

Spine Disorders

Diagnosis and Treatment

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Case 1

25 yo female s/p MVA 6 months prior to the visit: she was at a stop light when she was rear-ended by a pickup at about 25 mph. Did not get to ED but the day after noted neck pain and back pain. The back pain resolved after chiropractic Rx. The neck pain persists, especially with movement.



Objectives

1. Prevalence and outcome
2. Anatomy of the spine
3. Common disorders of the spine
4. Diagnostic tools
5. Treatment options
6. Red flags



Prevalence

- Neck and back pain are the leading MSK disorders that contribute to impairment and disability
- Overall affecting 100 million people in the US: 10-20%
- Lifetime prevalence at least 80%



Natural History of Back Pain

- Acute pain usually subsides spontaneously over time
- 50% resolve in 1-2 weeks
- 90% resolve in 6-12 weeks
- 85% recur in 1-2 years
- 10% become chronic (>6 weeks): 2nd most common reason for PCP office visits



Common Spine Disorders

- **Muscle/ligament strain**
- **Herniated Disc**
- **Degenerative spine disorders**
- **Spinal stenosis**
- **Spondylolisthesis**
- **Vertebral fractures**
- **Spine infections**
- **spine tumors**



Evaluation of Neck and Back Pain: History

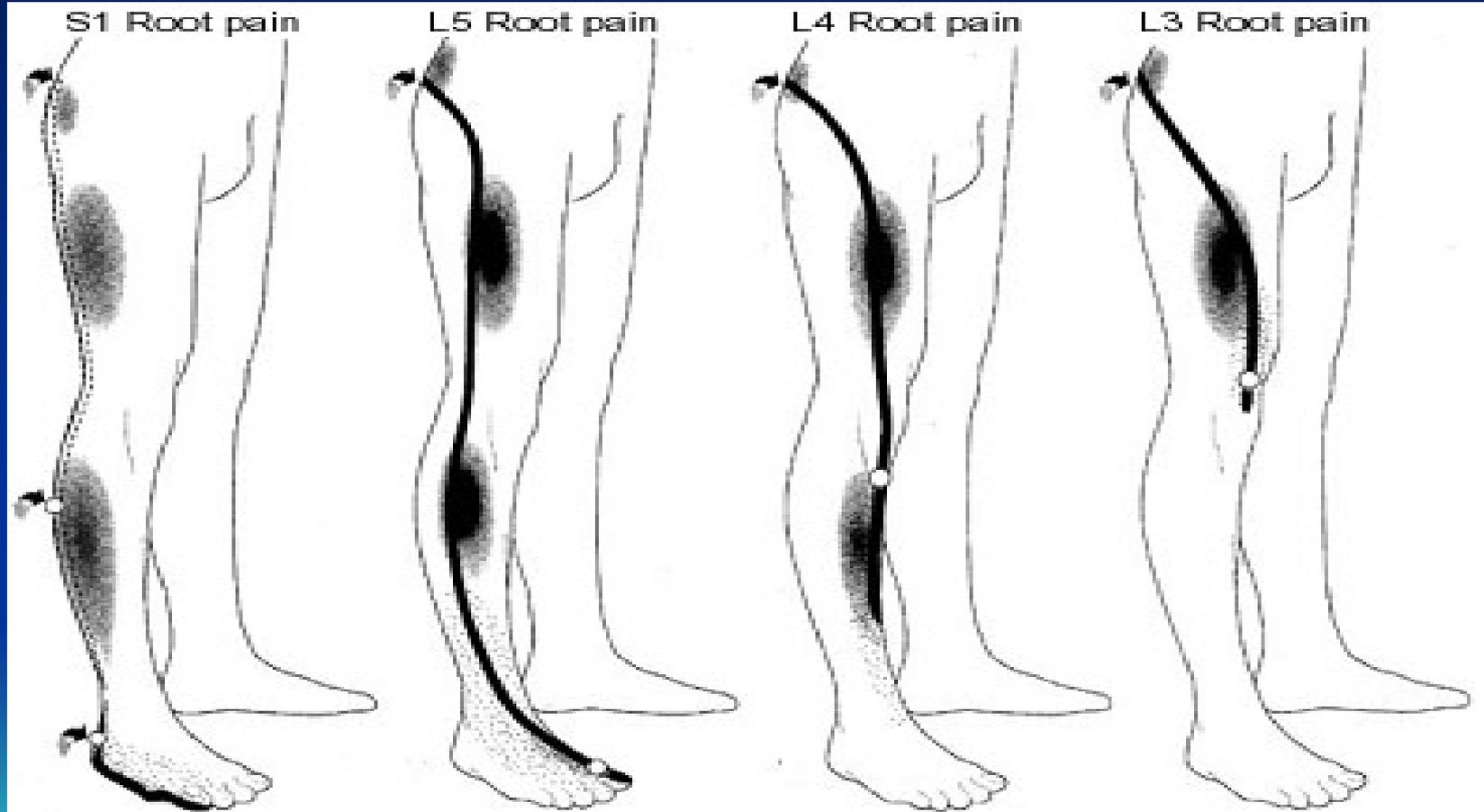
- **Cancer risk factors: age +50, h/o cancer, unexplained weight loss, no improvement after 4-6 weeks**
 - **Infection risk: IV drug use, UTI, local injection, etc.**
 - **Cauda Equina syndrome: urinary retention or incontinence, bowel incontinence, sexual dysfunction**
 - **Neurological involvement: saddle anesthesia, sciatica, sensory or motor deficits, positive SLR test**
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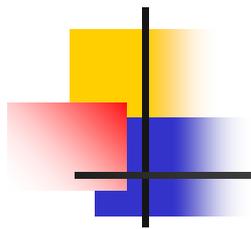
Evaluation of Neck and Back Pain: Physical Examination

- Neurological testing
- Palpation for tenderness
- Provocative tests (Spurling's, SLR)
- Upper motor signs: hyperreflexia, brisk DTRs, clonus, positive Hoffman's, Barbinski, etc.

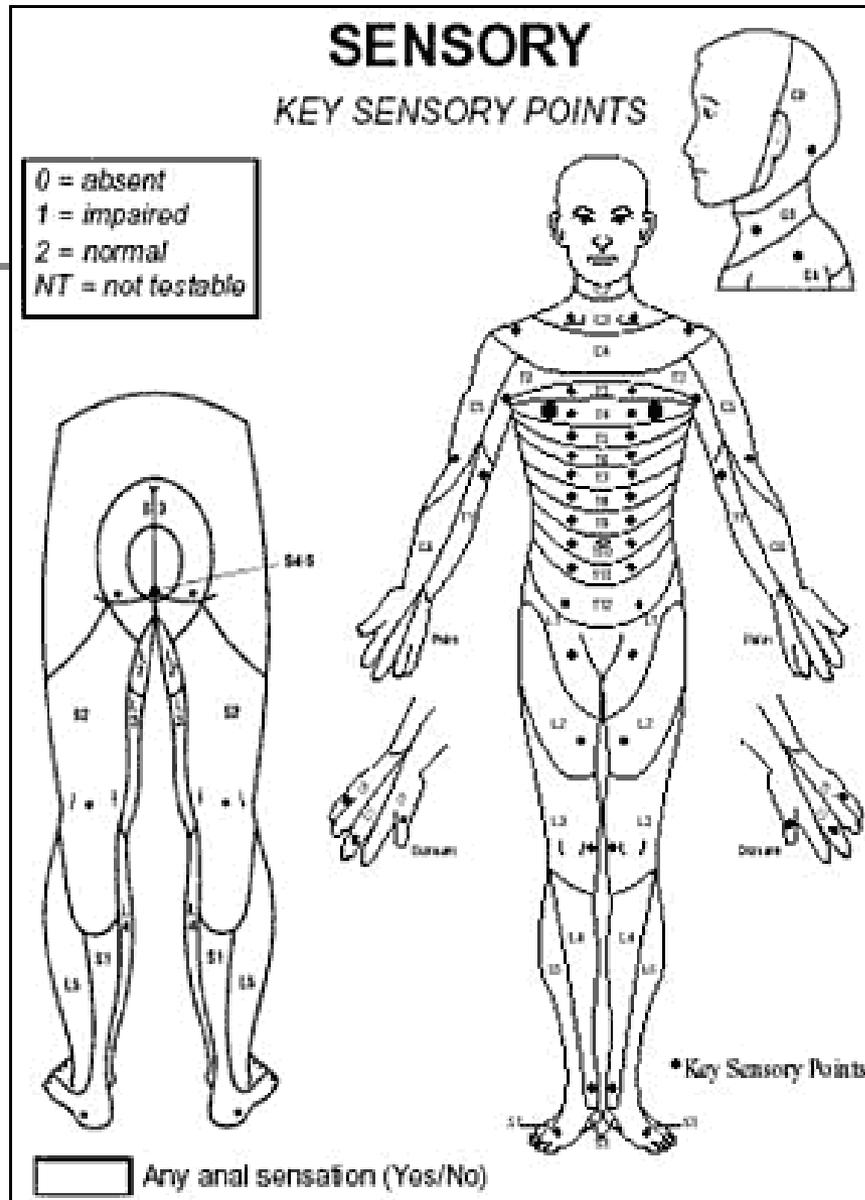


Lumbar Radicular Patterns





Lumbar Sensory Points

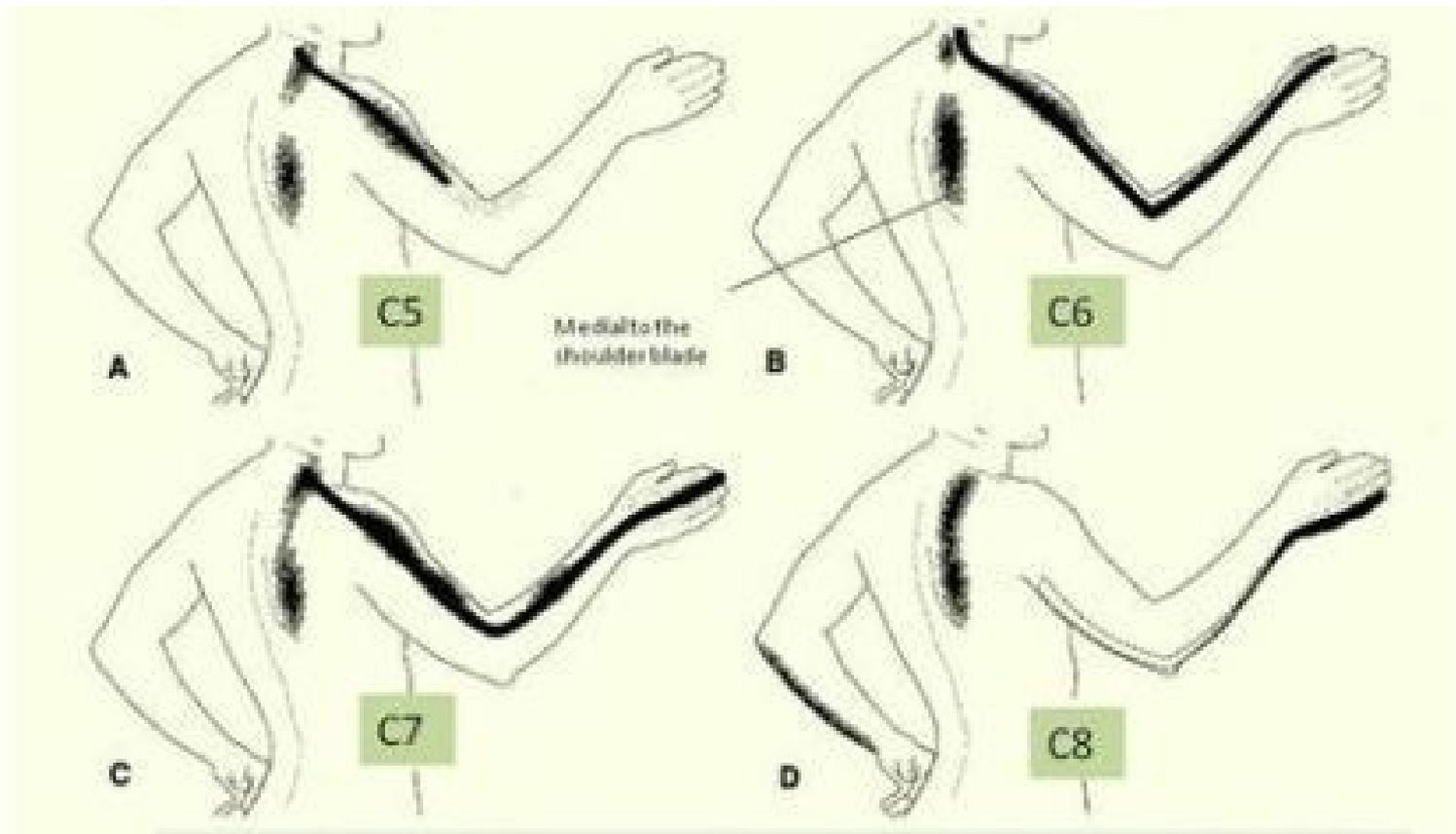


Lumbar Myotomes

- **L2: hip flexors (iliopsoas)**
- **L3: knee extensors (quadriceps)**
- **L4: Ankle dorsiflexors (tibialis anterior)**
- **L5: Long toe extensors (extensor hallucis longus)**
- **S1: ankle plantar flexors (gastrocnemius, soleus)**



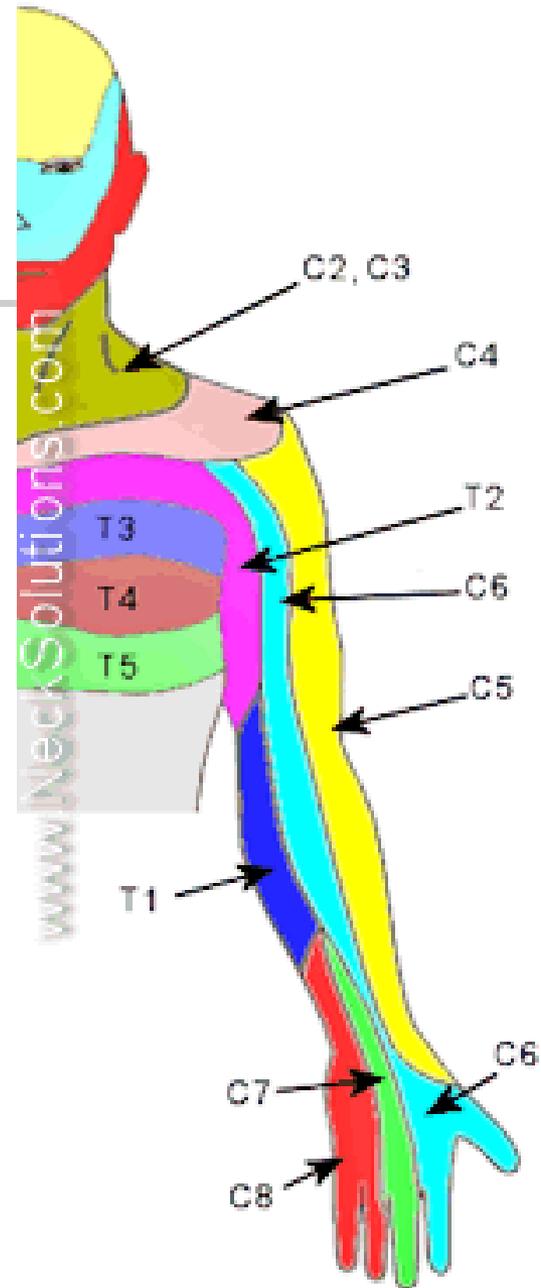
Cervical Radicular Patterns



Cervical Myotomes

- **C5: elbow flexors (biceps)**
- **C6: wrist extensors**
- **C7: elbow extensors (triceps)**
- **C8: finger flexors**
- **T1: finger abductors (ADM)**

Cervical Dermatomes



Red Flags

- **Cancer: h/o cancer, +50, Severe pain at rest or at night, weight loss**
- **Infection: Fever/chills, h/o drug/alcohol abuse or long term corticosteroid use**
- **Bowel/bladder/sexual dysfunction: Cauda equina syndrome or myelopathy**
- **Gait ataxia/upper motor neuron changes: myelopathy.**
- **Focal weakness or loss of balance**
- **Significant trauma**

Diagnostic Tools

- **Labs: r/o infection or cancer marker, etc.**
- **X-ray: r/o fracture, scoliosis, spondylolysis**
- **MRI(with or without contrast): tumor, infection, vascular malformation, spinal nerve or spinal cord compression**
- **CT myelogram: with contrast. Commonly used when MRI is contraindicated**



Treatment of Acute Neck & Back Pain

- Rest/activity as tolerated
- Ice/heat
- Anti-inflammatory
- Gradual stretching and controlled activity
- Muscle relaxants or narcotics to facilitate sleep



Chronic Back & Neck Pain

- **Chronic pain: >6 weeks**
- **Incomplete resolution of pain or recurrent pain**
- **Gradual progression of pain**
- **Chronic pain with acute change**



Chronic Spine Pain Treatment

- **Understanding pathology: accurate diagnosis, understand biomechanics of spine and effect of outside forces**
- **Behavior/activity modification: diet, lifestyle, back precautions**
- **Physical therapy: modalities, soft tissue release, stretching, strengthening, balance, mobility**



Chronic Spine Pain Treatment

- **Orthosis/assistive devices: spinal braces, mobility aids, reachers**
- **Medications: analgesics, anti-inflammatory, neuroleptic, muscle relaxant, treatment of underlying/associated conditions**
- **Injections: epidural, nerve root ablation, facet joints**
- **Alternative medicine: acupuncture, manual medicine, massage, yoga, etc.**



“Failed Back Syndrome”

- **All reasonable treatments, conservation and surgical exhausted**
- **Lifelong maintenance**
- **Interventions should:**
 - **Reduce pain**
 - **Improve societal productivity**
 - **Maximize physical and functional capacities**

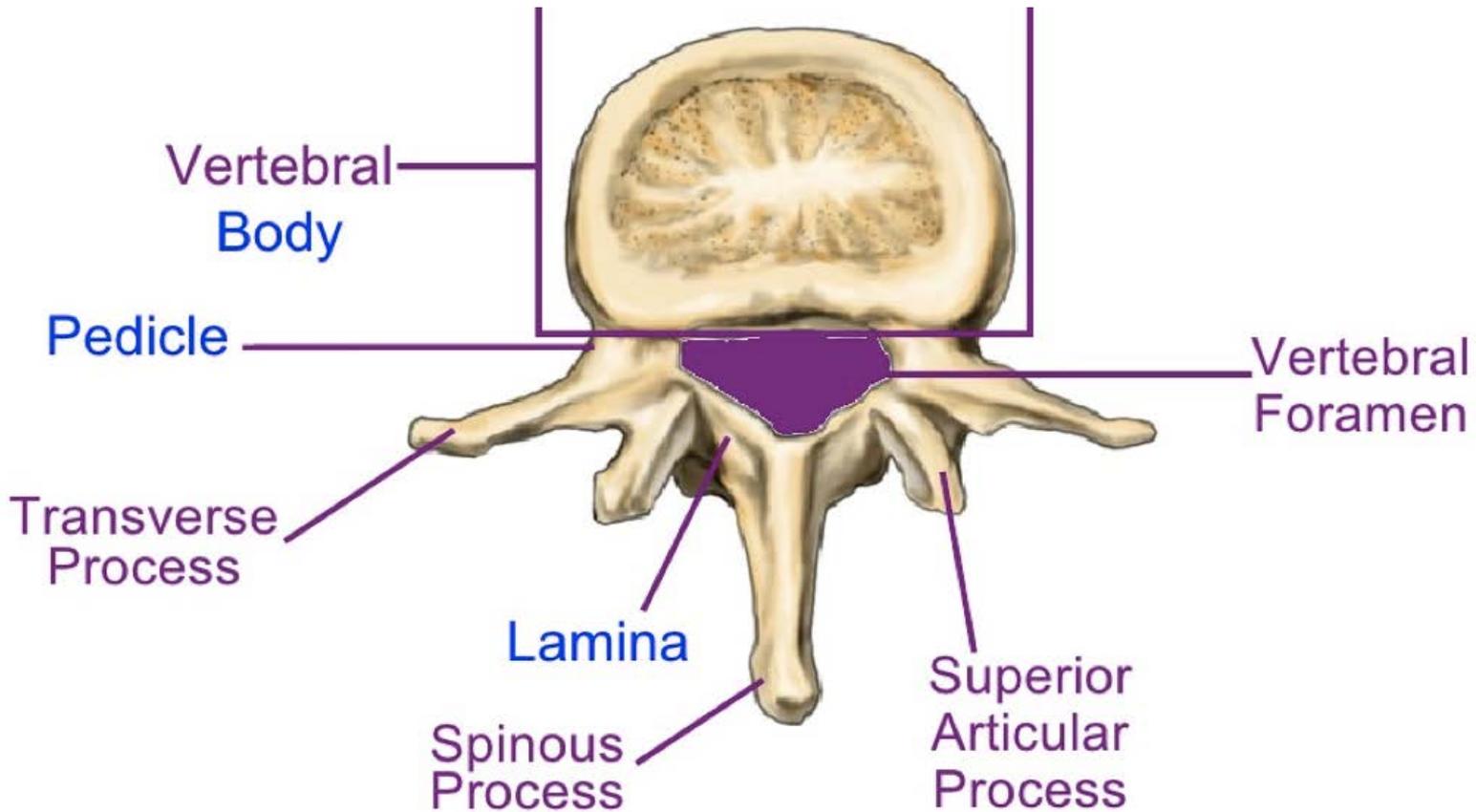


Anatomy

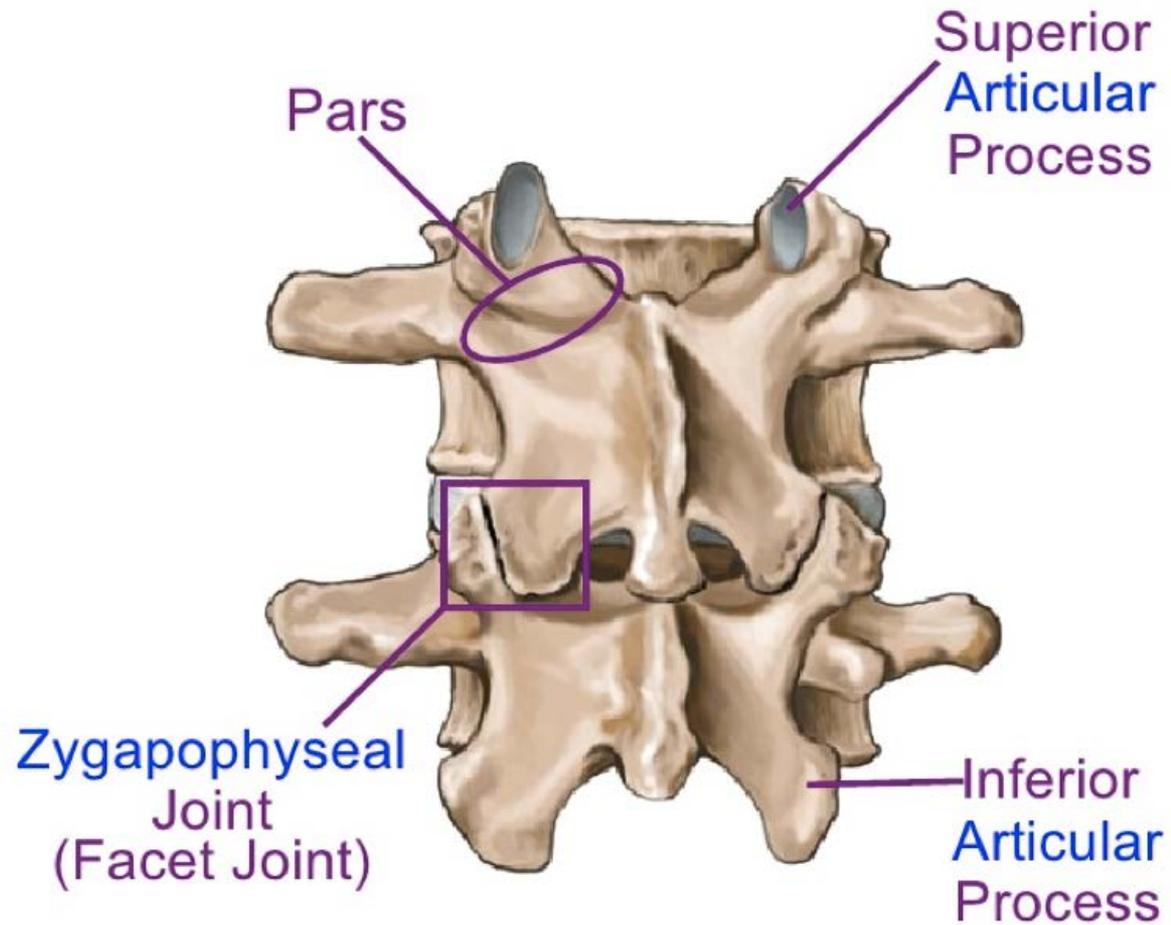
- **Vertebra**
- **Facet joint**
- **Intervertebral disc**
- **Spinal ligaments**
- **Muscles**



+ Vertebral Structures

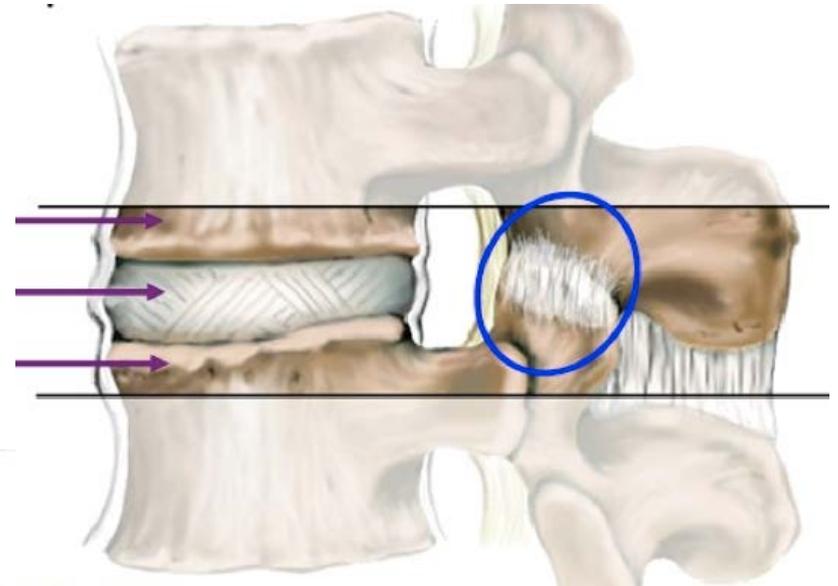
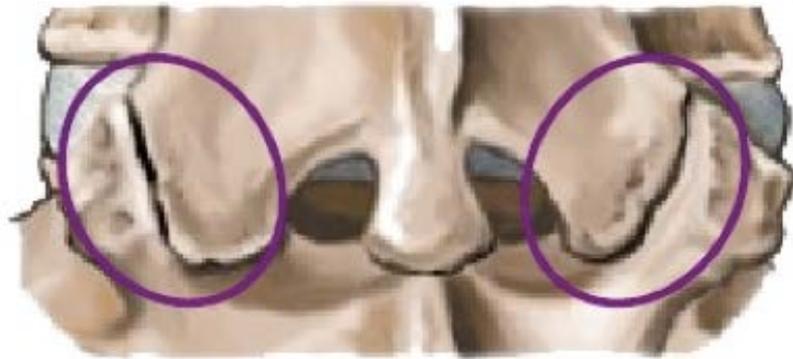


+ Vertebral Structures

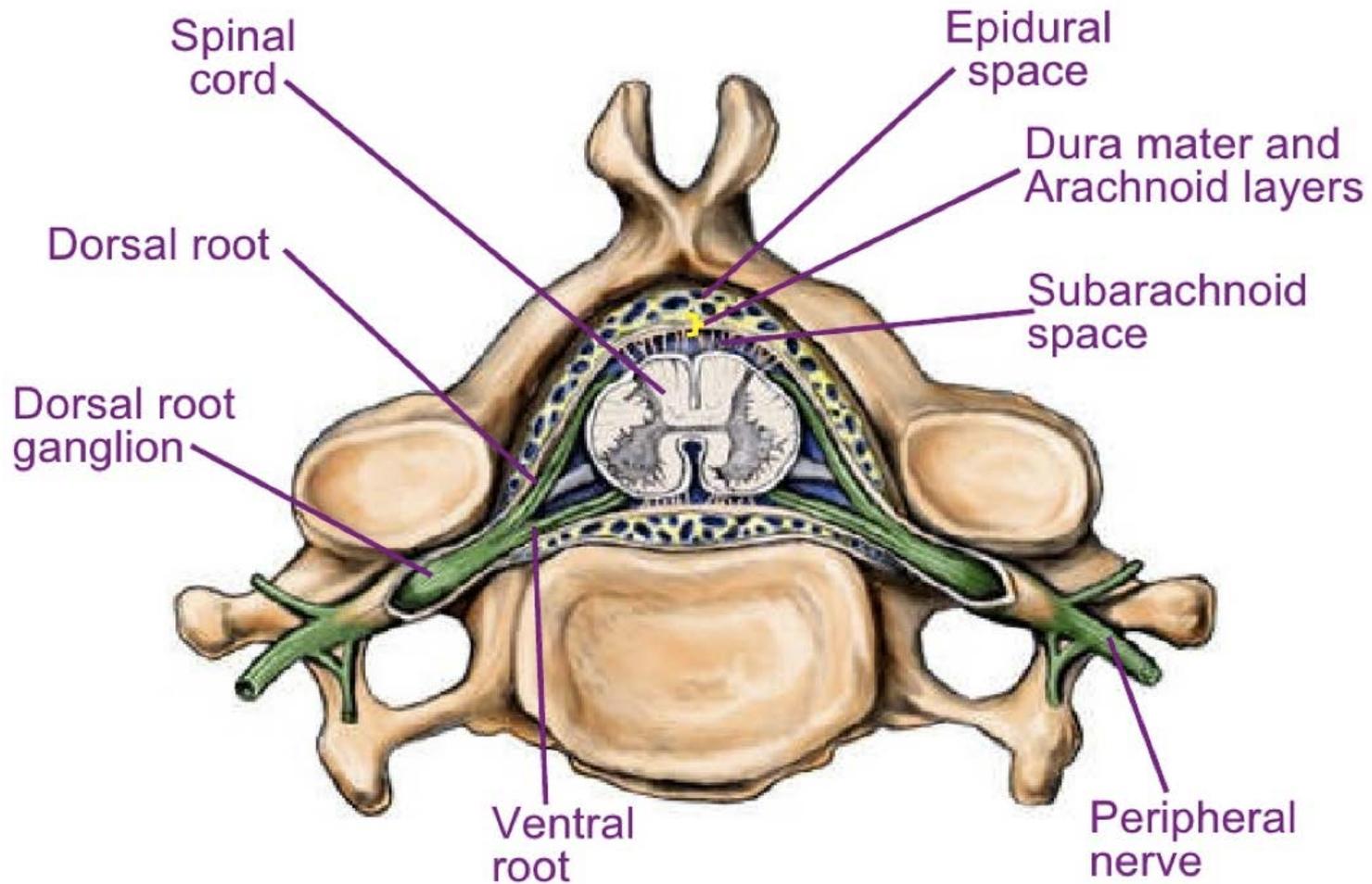


+ The Motion Segment

- **The Functional Unit** of the spine
- Composed of:
 - **Two adjacent vertebrae**
 - **Intervertebral disc**
 - Connecting ligaments
 - **Two facet joints and capsules**



+ Spinal Nerves



Case 1

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Case 1

- **PE: restricted ROM in C-spine. Increased tone in paraspinal. Normal sensation, strength, and DTRs.**
- **X-ray: loss of normal cervical lordosis**
- **MRI: not necessary unless poor response to treatment. Normal**
- **Rx: physical therapy: soft tissue release, modalities, stretching, posture correction, medications**

Soft Tissue Injury

- Trauma or microtrauma to muscles, connective tissue, ligaments, joint capsules, cartilage and blood vessels
- Minor tissue damage may result in significant pain
- Associated inflammation and muscle spasms may prolong symptoms
- Cervical Whiplash injury: commonly seen as a result of MVA

Case 2

- **32 yo male was working in yard, bent to pick up bags of cement and had acute sharp pain in low back, difficulty moving, bend to one side. Severe pain for about 1 week (bed ridden). Now can stand but still cannot sit long. Intermittent sharp pain with bending and sitting which radiates down posterior lateral aspect of the right leg.**

Case 2

- **PE: antalgic gait. Restricted motion in lumbar spine. Pain with forward flexion. Limited strength testing due to pain. Sensation decreased to light touch in L5 distribution. DTRs normal. Positive SLR at 30 degrees**
- **X-ray: mild disc space narrowing at L4/L5 and L5/S1**



MRI Findings of Lumbar Herniated Disc



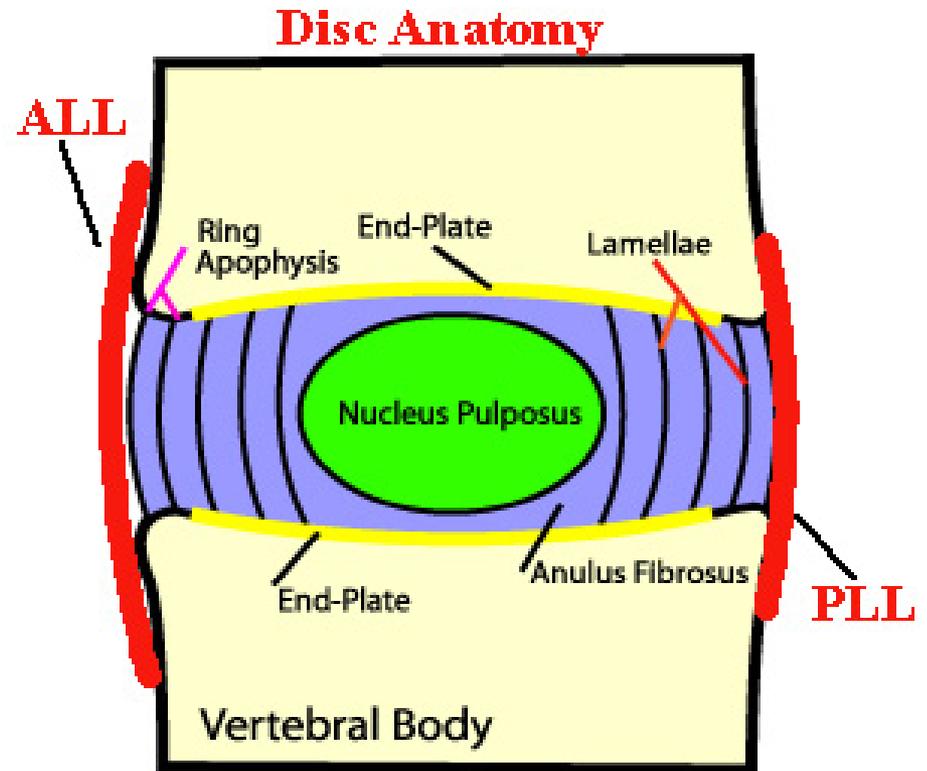
right paracentral disc
protrusion at L4/L5

Herniated Disc

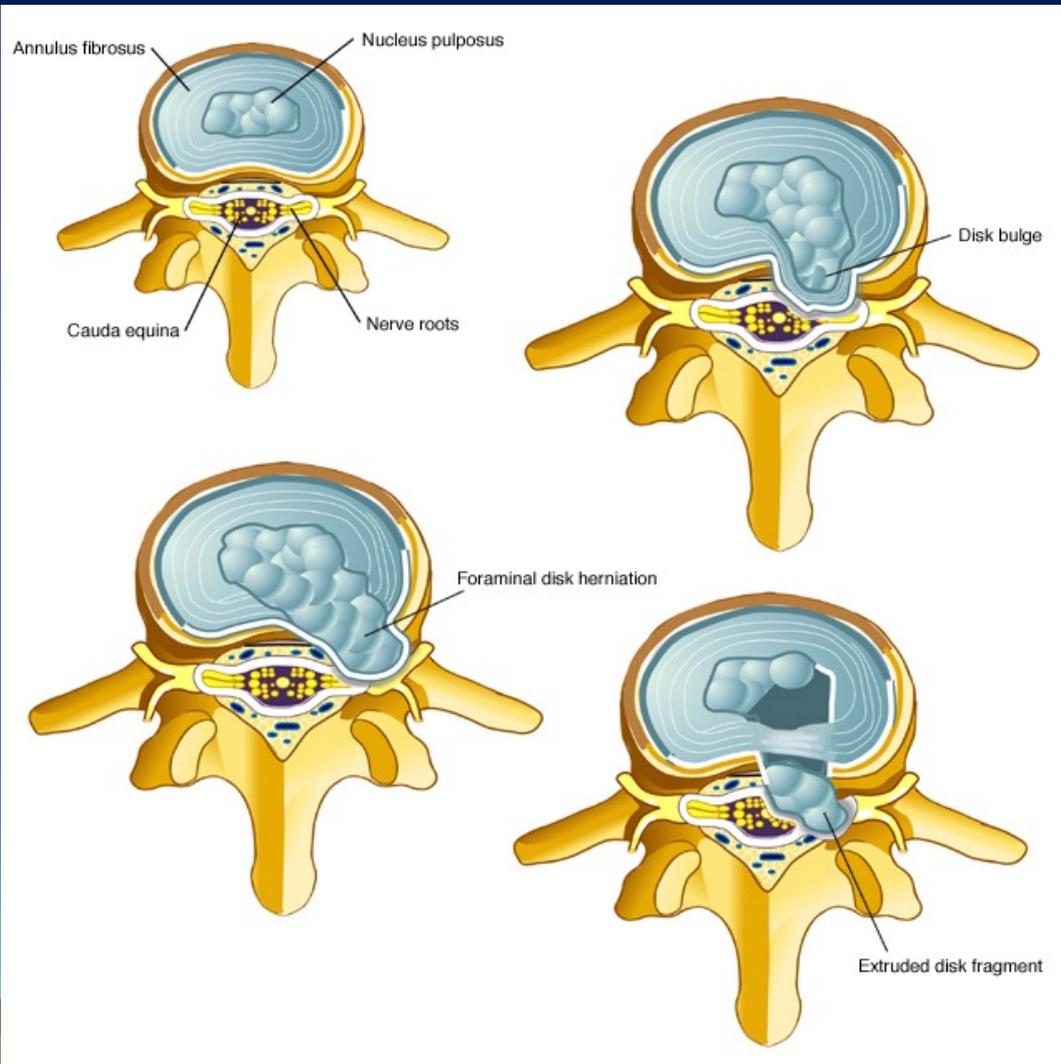
- **Most common: 30-40 yo**
 - **Common site: L4/L5, L5/S1, C5/C6**
 - **Acute neck or back pain radiating to arms or legs (sciatic-radicular pain)**
 - **Weakness in corresponding myotome**
 - **Numbness, paresthesia, altered sensation in associated dermatome**
 - **Triggers: spontaneous, lifting, bending, coughing/sneezing**
 - **Exacerbating with spinal motion**
- 

+Intervertebral disc Anatomy:

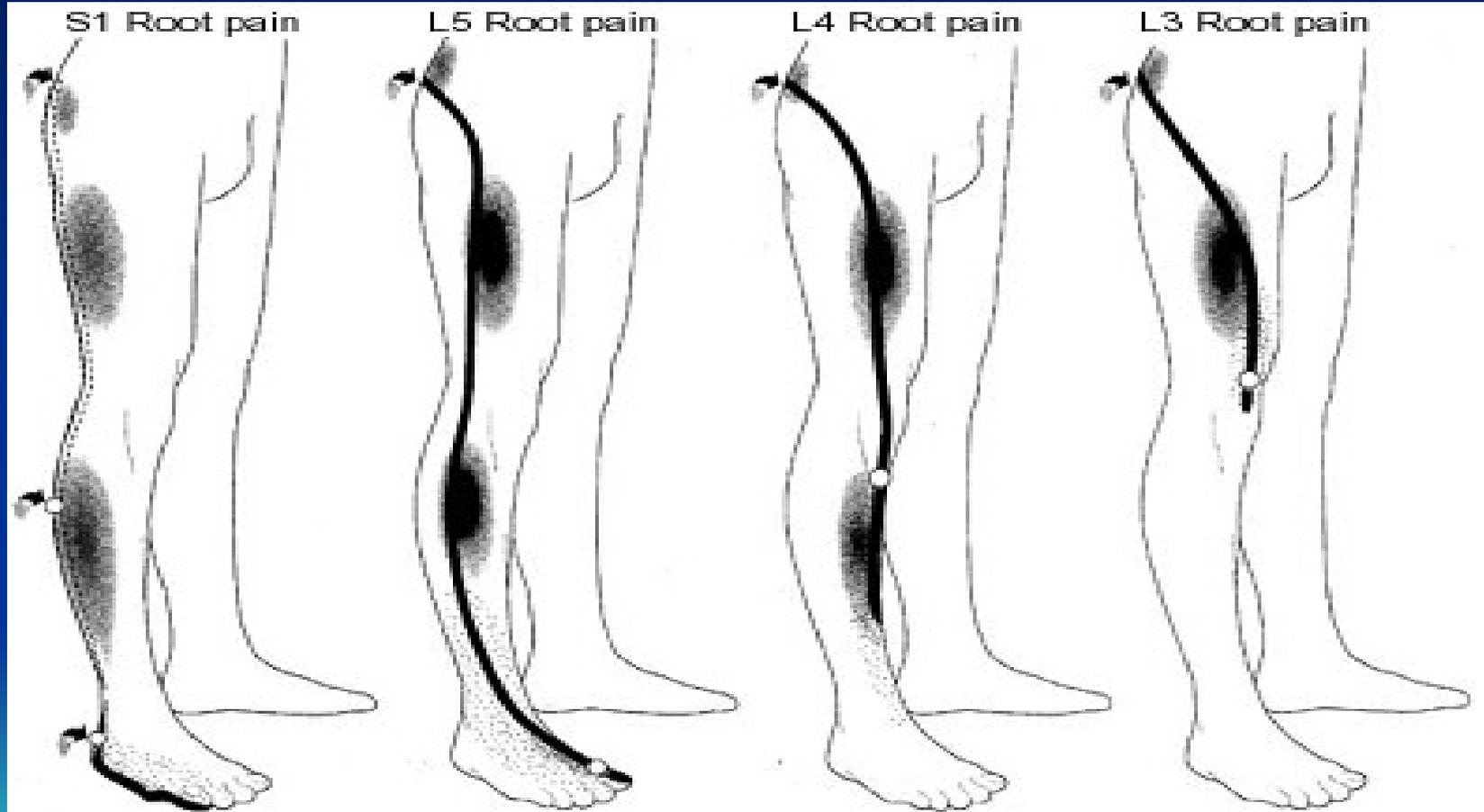
- Intervertebral disc has 3 components:
 - Nucleus pulposus
 - Annulus fibrosus
 - Vertebral end-plates



Herniated Disc



Lumbar Radicular Patterns



Lumbar Myotomes

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Provocative Test

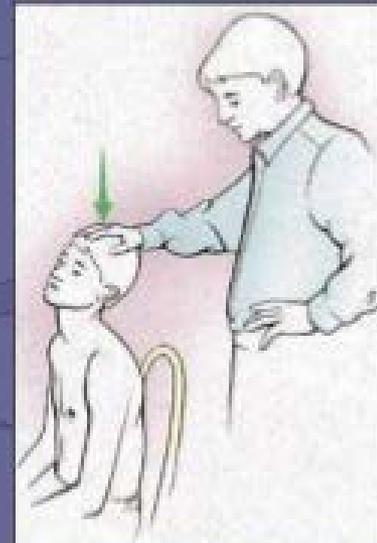
Reproduction of radicular symptoms by causing the tension of the nerve root

- Spurling's test
- Cervical compression test
- Straight leg raise test
- Sitting root test (slump test)

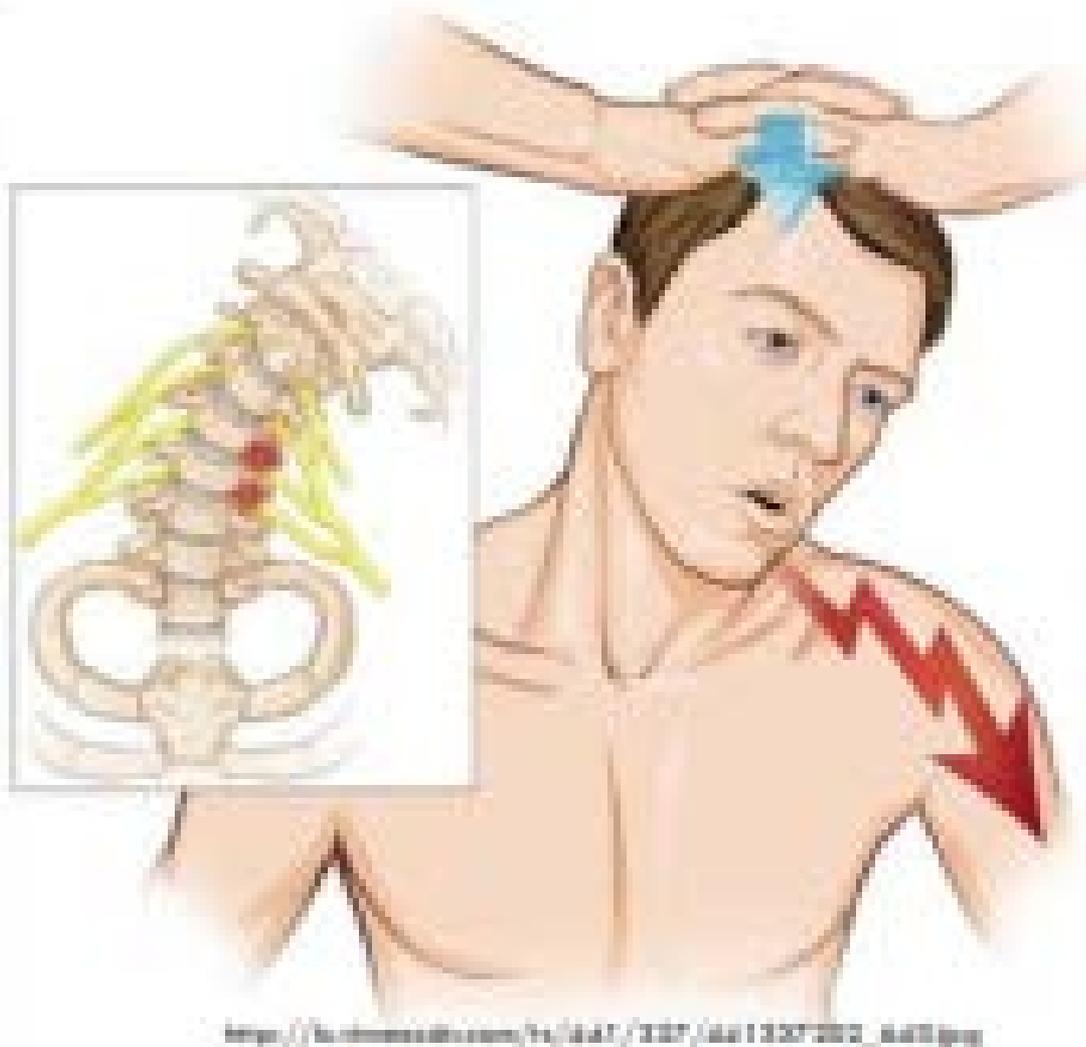


Spurling Maneuver

- Patients neck is extended
- Head rotated to symptomatic side
- Axial pressure applied to head
- May reproduce or worsen radicular pain



+ Spurling's Test



■ COMPRESSION TEST

- Press down upon the top of pt's head
- If there is increase pain in either cervical spine or upper extremity, note its exact distribution. So, we can locate the neurological level
- A narrowing of neural foramen, pressure on the facet joints or muscle spasm can cause increase pain upon compression



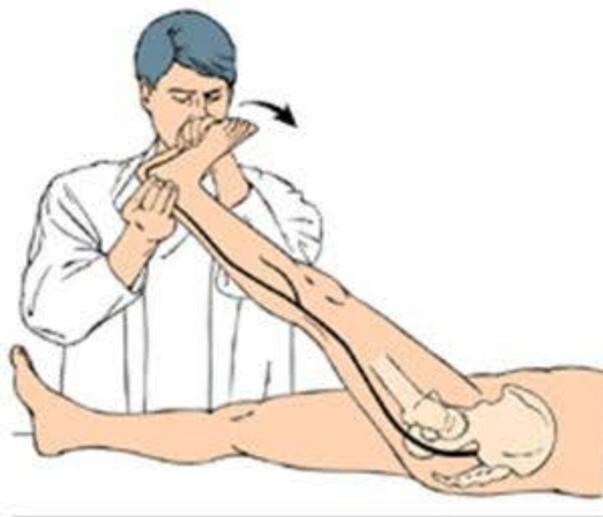
Fig. 39. The compression test.



Straight Leg Raising L4,5,S1



Straight leg raising



Dorsiflexion of foot intensifies pain



Crossed straight leg raising

+ Sitting Root Test (Slump Test)



Slump test for sciatica

Herniated Disc: Treatment

- Pain control: rest, anti-inflammatory
- PT: modalities, brace, extension exercises
- Alternative Rx: acupuncture, cupping, massage, etc.
- Injection
- Surgery



Case 3

- 43 yo female with h/o chronic low back pain after MVA 10 years ago, but pain resolved after PT. Three years ago she began to have intermittent pain with prolonged sitting or standing. The pain has progressed for the past 6 months. She has pain with sitting > 1 hour, or standing > 30 minutes. Often lies down during day for pain relief. Pain is significantly impacting her life.

Case 3

- **PE:** Limited ROM of spine with c/o pain at end of range in flexion and extension. Normal strength and sensation. DTRs are normal. SLR negative.
 - **X-ray:** disc space narrowing at L5/S1 with spondylosis and grade 1 spondylolisthesis, moderate facet arthropathy.
 - **MRI:** advanced disc degeneration at L5/S1, causing foraminal narrowing and nerve impingement.
- 

Degenerative Spine

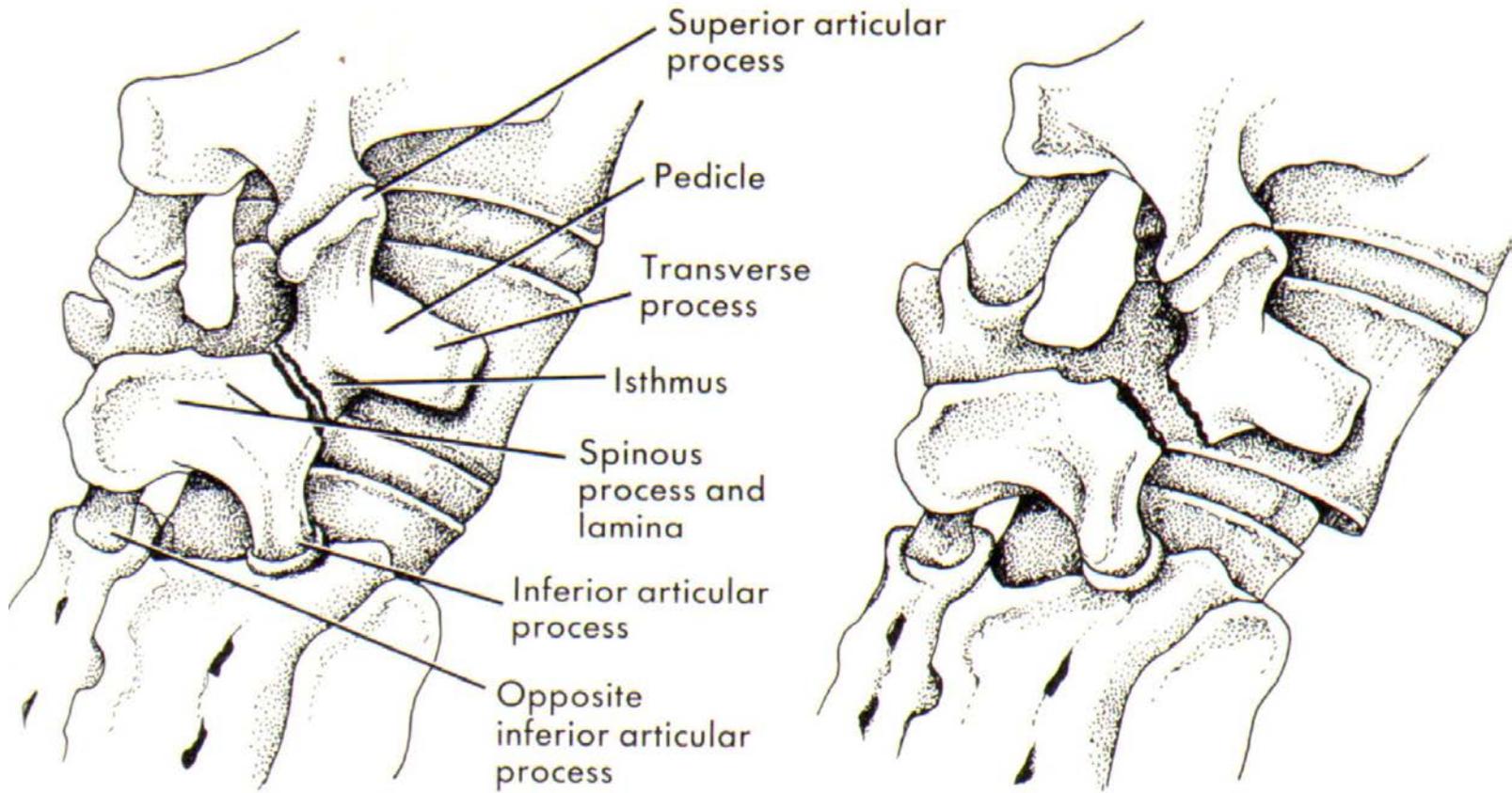
- **The three joint complex (intervertebral disc, two facet joints) are involved.**
- **Loss of water content in the intervertebral disc results in: cracks and tears of the disc, loss of disc space, osteophytes formation.**
- **Arthritic change in facets, cartilage disruption, osteophytes formation, sublux of the joints.**
- **Secondary narrowing of the neuroforamina or central canal.**
- **High risk: heavy labor, athletes, smoker, obese**

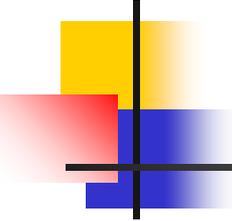
Spondylolysis

- Spinal osteoarthritis
- Degenerative changes in the facet joint, disc, etc.
- It can occur at cervical, thoracic or lumbar spine.
- It may cause spinal cord or nerve root compression, result in spinal cord injury (myelopathy), or radiculopathy.
- It can occur in children and adolescents: most common at L5. Repetitive hyperextension (dancing, gymnastics, or football)

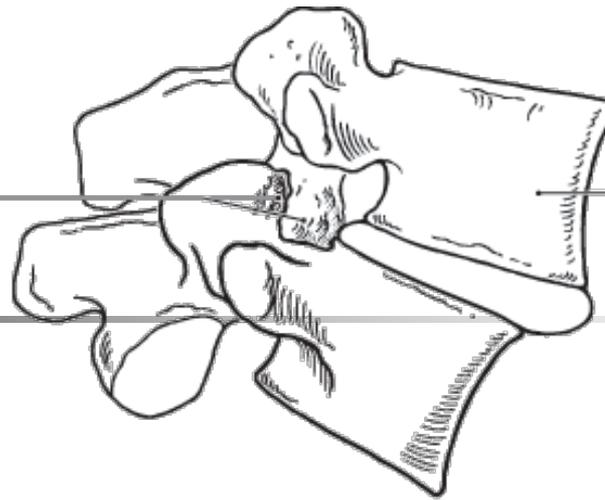


+ Pars Interarticularis

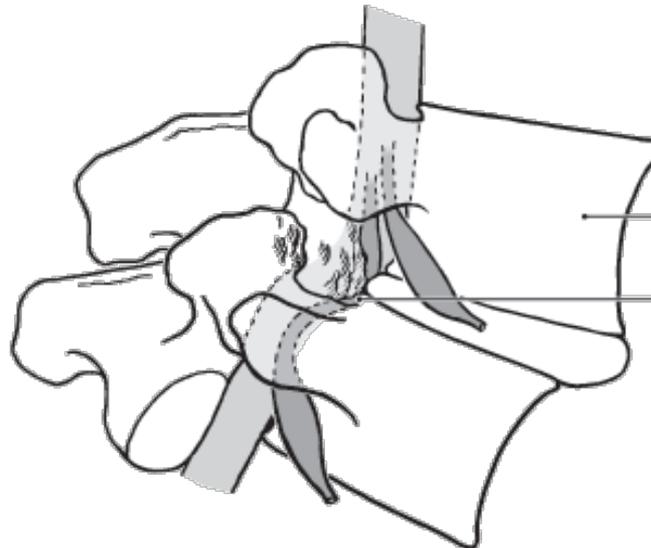




Degenerative changes
in posterior facets
*Changements dégénératifs
dans les facettes postérieures*



Vertebral body
(slipped forward)
*Corps vertébral
(ayant glissé vers
l'avant)*



Vertebral body
Corps vertébral

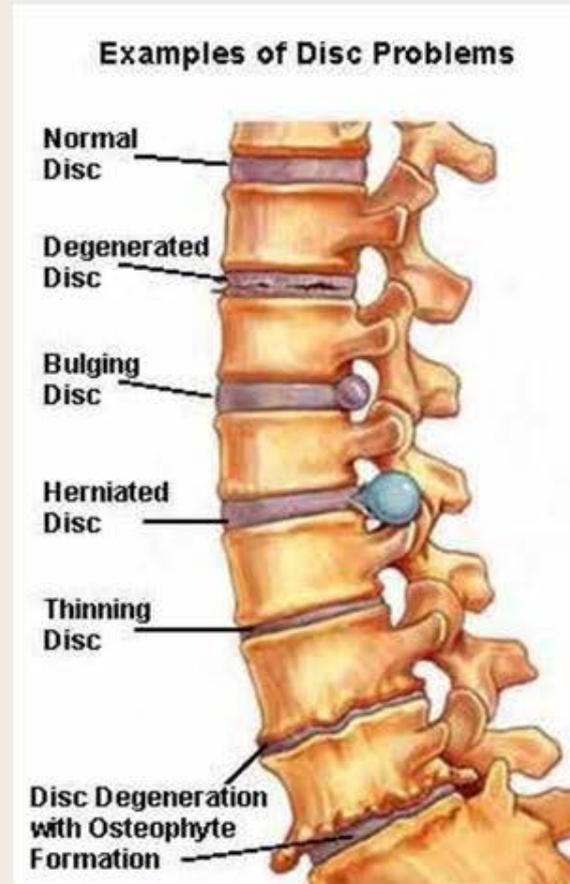
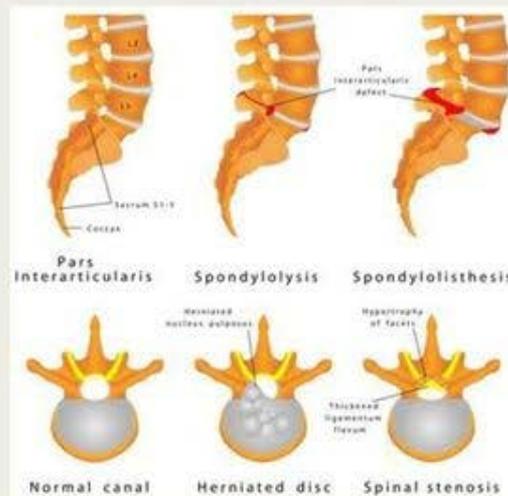
Compressed nerve
Nerf comprimé

Degenerative spondylolisthesis — forward slip of L4 upon L5 vertebra due to degenerative changes in ligaments and facet joints. Lower picture shows how nerve root may be compressed.

Spondylolisthésis dégénératif — glissement vers l'avant de L4 sur L5 dû à des changements dégénératifs dans les ligaments et les facettes articulaires. Le deuxième croquis montre comment la racine nerveuse peut-être comprimée

Degenerative Spine Disease

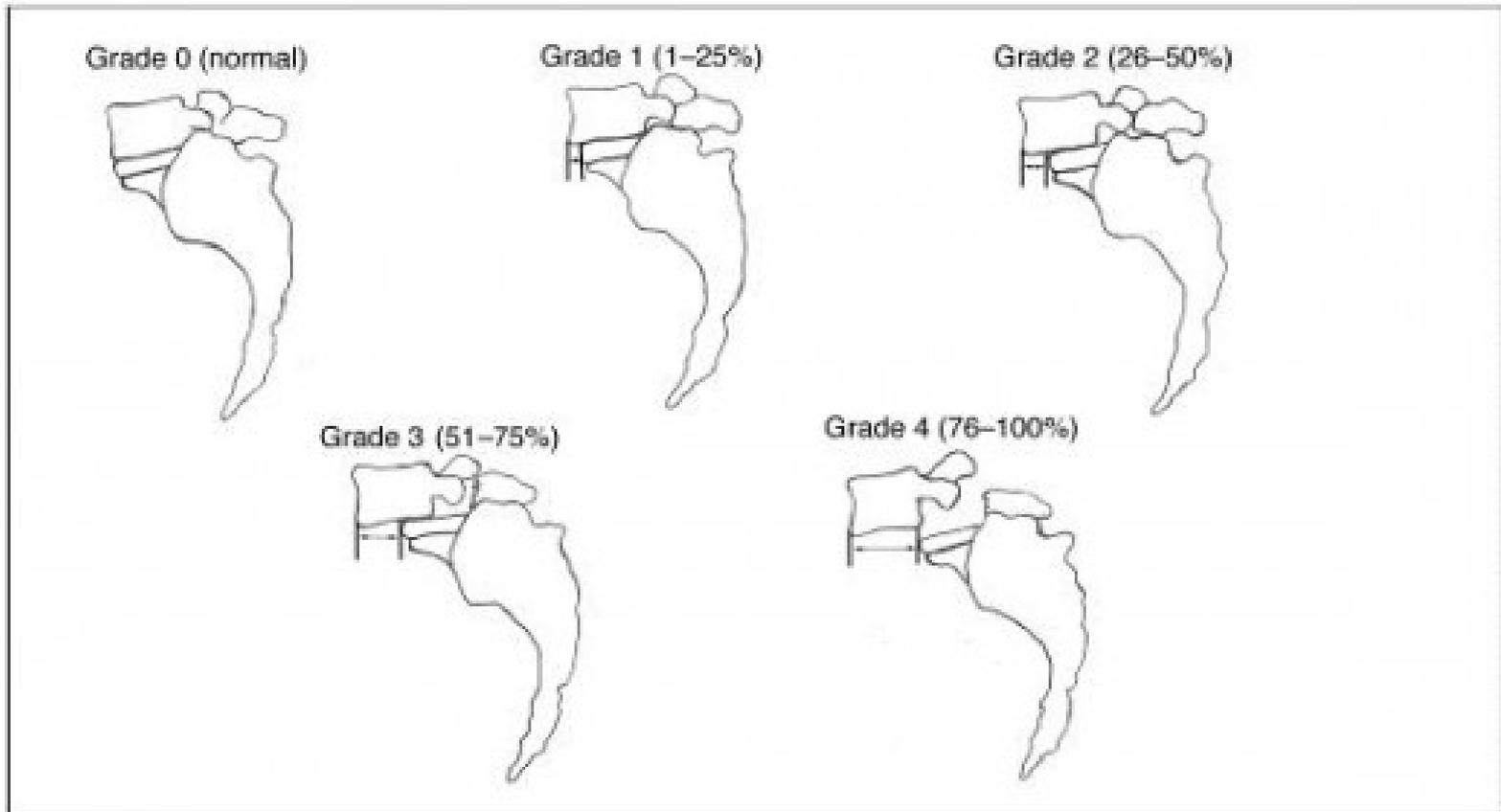
- Herniated discs
- Degenerative disc disease
- Spinal osteoarthritis
- Spondylolisthesis
- Spinal stenosis
- Degenerative scoliosis



Spondylolisthesis

- Slippage of a vertebral body with respect to the vertebral body below it
- Most common at lumbar region.
- Causes:
 - congenital
 - degenerative: L4/L5
 - traumatic
 - pathological
 - postsurgical

+ Meyerding grading of slippage for Spondylolisthesis:



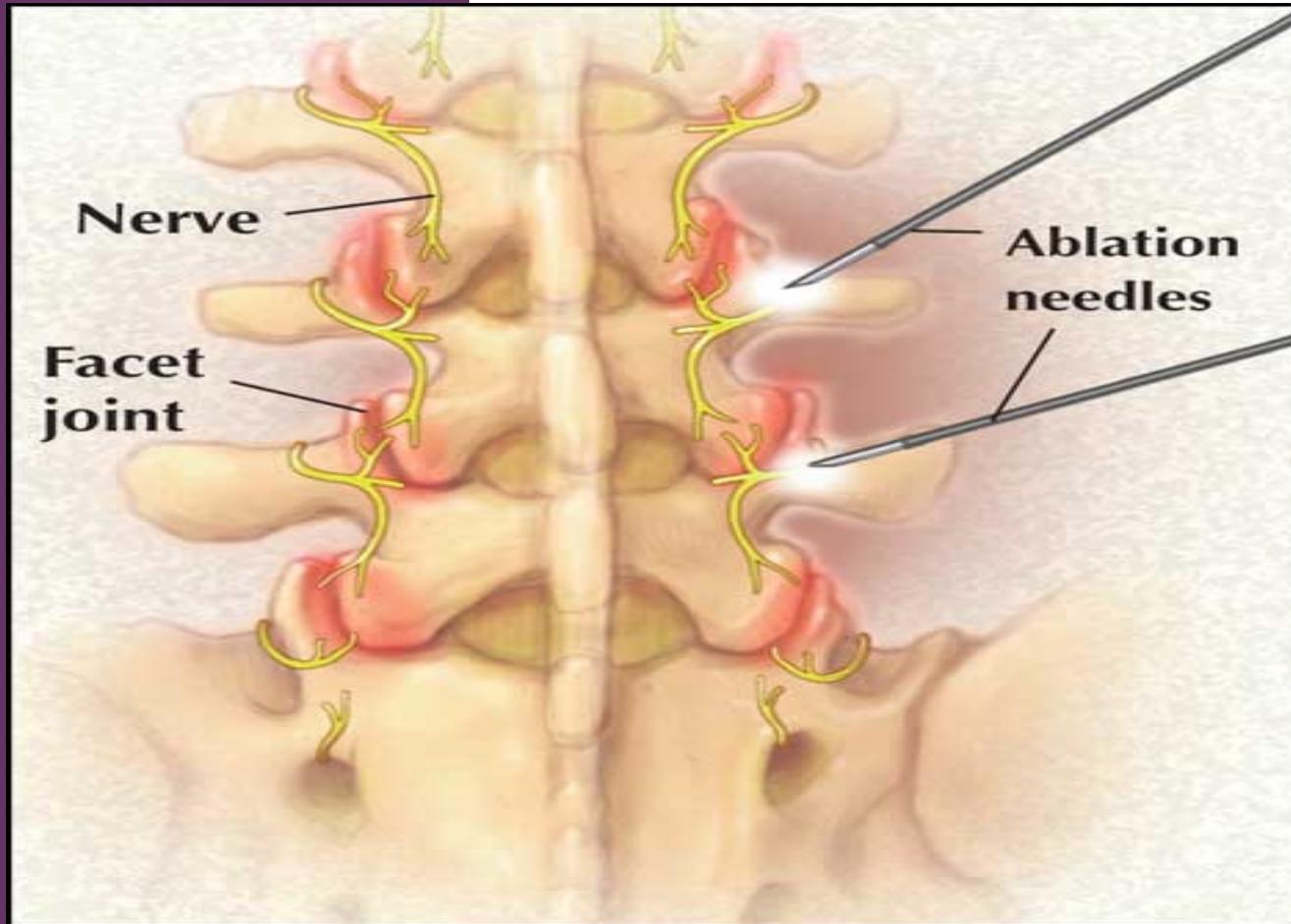
Spondylolisthesis

- **Grading of slippage:**
 - **Grade 0: 0% slippage**
 - **Grade 1: 1-25%**
 - **Grade 2: 26-50%**
 - **Grade 3: 51-75%. surgery if symptomatic**
 - **Grade 4: 76-100%: surgery**

Degenerative Spine: Treatment

- **Anti-inflammatory/analgesic medications**
- **PT: stretching, core strengthening, posture, modalities**
- **Bracing**
- **Alternative Rx: acupuncture**
- **Facet injection/medial branch block/radio-frequency ablation**
- **Surgery**





Applying radiofrequency energy to the facet joint nerve involves placing an insulated wire near the nerve tissue.

Case 4

- **68 yo male with significant limitation in ambulation due to leg pain. H/o back pain for >20 years. Gradual progression to aching pain through legs when standing more than 5-10 minutes. Prefers walking behind a shopping cart**

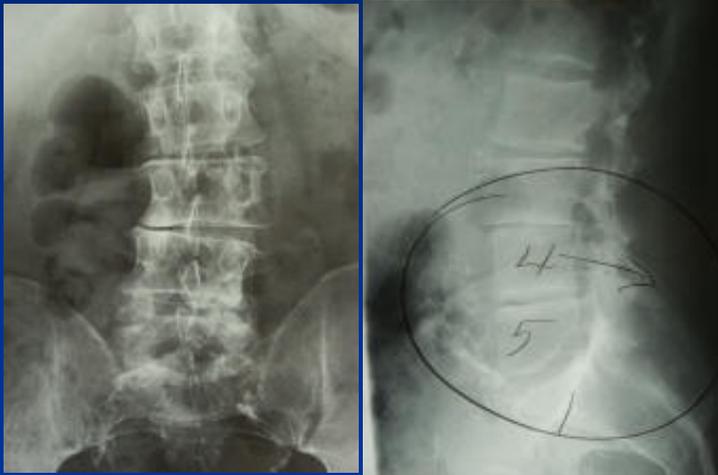


Case 4

- **PE: mildly stooped gait. Limited ROM in the lumbar spine. Normal strength and sensation in LEs. DTRs are diminished symmetrically**



X-Ray of Spinal Stenosis



X-ray: advanced degenerative change at multiple levels

MRI Findings of Spinal Stenosis

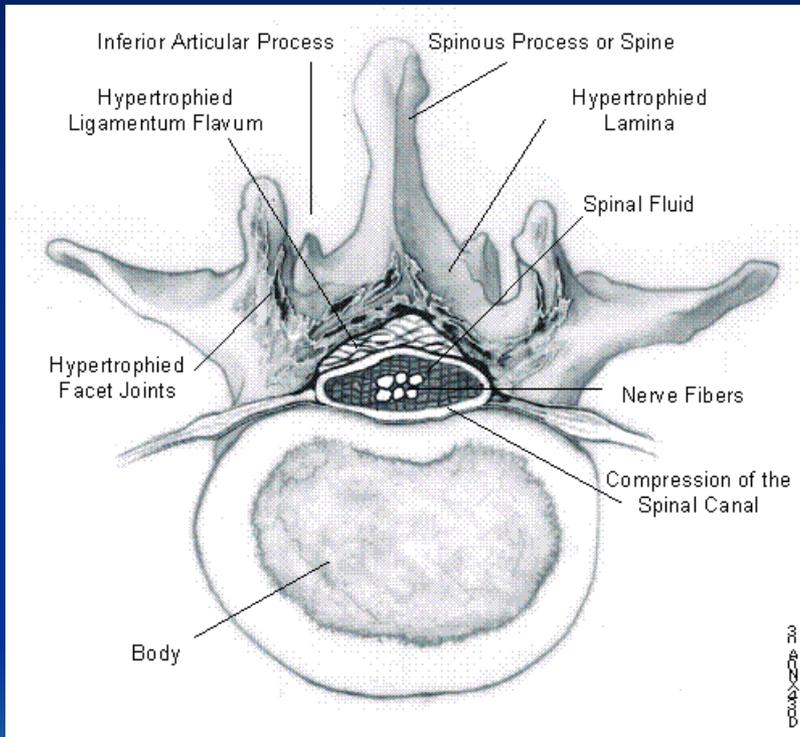


**MRI: disc degeneration
at L2/L3 thru L5/S1.**

**Severe facet arthropathy
at L4/L5 and L5/S1.**

Severe spinal stenosis at L4/L5

Spinal Stenosis



- **Narrowing of the spinal canal**
- **A result of degenerative changes, disc bulging, facet & ligament hypertrophy & osteophytes**
- **Onset usually gradual with progressive increase in symptoms.**
- **May be acute with disc herniation**

Spinal Stenosis: Treatment

- **Pain control: anti-inflammatory or analgesics**
- **Physical therapy/modalities**
- **Alternative Rx: acupuncture**
- **Spinal injections**
- **Mobility modification**
- **Surgery: bowel or bladder dysfunction, severe pain, severe motor deficits**



Cervical Spinal Stenosis

- May be clinically silent
- Most commonly due to cervical spondylosis
- May present as myelopathy (spinal cord syndrome)
- Paresthesia in UE, hyperreflexia in LE, gait disturbance, minimal LE weakness
- MRI best assessment tool: cord compression

Case 5

- **59 yo male with low back pain for two months w/o injury, progressively getting worse. Pain not related to position or activity. Uses sleeping meds and pain meds to get to sleep. PT with minimal improvement.**



Case 5

- **PE: normal gait. Good ROM in spine with no change in pain. Normal strength and sensation. DTRs normal. SLR negative. No spasm or tenderness**
- **X-ray: (age over 50, severe pain at rest) mild degenerative changes in lumbar spine**



Spine Tumors



**MRI: localized lesions in
L3/L4 vertebral bodies on
T2 images**

Spine Tumors

- Primary or metastatic
- Pain often present at night, may be worse with activity
- May have sensory or motor deficits
- Mostly seen at the upper or mid thoracic levels
- Red flags:
 - age over 50
 - h/o cancer
 - severe pain at rest
 - associated with low grade fever
 - bowel or bladder symptoms



Spinal Tumor: Treatment

- **Cancer work up**
- **Possible spine biopsy**
- **Chemo/radiation Rx**
- **Pain medication**
- **Surgical stabilization**

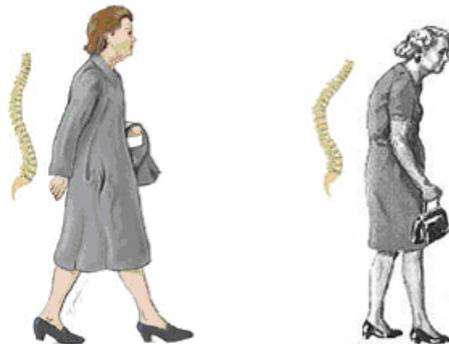


Vertebral Body Compression Fracture

- **Mostly associated with osteoporosis**
- **Most commonly seen at the thoracolumbar junction**
- **Other causes: trauma, medication related (corticosteroids), Neoplasm**
- **Sudden onset pain**
- **Braces, surgery**

Degenerative Kyphoscoliosis

- Degeneration of discs, facet subluxation, compression deformities contribute to scoliosis and increased kyphosis
- Multiple possible pain generators can make treatment difficult



Degenerative Kyphoscoliosis Treatment

- Medication: ? Narcotic analgesics
- Evaluation/ treatment of osteoporosis
- Spinal orthosis
- Physical therapy: balance, mobility, strength, safety, weight bearing exercise
- Modification of activities
- Mobility aid
- Injections
- Surgery



Summary: Spine Disorder

- **Acutely, focus is managing pain**
- **Persistent symptoms require:**
 - **Diagnosis**
 - **Understanding of pathology**
 - **Elimination or minimization of causal/exacerbating factors**
- **If factors persist:**
 - **Identify functional deficits**
 - **Optimize function (possibly through surgery)**
 - **Control pain**
 - **Maximize healing potential**

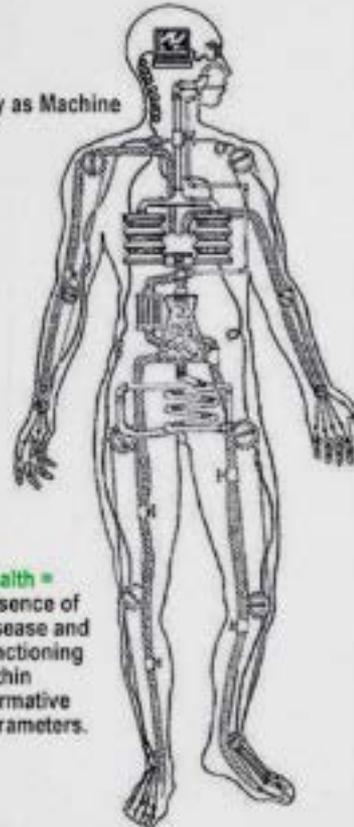


WESTERN vs. EASTERN MEDICINE

WEST

EAST

Body as Machine



Health =
absence of
disease and
functioning
within
normative
parameters.

Outlook of medicine:
War on disease with doctors as general,
disease as enemy, and patient as
occupied territory. Goal is to eradicate
symptoms and maximize performance.

Body as Garden



Health =
integrity,
adaptability,
continuity.

Outlook of medicine:
Cultivate health with doctor and
patient in partnership to improve
ecological conditions. Goal is to
enhance self-regulatory capacity.

THANK YOU