylolysis and Spondylolisthesis



Posterior oblique radiographic view mimics shape of Scotty dog. In simple spondylolysis, dog appears to be wearing collar.

In spondylolisthesis, "Scotty dog" appears decapitated

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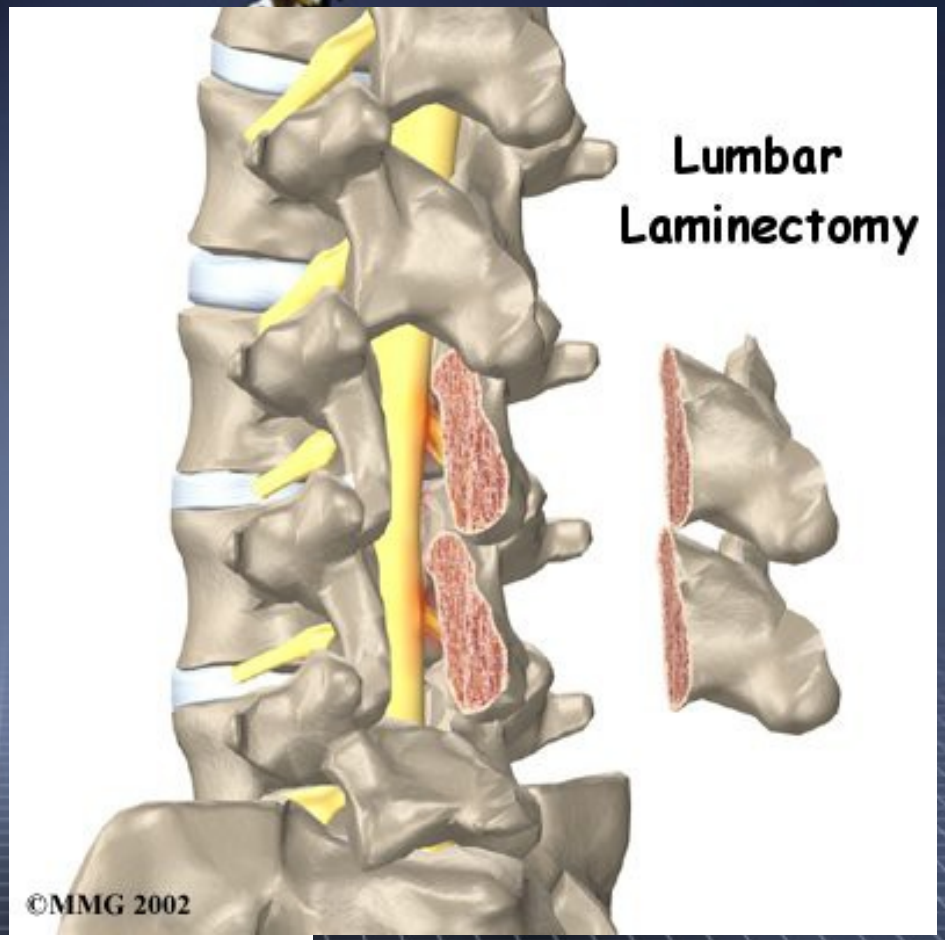
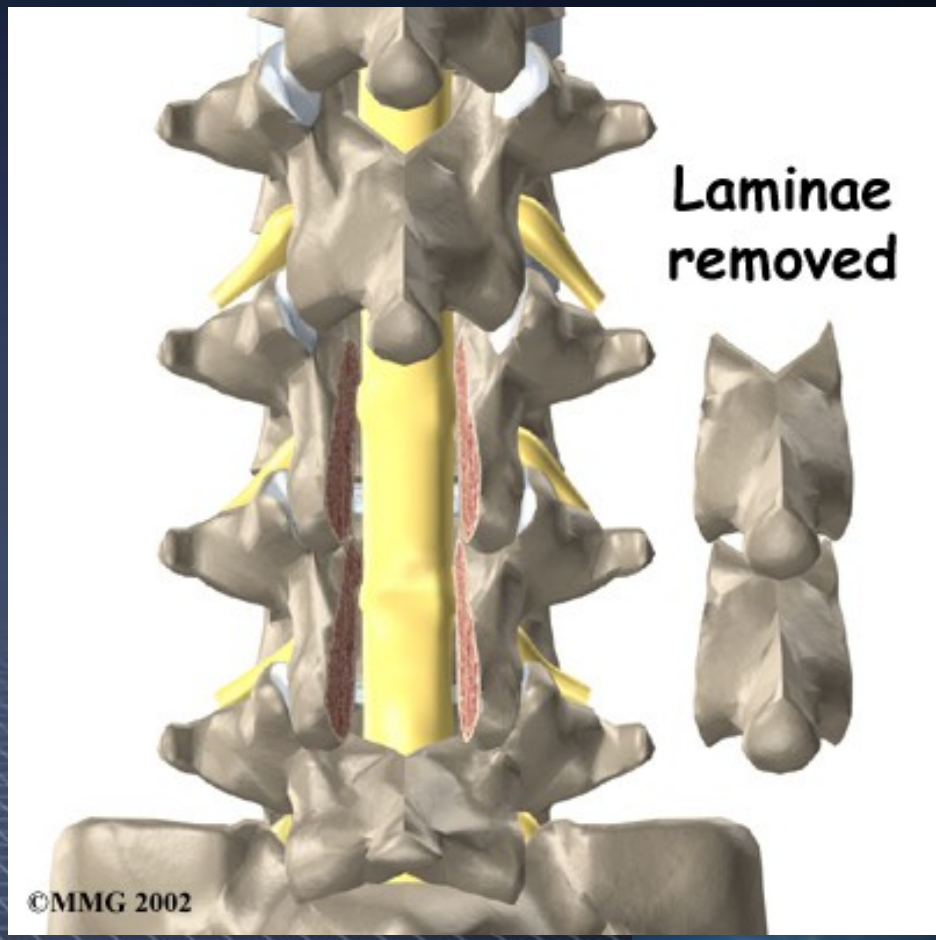
Laminectomy





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Spondylolisthesis

Forward translation of one vertebral body with respect to another

Most common in lower lumbar spine

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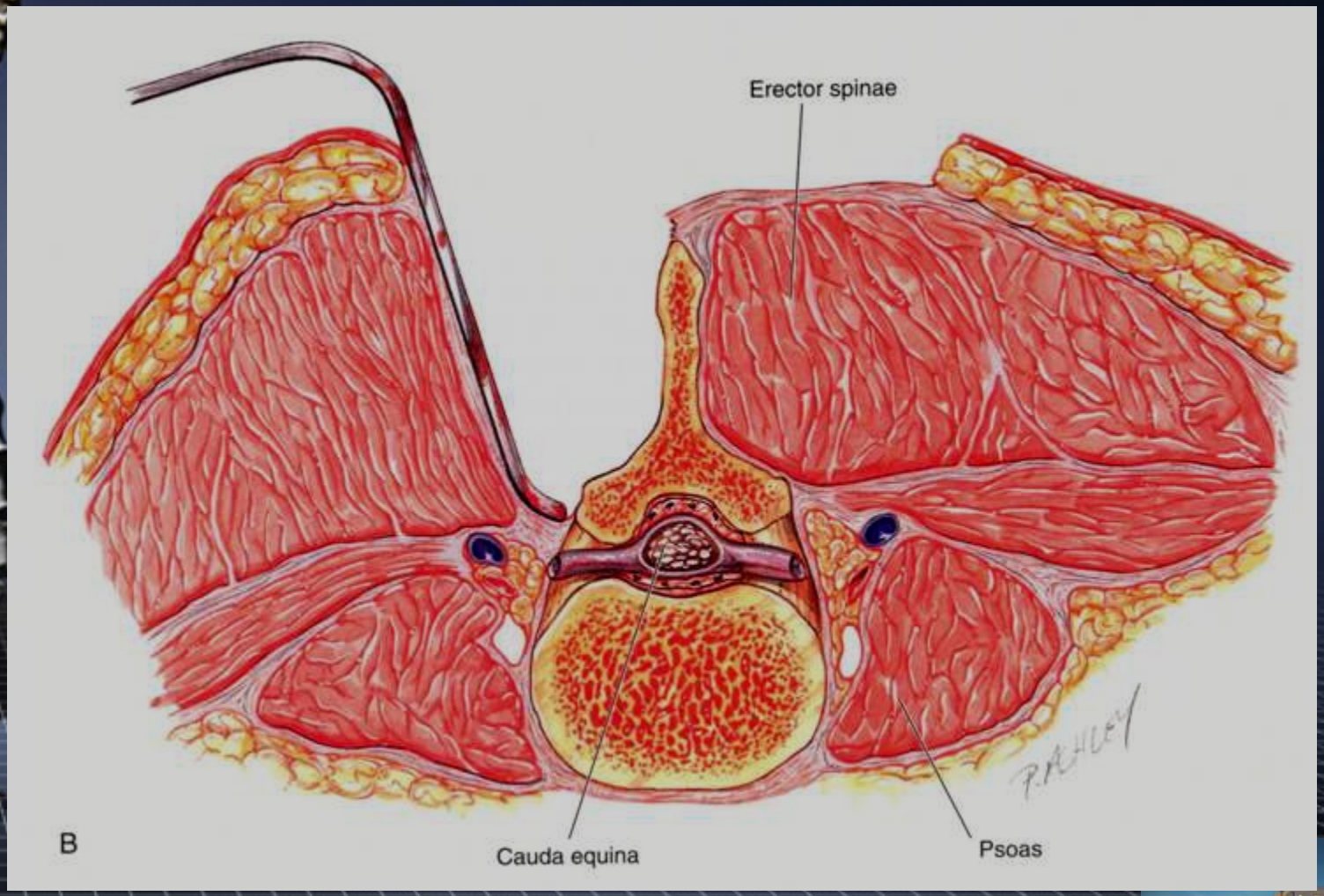

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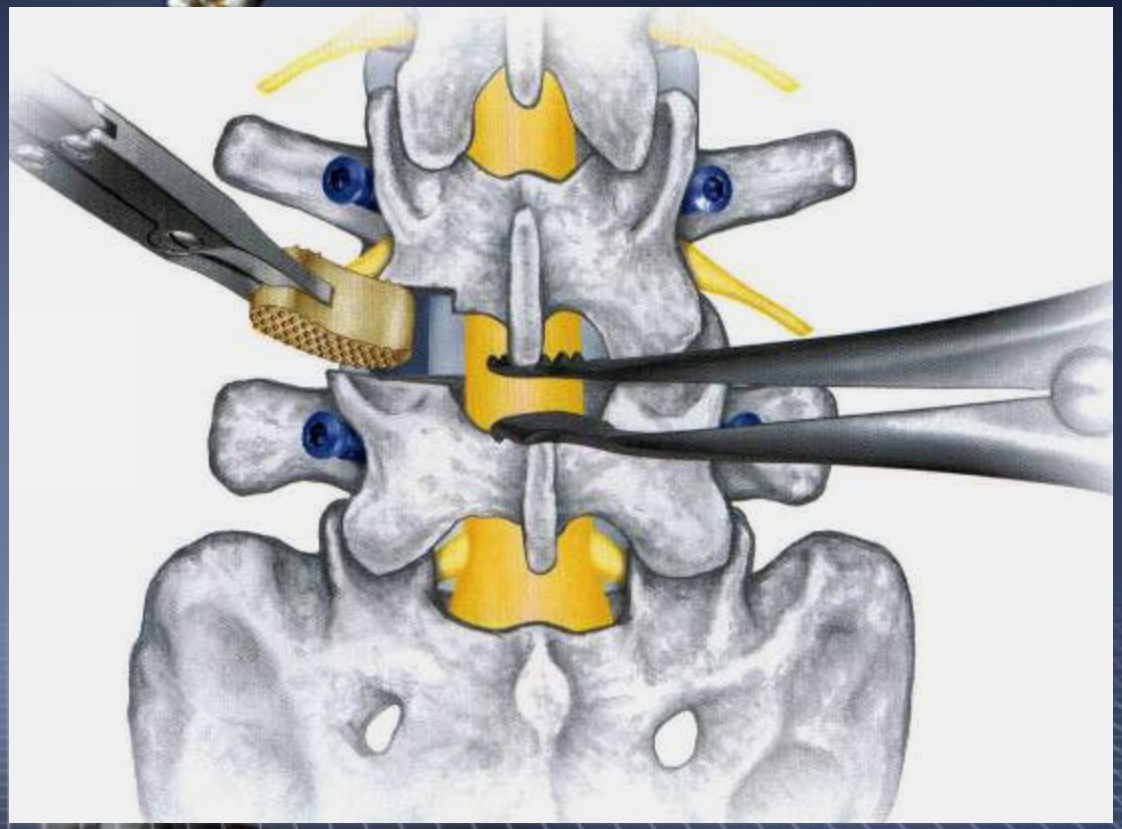
Surgery

- Goals
  - Decompression of neural elements
  - Stabilization of unstable spinal levels
  - Correction of deformity



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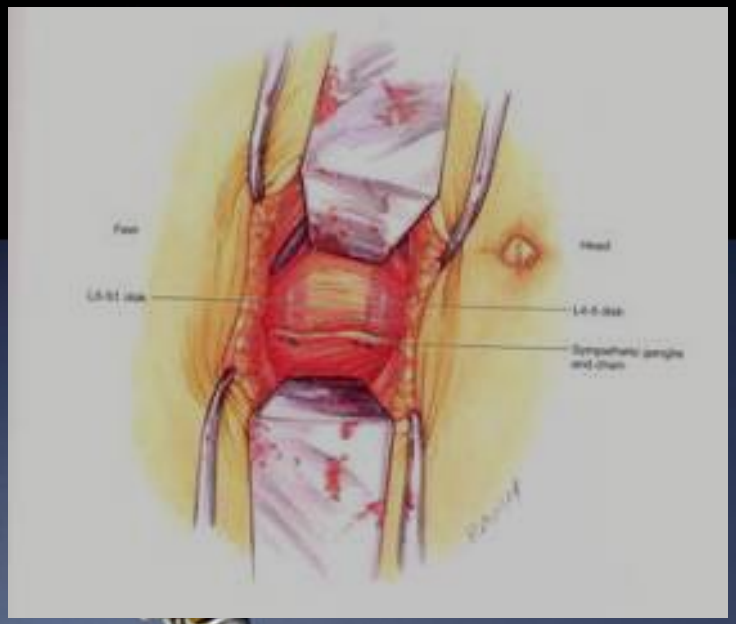
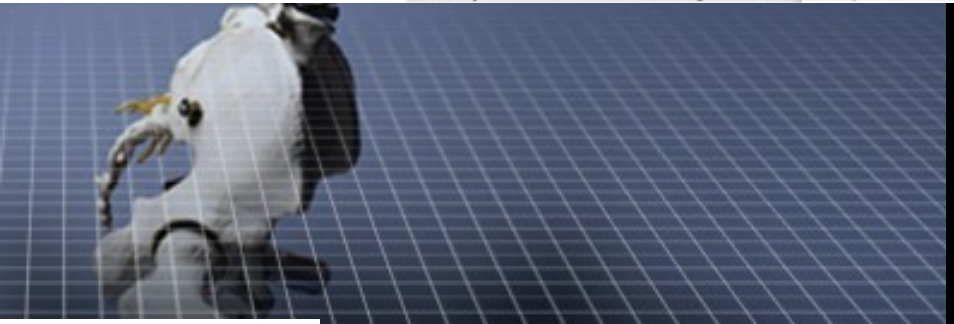

Foot
Head
L5-S1 disk
L4-5 disk
Sympathetic ganglia and chain



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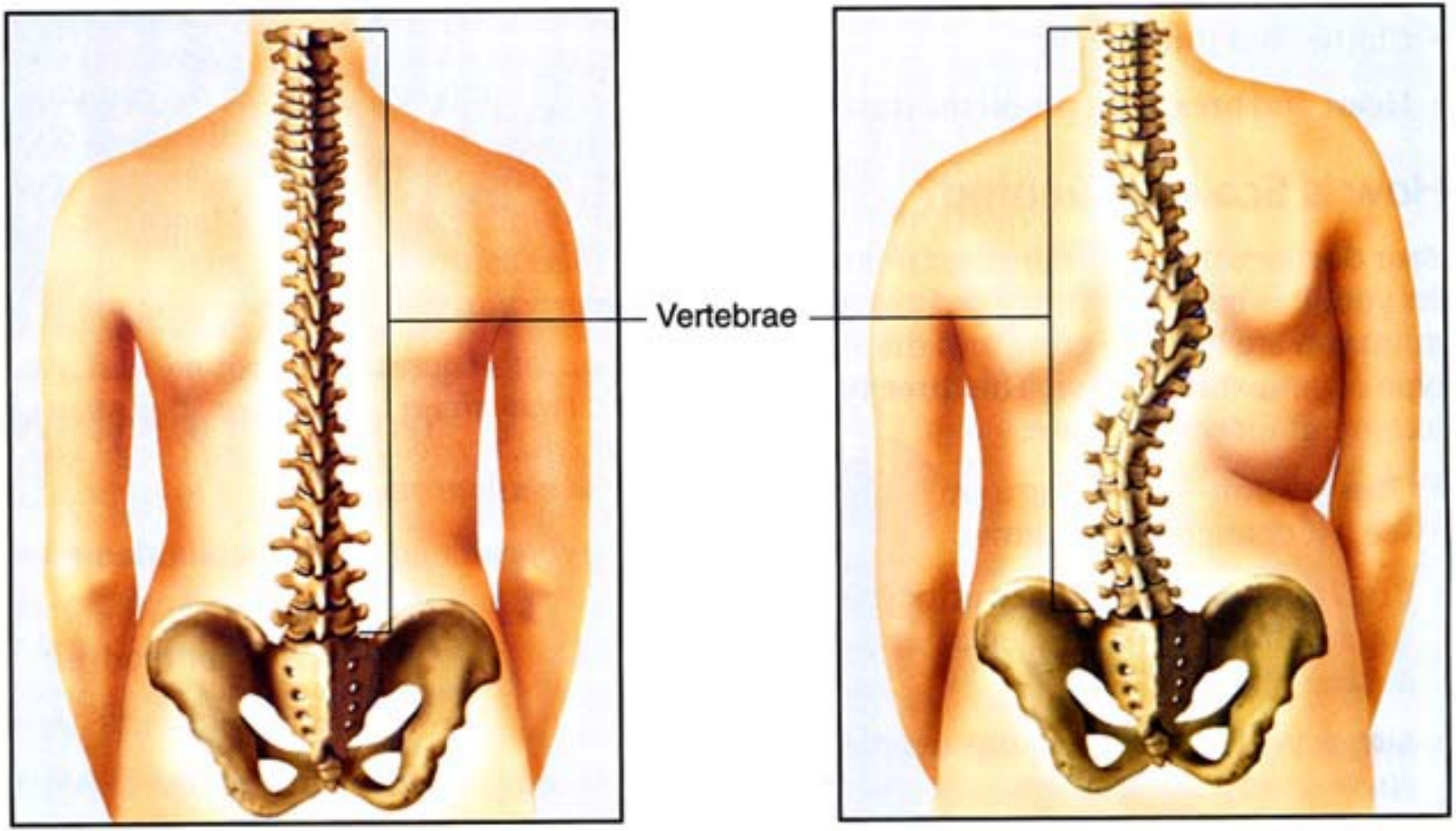

A Healthy Spine

A Spine with Scoliosis

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Know your surgeon

OR

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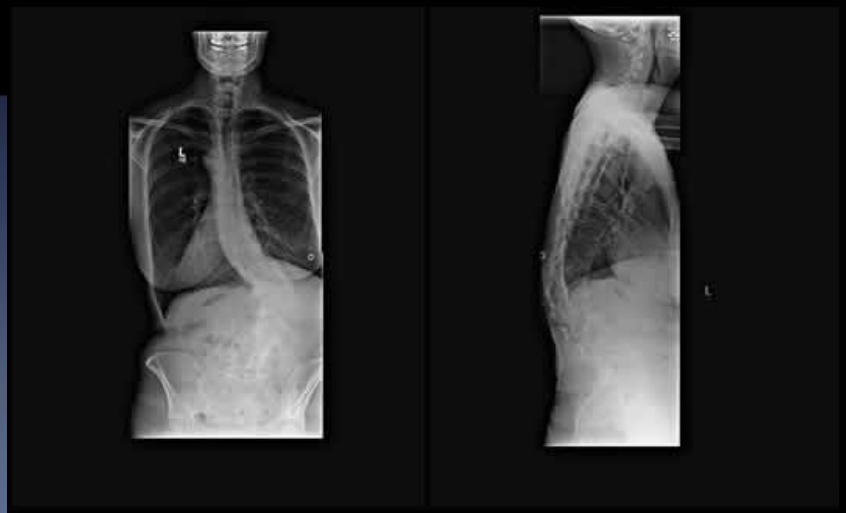
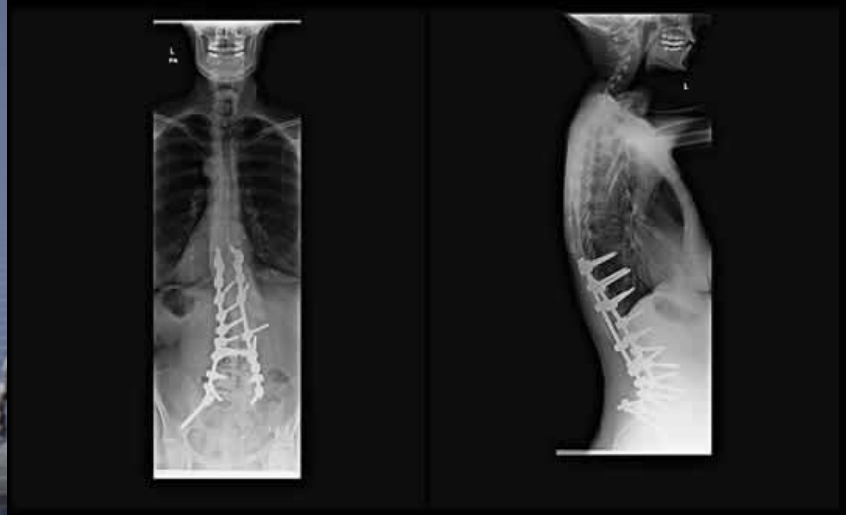
REMEMBER

- “The technically perfect procedure performed on a patient without appropriate indication is a failure”

  Dr. Richard Fessler

- Selection, Selection, Selection

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Case 1

- 62 y/o Caucasian female
- Comorbidities
  - HTN, COPD, Tobacco abuse, MVP, CAD
- Presenting symptoms
  - Debilitating lower back pain
  - Bilateral leg pain: right > left
  - Claudication
- Diagnostic findings
  - CT myelogram showed severe lumbar stenosis L2-L5, lateral listhesis
  - MRI showed DDD and L2-L5 stenosis
  - Flexion & extension X-rays show exacerbation of spondylolithesis
- No previous lower back surgery
  - PE: 5/5 motor bilaterally in LE muscle groups, decreased sensation in left L5 dermatome, and reflexes 1+ bilaterally.

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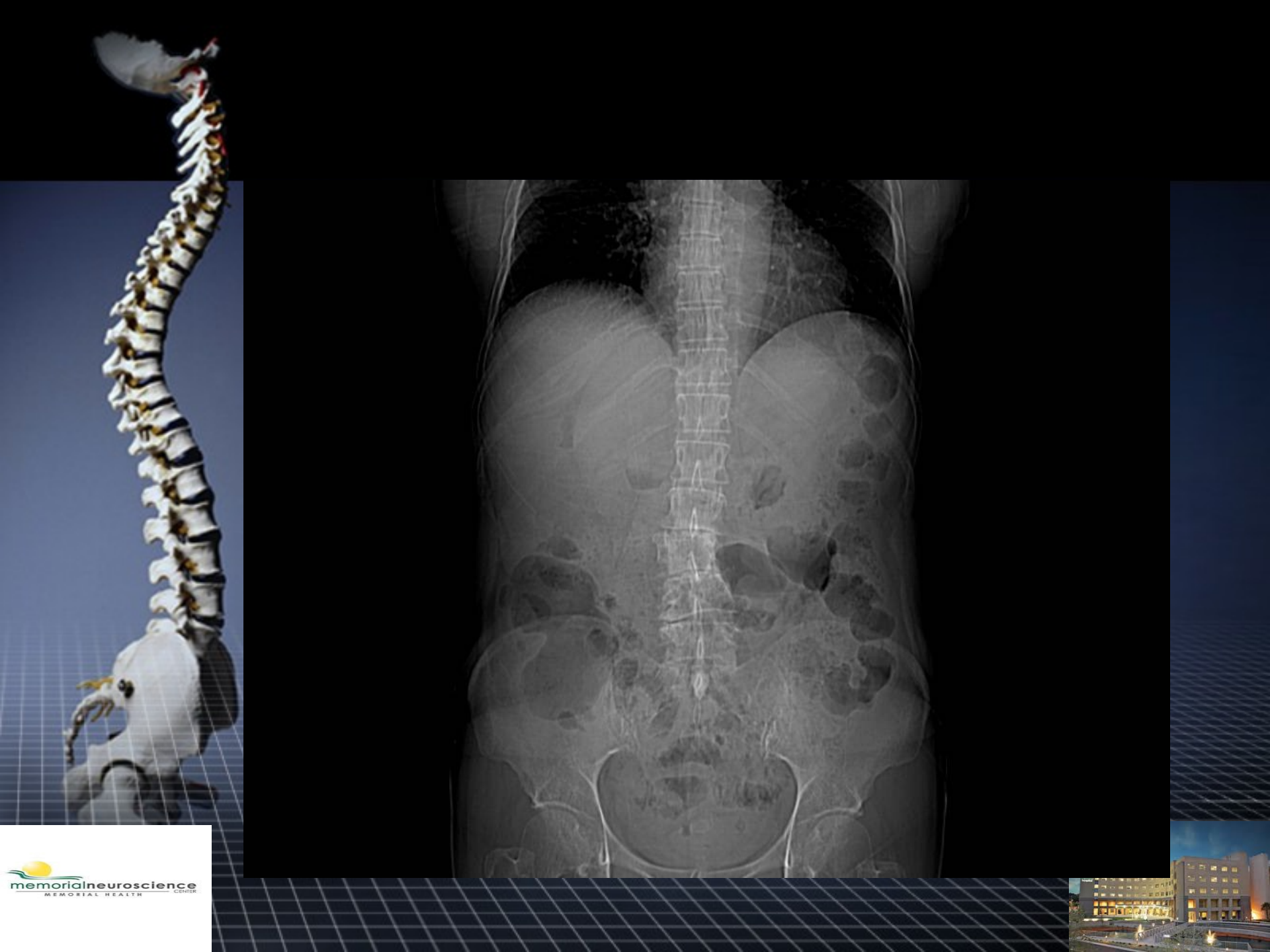
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Surgical Options?

- Posterior decompression
- Posterior decompression and TLIFs and instrumentation
- Anterior
- Anterior and posterior
- Lateral interbody standalone
- Lateral interbody and posterior decompression and instrumentation
- Lateral interbody and percutaneous instrumentation
- Other options

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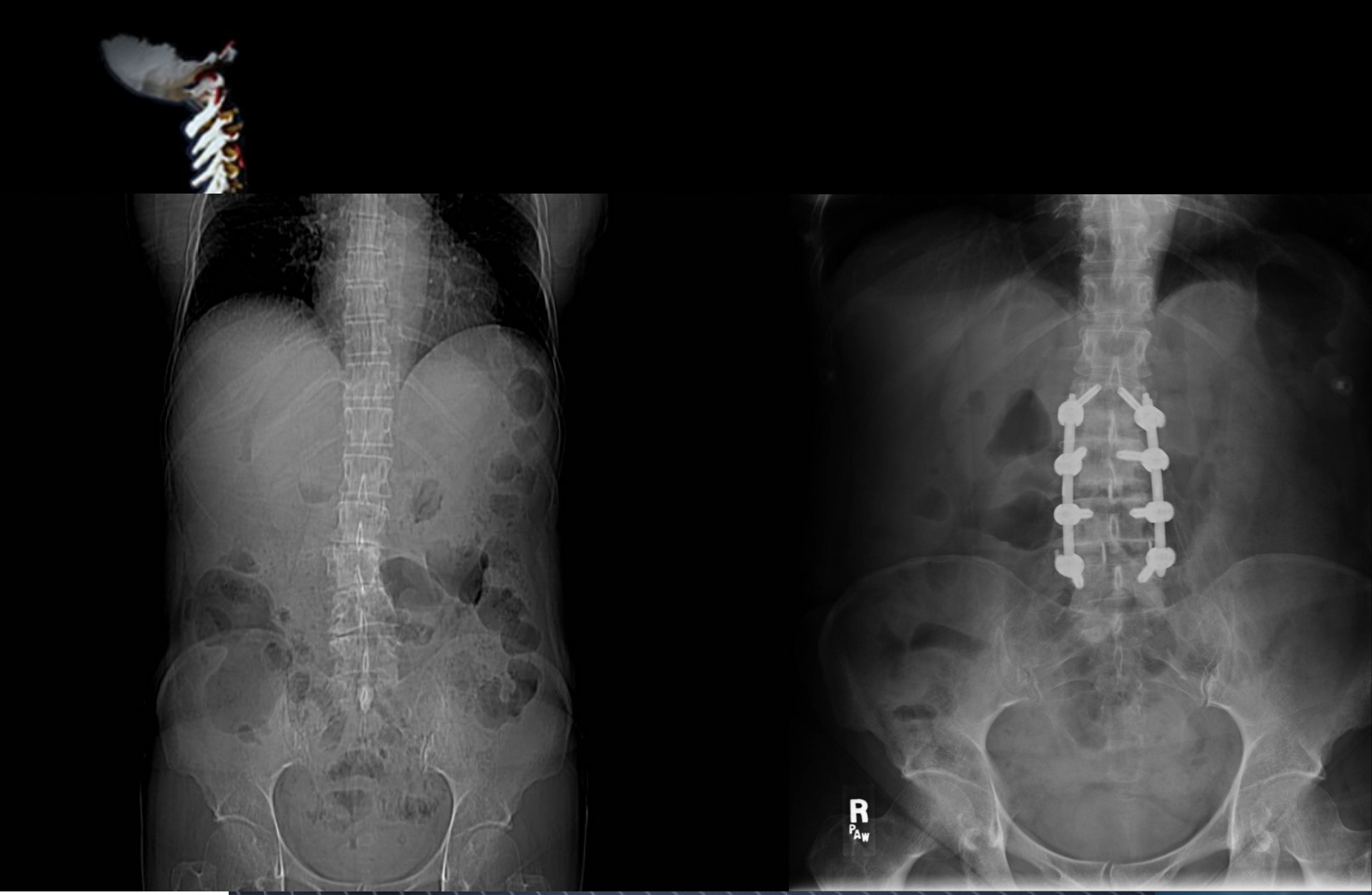

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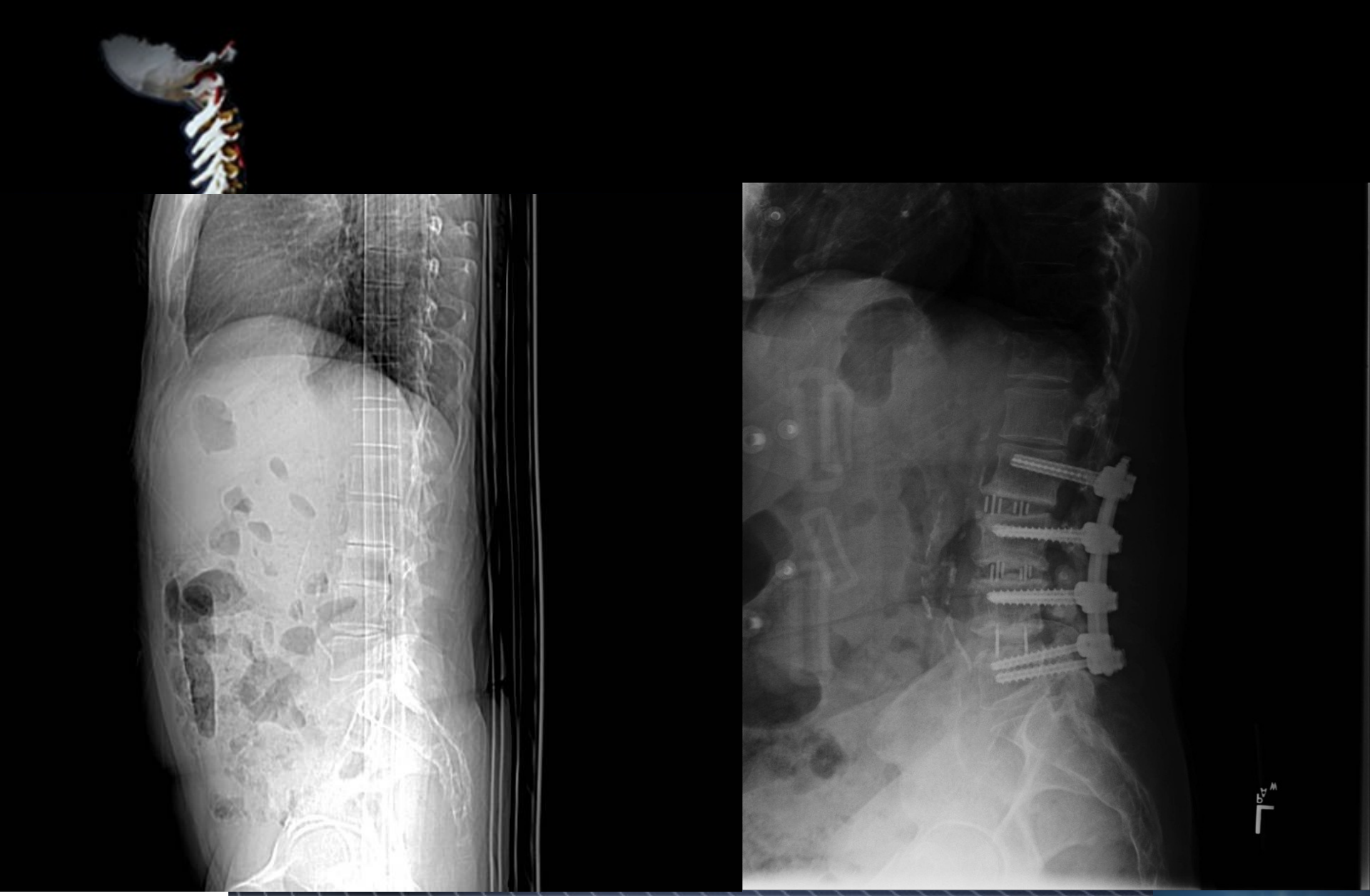

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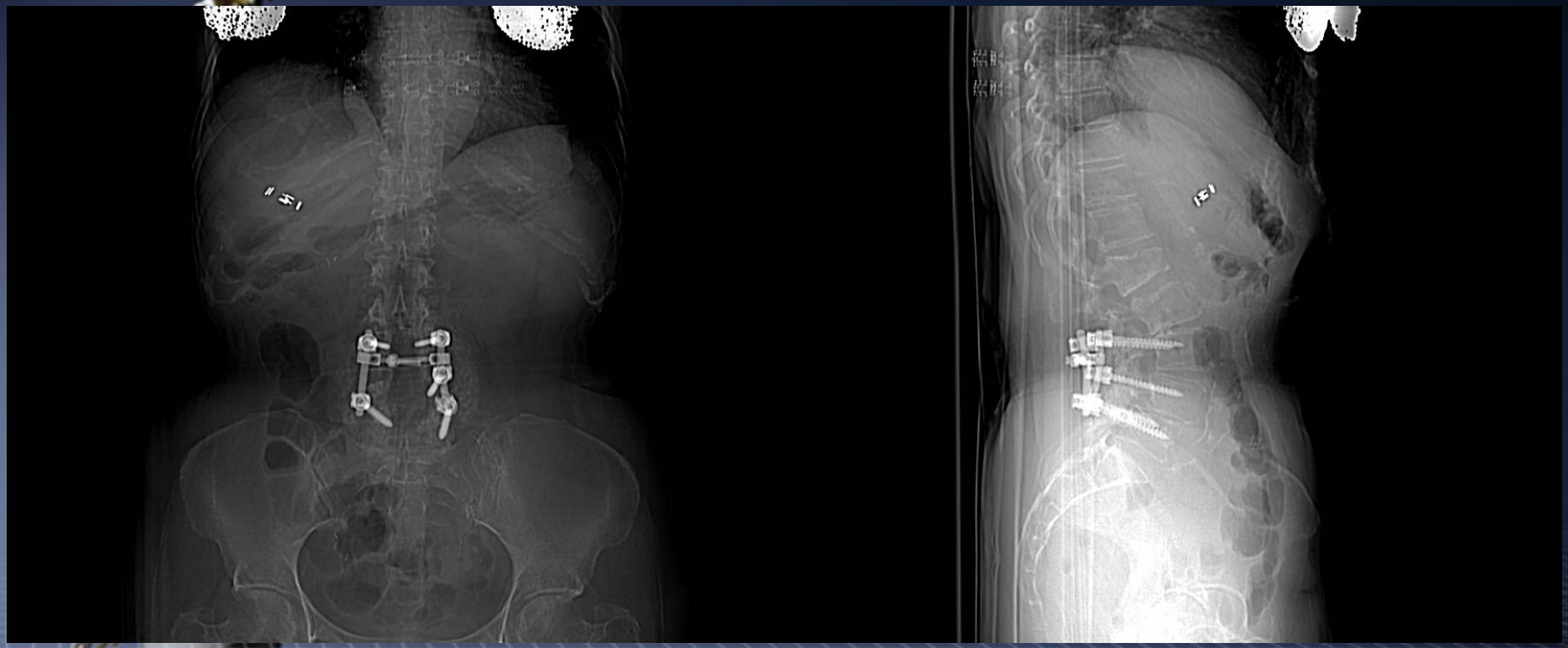
Case 2

- **73 y/o Caucasian female**
- **Comorbidities**
  - HTN, Hyperlipidemia, GERD, Arthritis
- **Presenting symptoms**
  - Fall with increased back pain and bilateral leg pain
  - Leg pain located in inner thighs
- **Diagnostic findings**
  - X-rays of L-spine: L1 vertebral body compression fx with 30% loss of volume, lumbar instrumentation L3-L5
  - CT of L-spine: Pedicl fxs at L2, subacute to chronic, Chronic L1 and L5 compression fxs
  - MRI of L-spine: Chronic compression fxs fo L1 & L5, Lumbar decompression L3-L5, Grade 1 anterior spondylolisthesis L4 on L5
- **Other interesting H&P attributes**
  - Previous Lumbar decompression and fusion L3-L5



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Case 3

- **59 y/o Caucasian female**
- **Comorbidities**
  - Depression, HTN, Hyperlipidemia, and Memory problems
- **Presenting symptoms**
- Debilitating back pain for nine months
  - Paraesthesias in the lower extremities in L3 & L4 dermatomes bilaterally
  - Pain is worse with activity such as walking or standing, max distance 10-20 ft
- **Diagnostic findings**
  - MRI showed degenerative spondylolisthesis at L3/4 & L4/5 with broad based disc protrusion, moderate central canal stenosis and L5/S1 bilateral foraminal stenosis
  - CT of T-spine Dextroscoliosis
  - CT of L-spine : levoscoliosis with anterolisthesis L4/5 and L3/4 with retrolisthesis L5/S1, central and foraminal stenosis L3-S1.
  - X-rays: 36 inch show 24 degree rotatory levoscolisosi of L-spine centered at L2

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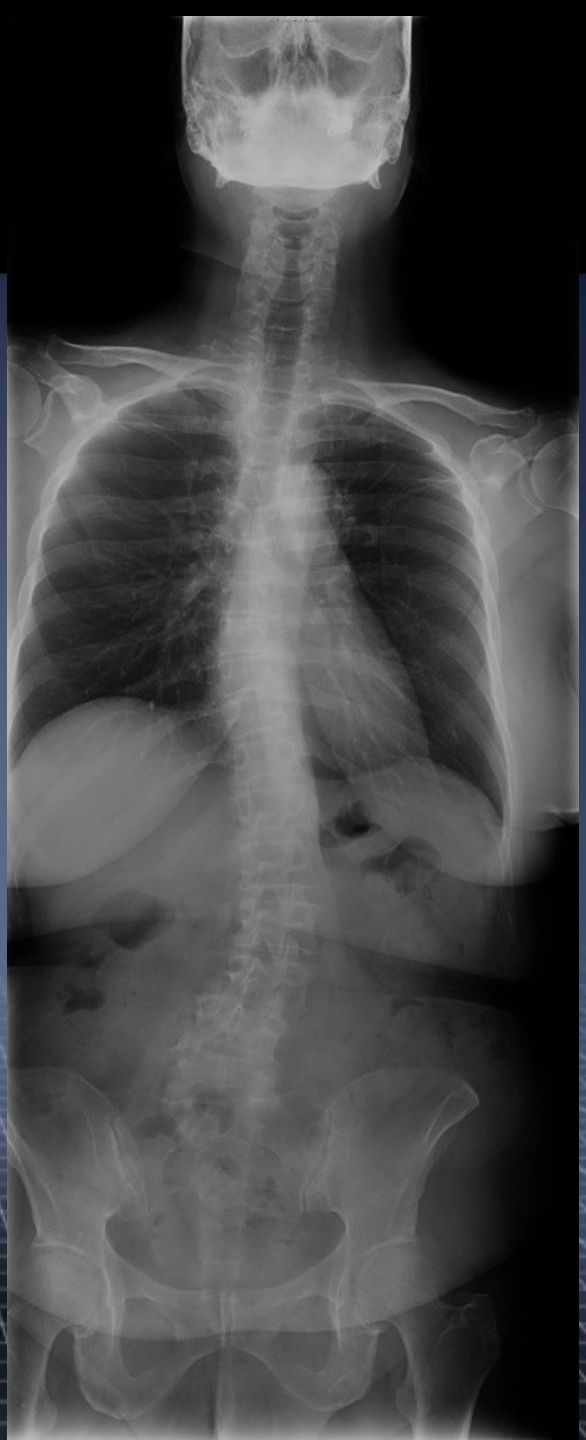

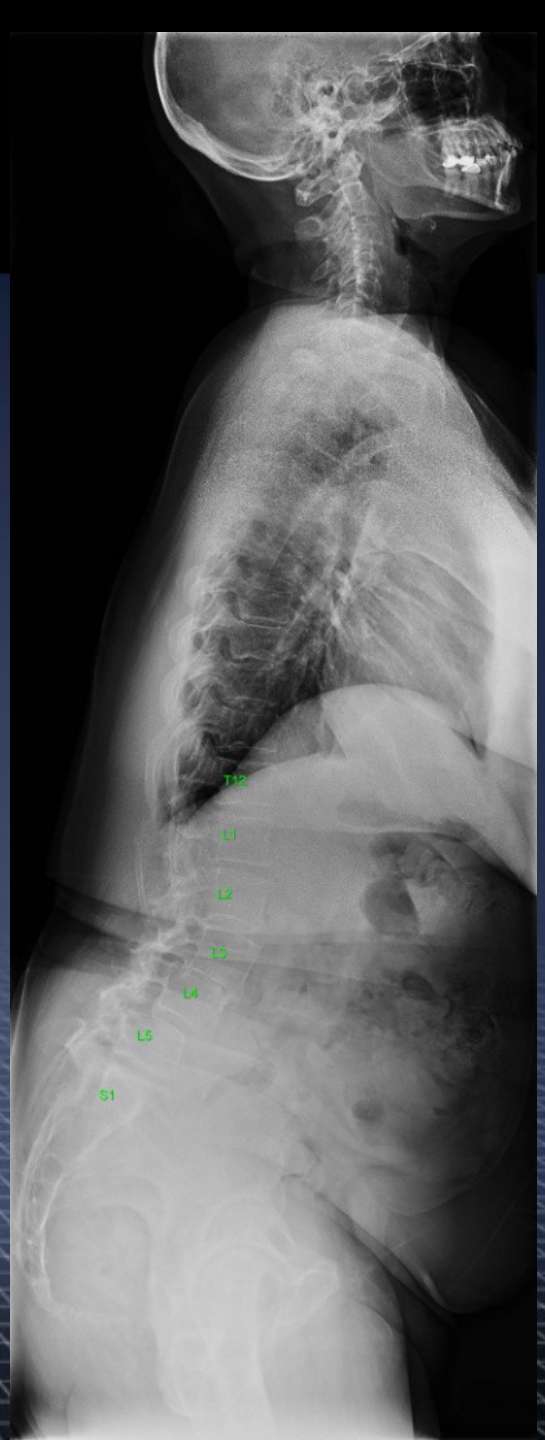

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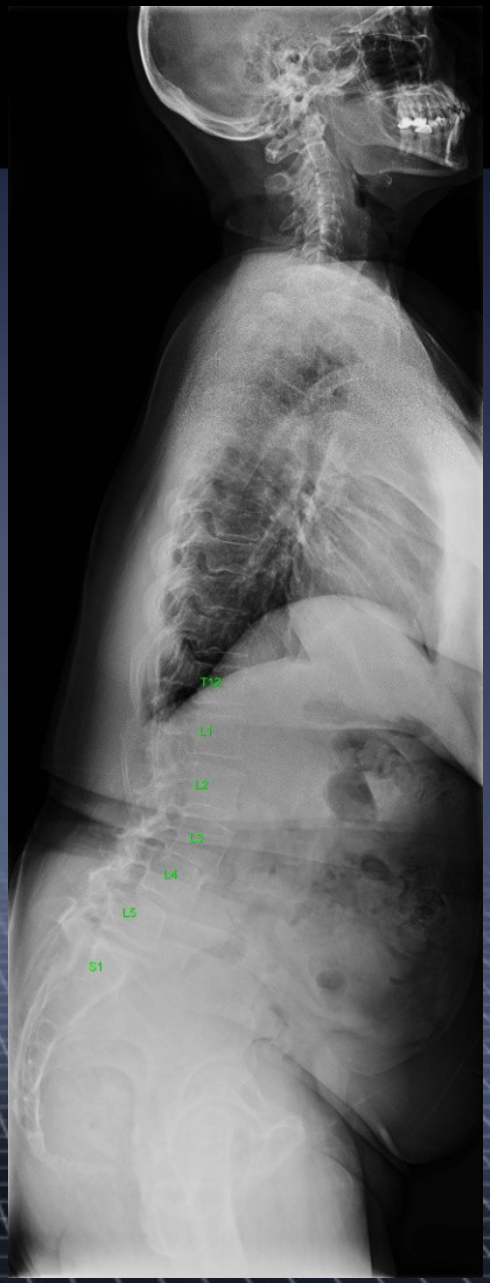

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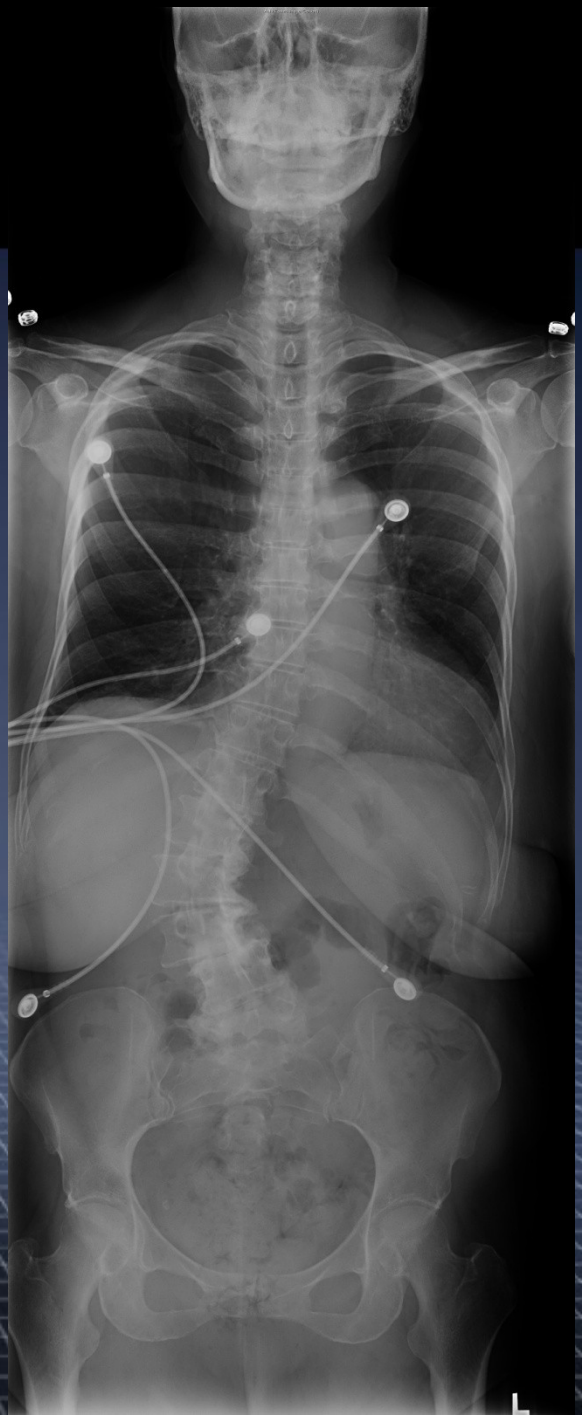
Case 4

- 63 y/o female
- Living in a convalescent home and wheelchair bound secondary to back pain
- PMH: Diabetes, tobacco abuse, CAD, scoliosis
- Previous L3-L4 laminectomies with temporary relief
- Exam: 4+/5 LE strength throughout, peripheral neuropathy



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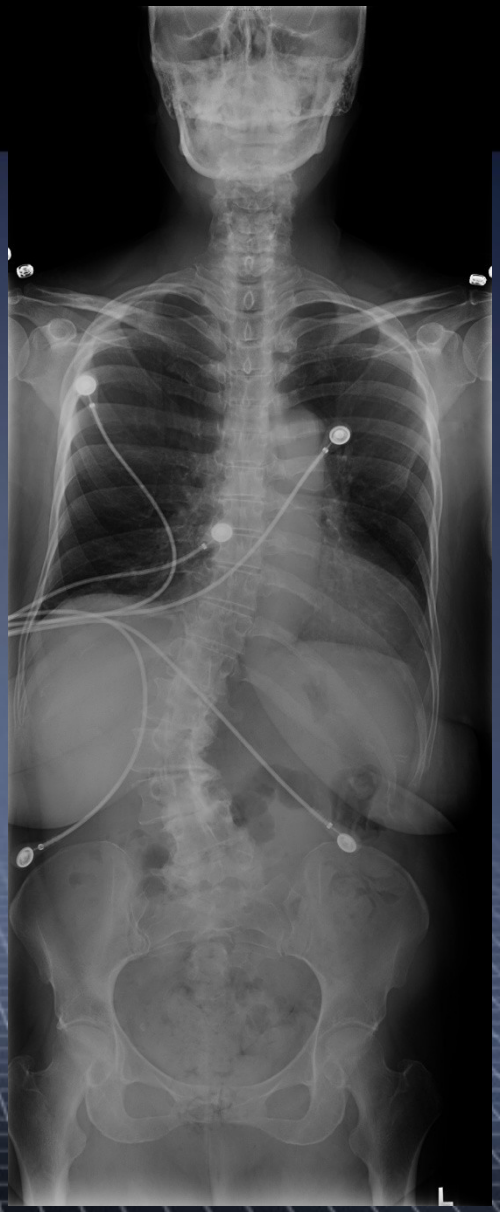
Surgical Options?

- Where to start?
- Where to stop?
- Posterior alone?
- Anterior/Posterior?
- Anterior/Lateral/Posterior?
- MIS Option?



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Chin on Chest Cervical Deformity

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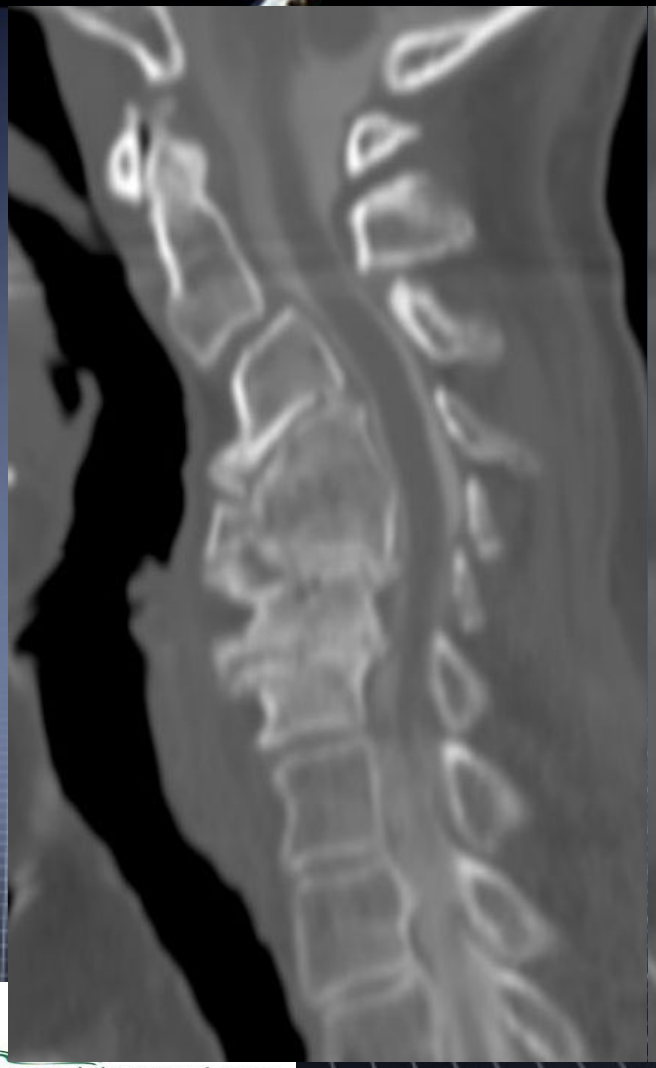

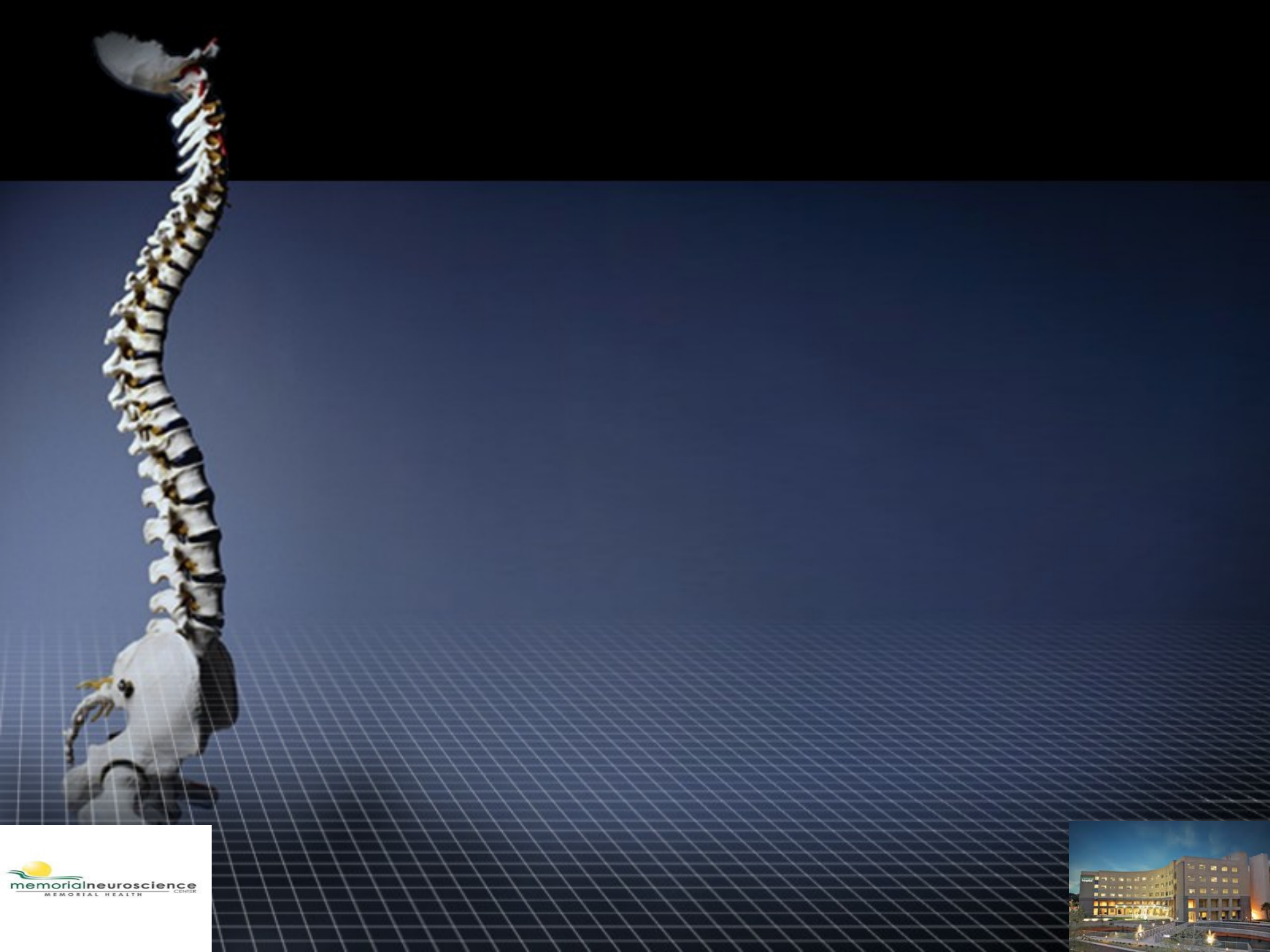
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