Evaluation of Low Back Pain

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Introduction

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History

Observation (Body Language)

Test

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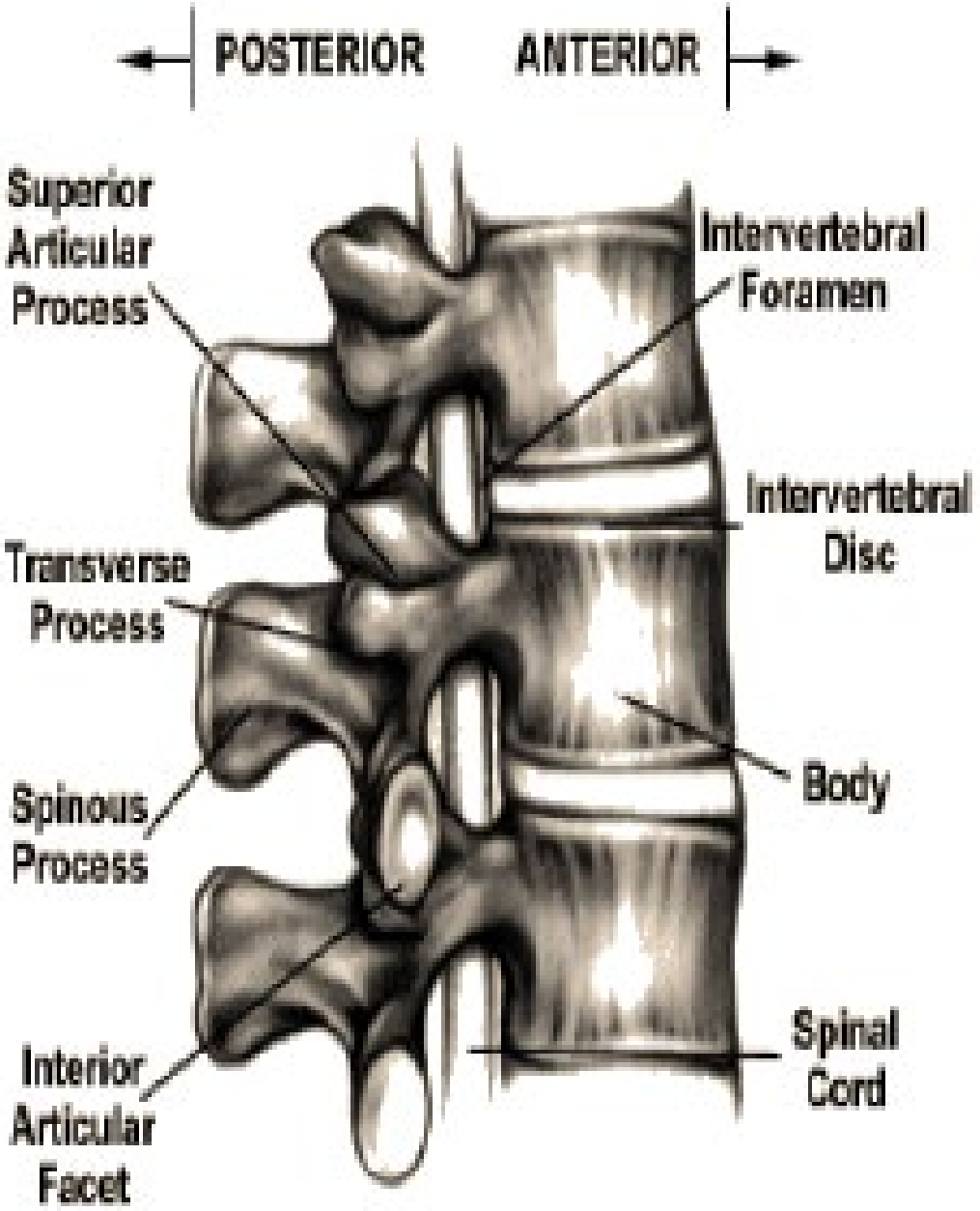
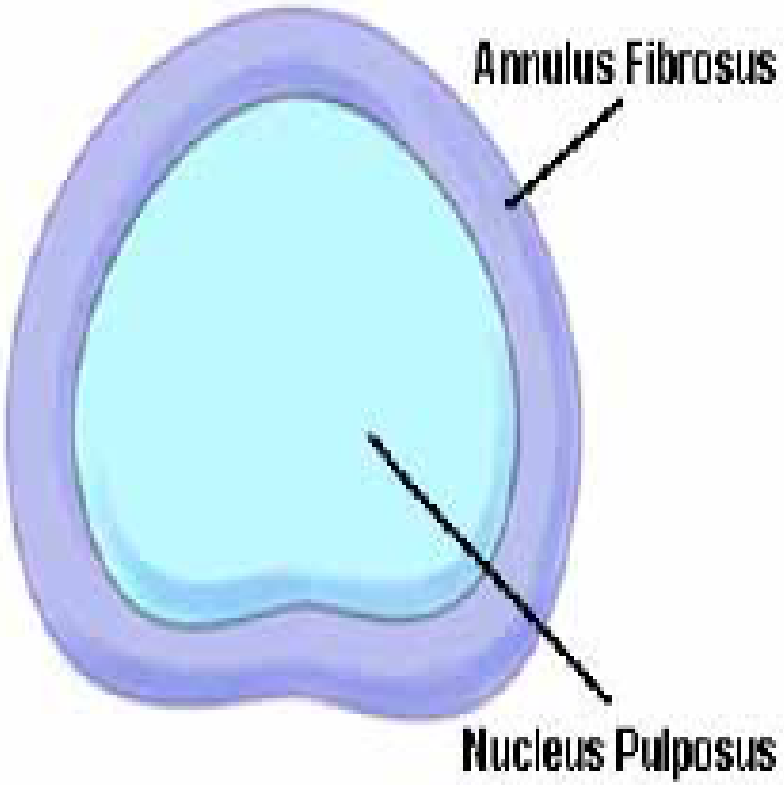

POSTERIOR
ANTERIOR
Superior Articular Process
Intervertebral Foramen
Intervertebral Disc
Transverse Process
Body
Spinous Process
Spinal Cord
Interior Articular Facet

Axial (Overhead) View
of Intervertebral Disc



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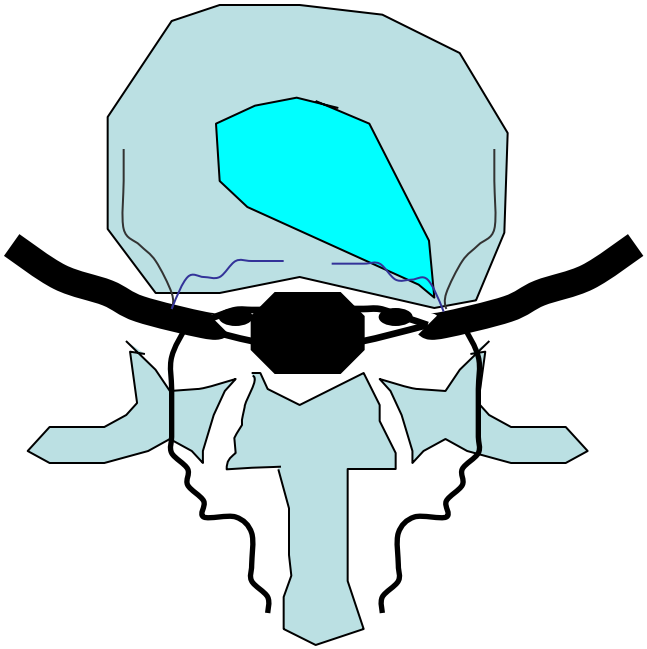
What is Back Pain ?



Most disc herniations occur at L5-S1

At least 30% of the healthy symptomless population have clinically significant disc protrusions (Stadnik et al., 1998).

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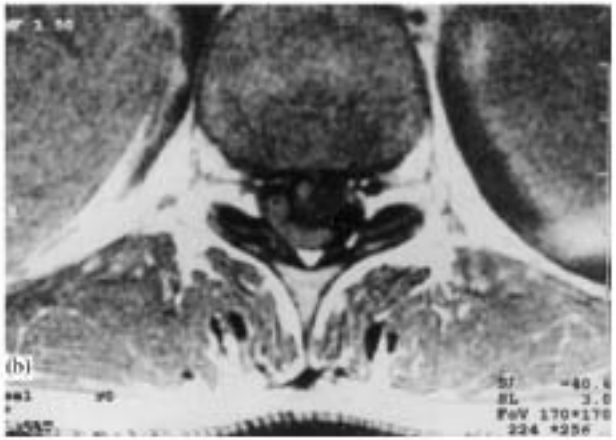
What is Back Pain ?



Several studies have shown that there is no correlation between MRI findings and patients' low back symptoms.

1. Wittenberg et al., 1998

2. Smith et al., 1998

3. Savage et al., 1997

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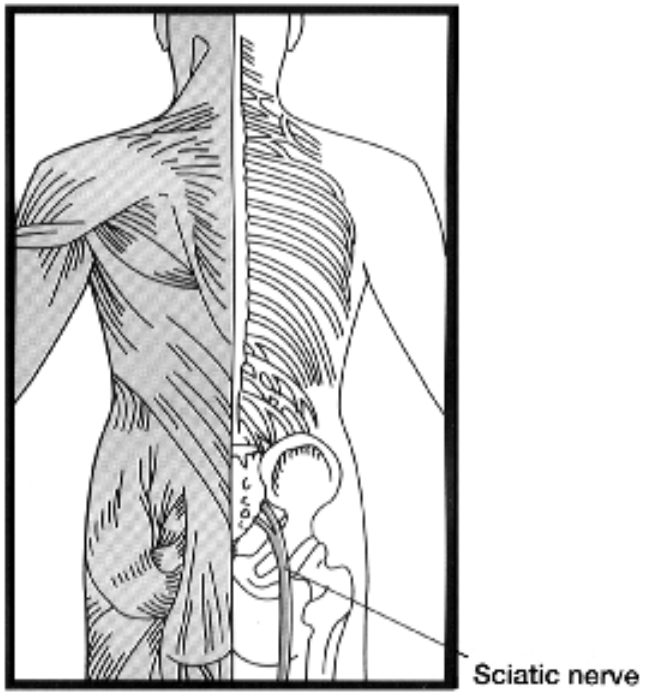
What is Back Pain ?

There are many more joints in the back than discs.

There are many more muscles than joints.

The most common cause of low back pain is when one or more muscles "forget" to relax. We call this a somatic dysfunction.



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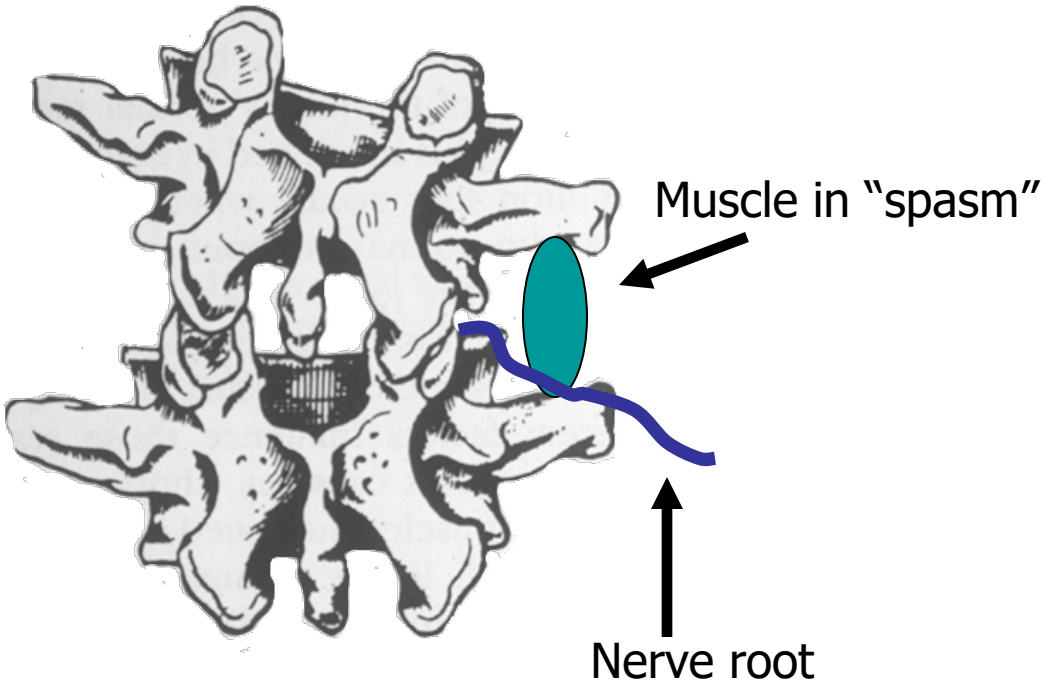
Common Sources of LBP

Somatic dysfunction



In somatic dysfunction, some muscles become overactive ("spasm") and other muscles become inactive.

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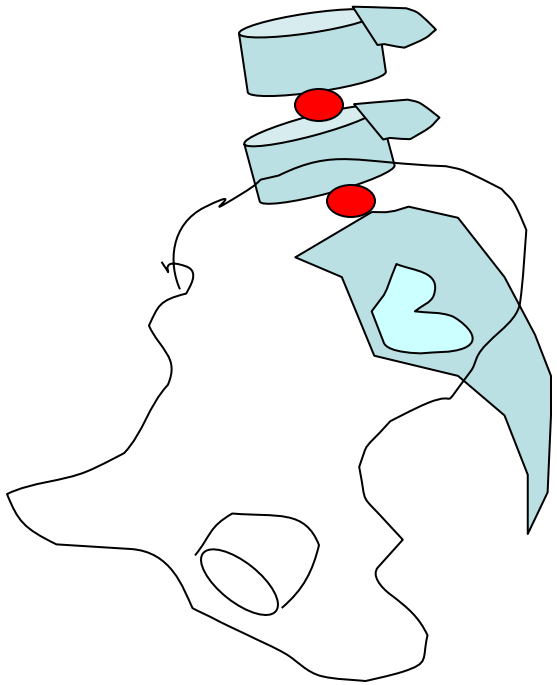
Common Sources of LBP



Any dysfunction involving the thoracic or lumbar spine, the sacroiliac joint or the hip can create low back pain.

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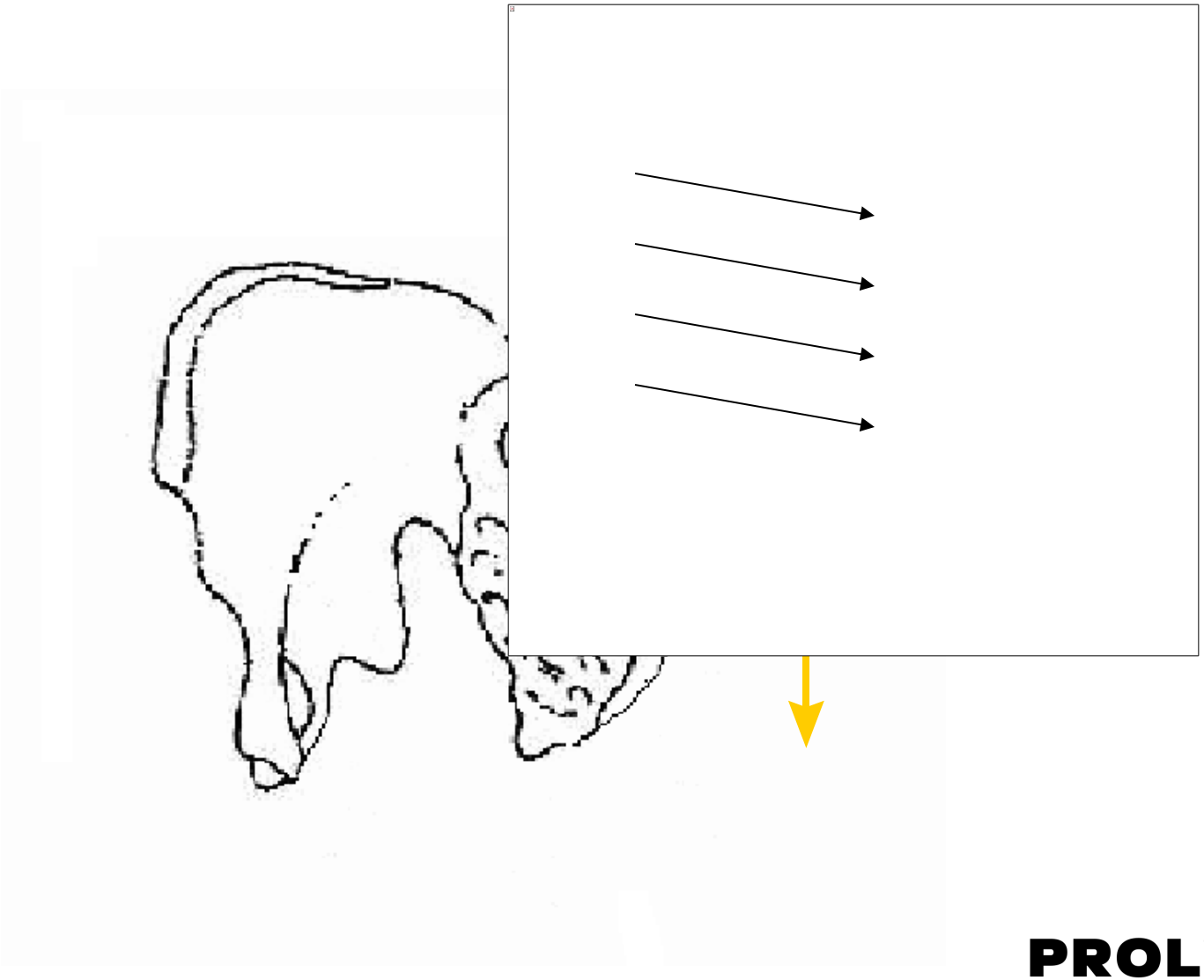
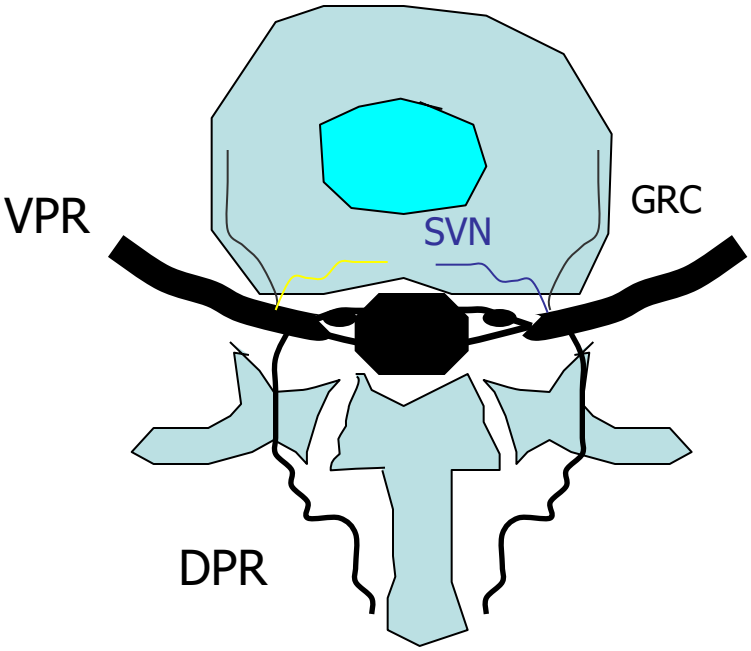
Common Sources of LBP



Common Sources of LBP



Disc

1. posteriorly - sinu vertebral nn.
2. laterally - gray rami communicantes
   a. branches of ventral rami
3. various types of nerve endings up to ½ annulus depth

Targets for dorsal primary ramus

1. facet joints
2. interspinous ligaments
3. back muscles

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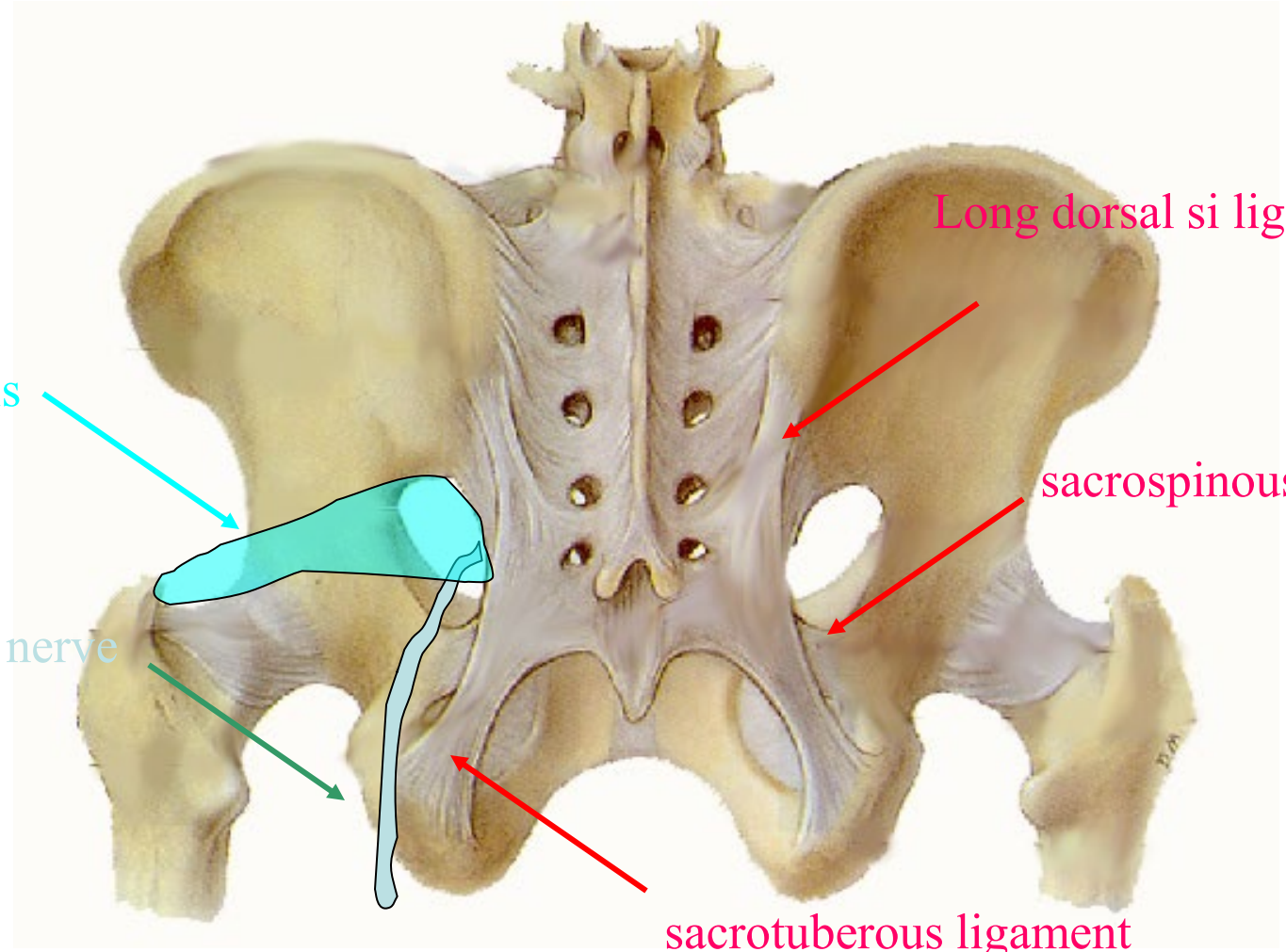
Common Sources of LBP



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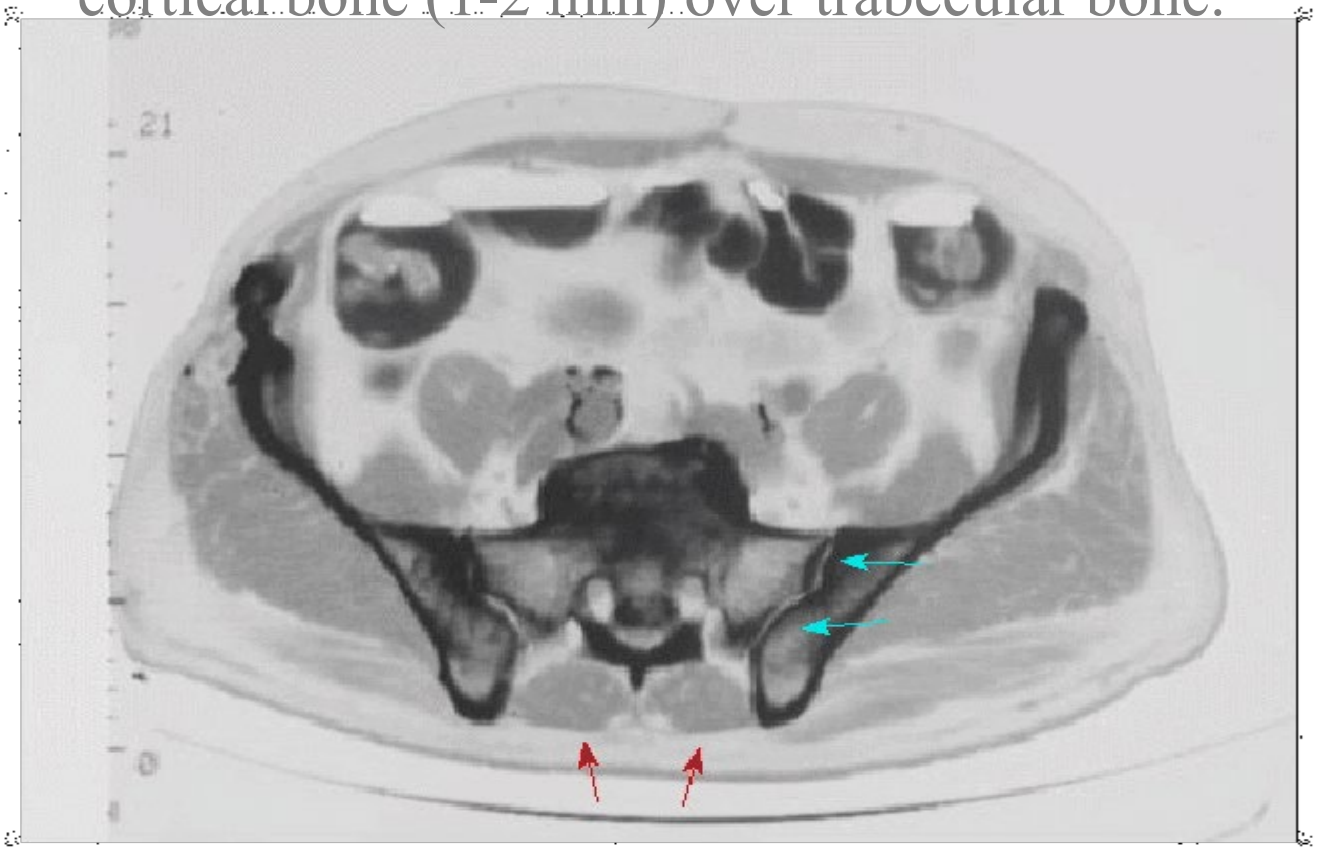
Role of the sacroiliac joint

The coxal bones consist of a thin shell of cortical bone (1-2 mm) over trabecular bone.



Muscles play an important role in helping the pelvis resist stress. When muscles can't work due to pain, the risk of injury increases.

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Back Facts

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Introduction

- COMMON, 2ND only to URTI
- Tx is symptomatic
- HISTORY is critical to ruling out serious issues.
- Conduct a Physical Exam to confirm and assess functional status

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- What Causes Acute Low Back Pain
  - Muscle strain?
  - DJD or OA?
  - Disc disease?
  - Who cares?
    - Initially they are all treated same for the most part.
    - Most all get better with conservative treatment.
- Beware of the serious causes!

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Evaluate for “Red Flags”: May Signal Serious Causes of LBP

- Cancer
- Infection
- Fracture
- Sciatica
- Cauda Equina syndrome
- Ankylosing spondylitis

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Sciatica

- The sciatic nerve is the longest nerve in your body. It runs from your spinal cord to your buttock and hip area and down the back of each leg. The term "sciatica" refers to pain that radiates along the path of this nerve — from your back down your buttock and leg. Source: Mayoclinic.com

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Cauda Equina Syndrome:

- Caused by massive midline disc herniation or mass compressing cord or cauda equina.
  - Rare (<.04% of LBP patients).
  - Needs emergent surgical referral.
- Symptoms: bilateral lower extremity weakness, numbness, or progressive neurological deficit.
- Ask about:
  - Recent urinary retention (most common) or incontinence?
  - Fecal incontinence?

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Ankylosing spondylitis

- Ankylosing spondylitis is one of many forms of inflammatory arthritis, the most common of which is rheumatoid arthritis. Ankylosing spondylitis primarily causes inflammation of the joints between the vertebrae of your spine and the joints between your spine and pelvis (sacroiliac joints). Source: Mayoclinic.com

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Evaluation of the Patient With LBP

- Start with a detailed history – your best diagnostic tool.
  - Get an idea of the severity.
  - Look for the “red flags” of serious causes.
- Use the physical exam to confirm what you suspect based on history.
- Keep in mind:
  - Most of the time you won’t have a definitive diagnosis.
  - Imaging rarely changes initial treatment.
  - Most patients get better with conservative TX.

What Was the Mechanism of Injury or Overuse?

- Was there an acute trauma or injury?
  - Sudden severe pain with bending.
  - Motor vehicle accident or fall.
- Was there a recent history of excessive lifting or bending?

- About 85-90% of LBP sufferers will get better in 3 days to 6 weeks
  - –Most back problems are not surgical cases
- Of the remaining 10-15%, most will never get completely well

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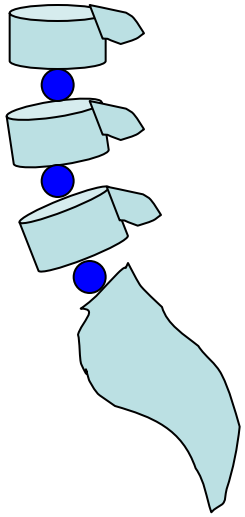
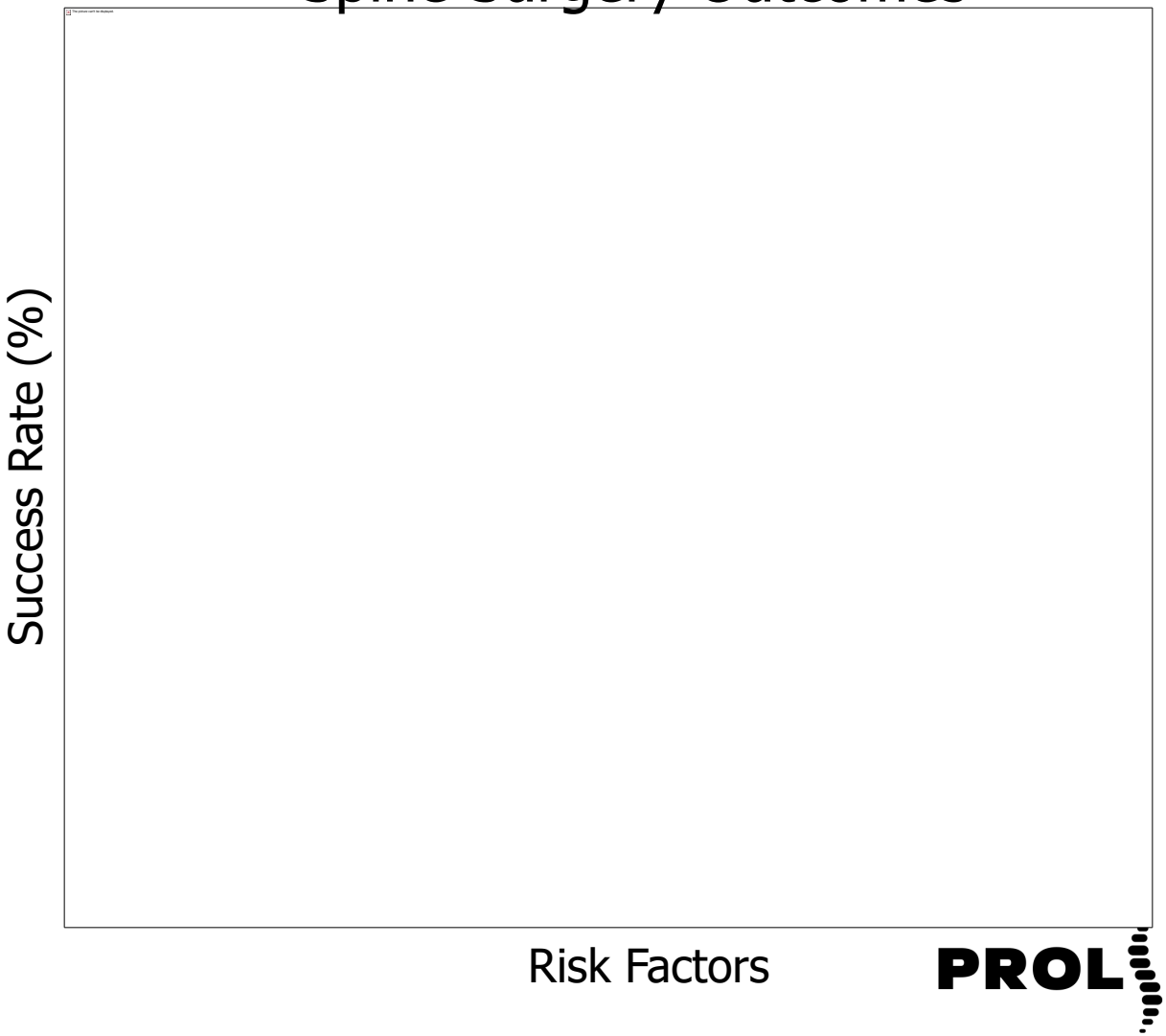
Treatment Approaches

Surgery





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Causes/Exacerbating Factors

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Mechanisms of Injury

- Congenital abnormalities
- Poor body mechanics
- Back trauma

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Pathology of Low Back Pain

- Causes:
  - –Herniated disks, facet pathology, spinal stenosis, stress fractures (spondys), compression fractures, ligamentous sprains, adaptive shortening, and muscle strain
- Do spinal abnormalities always cause low back pain?
  - –MRIs on 98 people with no back pain
    - Dr. Maureen Jensen, Hoag Memorial Hospital, Newport Beach, CA. (1995)
  - –Nearly 2/3 had spinal abnormalities including bulging or protruding discs

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Intervertebral Discs

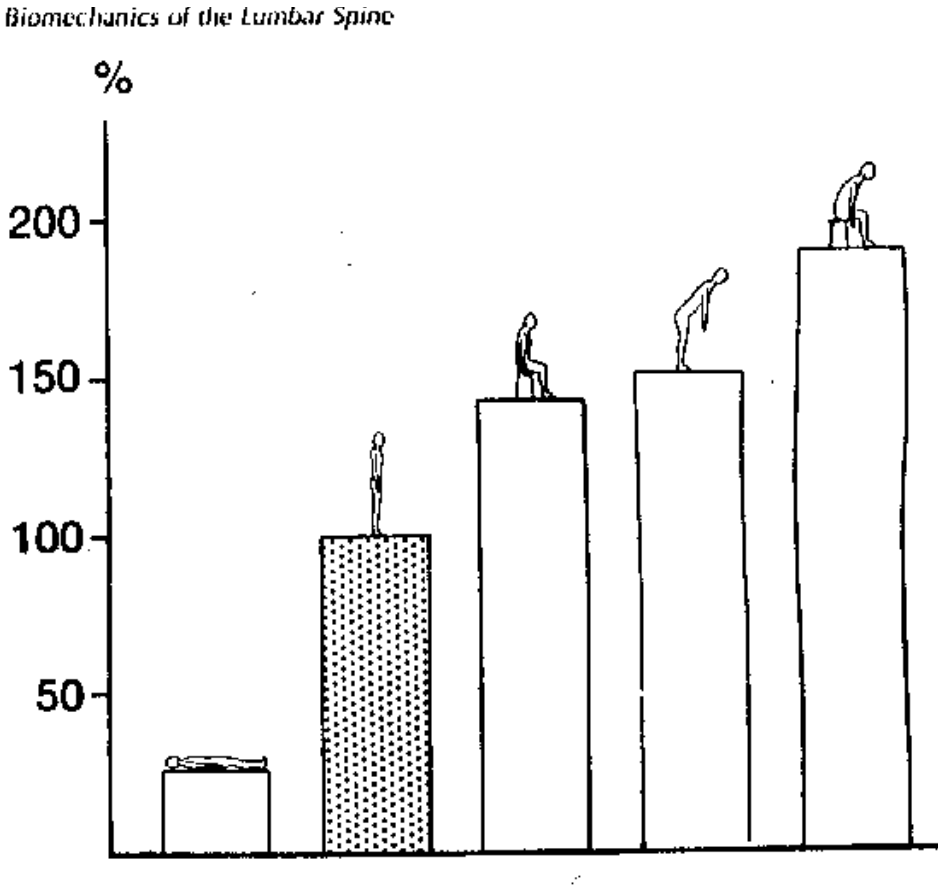

Fig. 10–12. The relative loads on the third lumbar disc for various body positions in livin subjects are compared with the load during upright standing, depicted as 100%. (Adapte from Nachemson, 1975.)

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The Key Players

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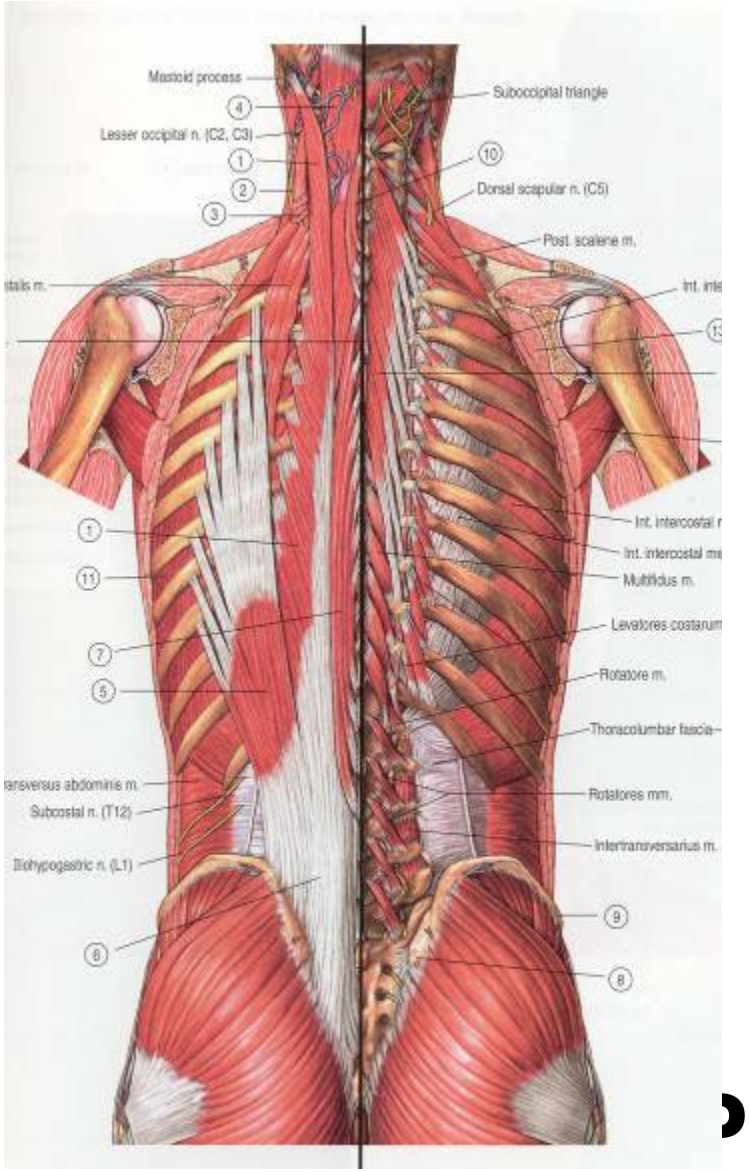
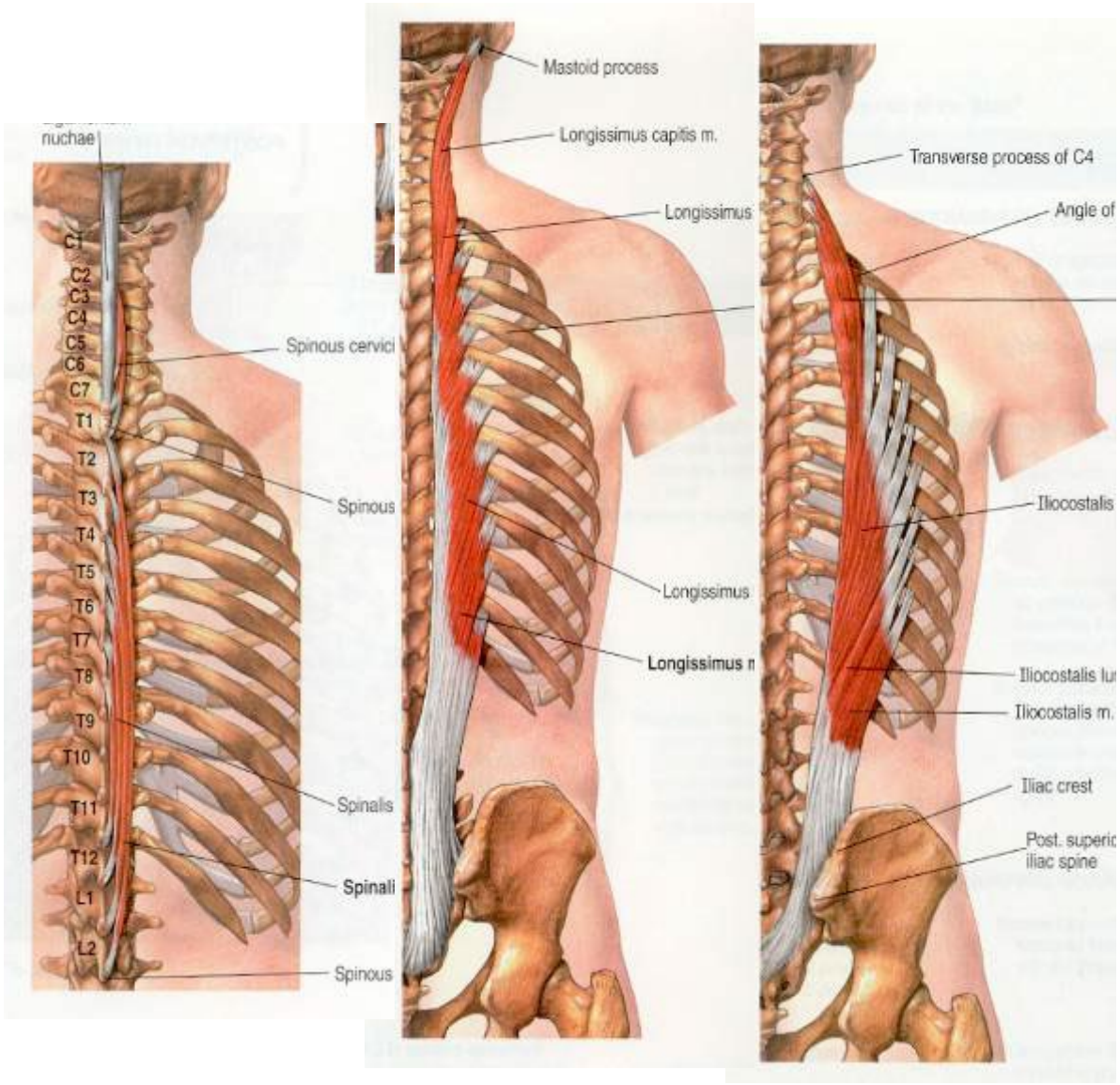
Trunk Musculature

Musculature

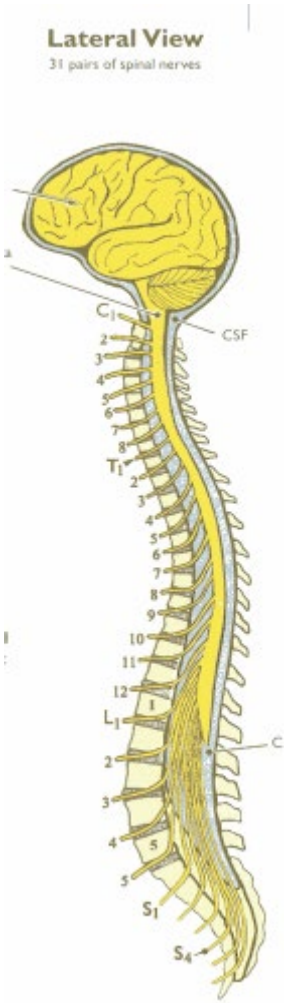
- Superficial
  - Thoracic group
  - Abdominal group
  - Erector Spinae group
    - Spinalis
    - Longissimus
    - Iliocostalis
- Deep
  - Transversospinal group
    - Multifidus
    - Rotatores
    - Intertransversarius

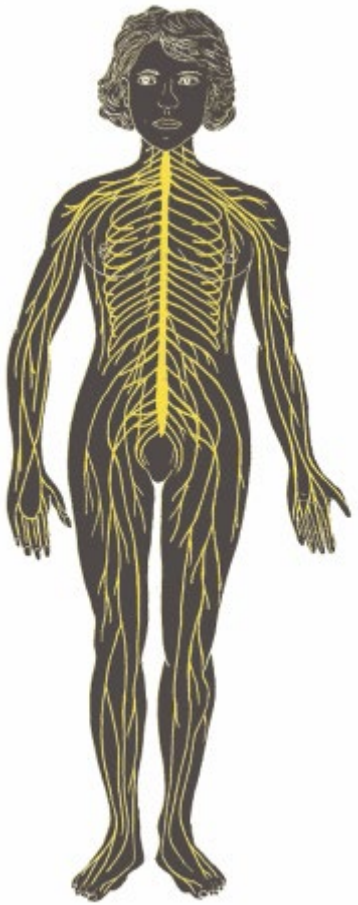



nuchae
C1
C2
C3
C4
C5
C6
C7
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
Spinous cervici
Spinous
Spinalis
Spinali
Spinous
Mastoid process
Longissimus capitis m.
Longissimus
Longissimus
Longissimus
Transverse process of C4
Angle of
Iliocostalis
Iliocostalis lu
Iliocostalis m.
Iliac crest
Post. superic
iliac spine

Nerves

- Spinal Nerves and Plexi
  - 31 spinal nerves
  - 4 Plexi
    - Cervical
    - Brachial
    - Lumbar (T12-L5)
      - Femoral, Obturator
    - Sacral (L4-S5)
      - Sciatic
        - » Tibial and Common Peroneal





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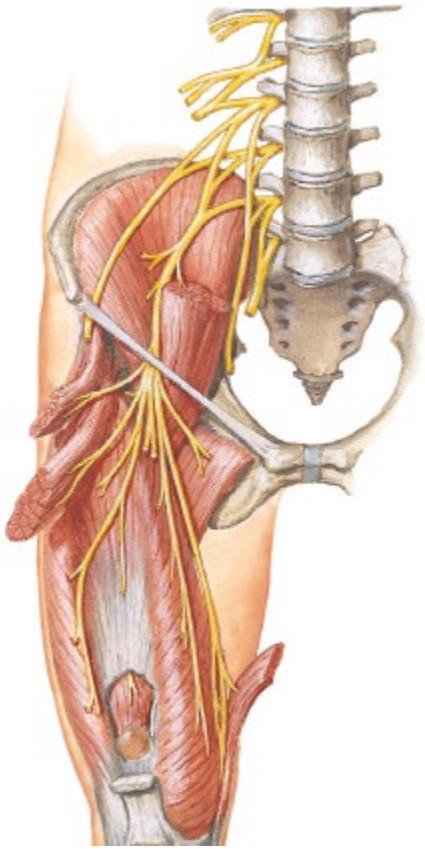

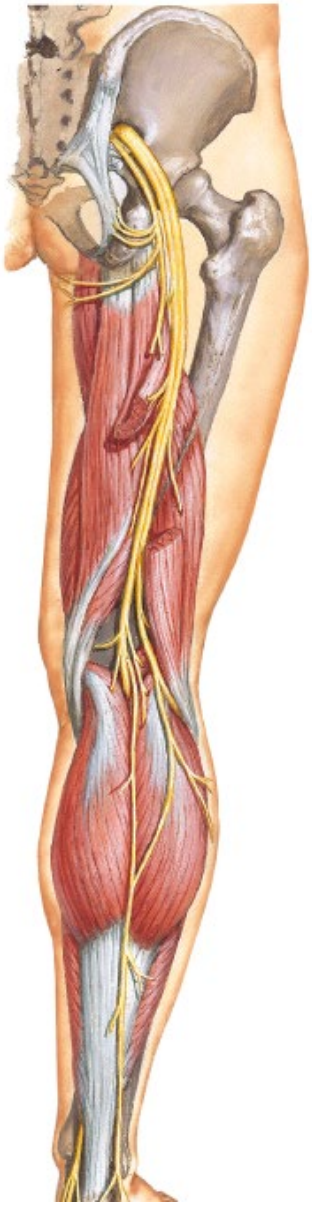

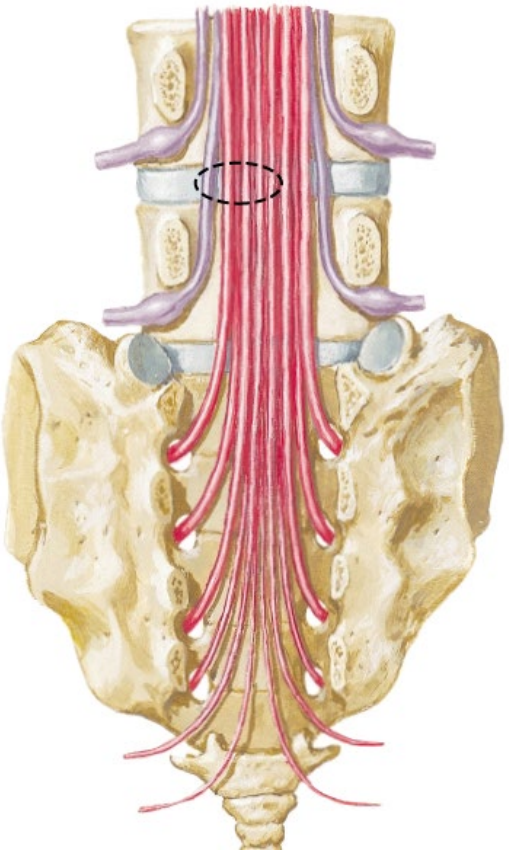

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Neural Testing

Dermatomes

-correspond to an area of skin that is innervated by the cutaneous neurons of a single spinal nerve or cranial nerve.

Myotomes

-correspond to groups of muscles innervated by a specific nerve root.

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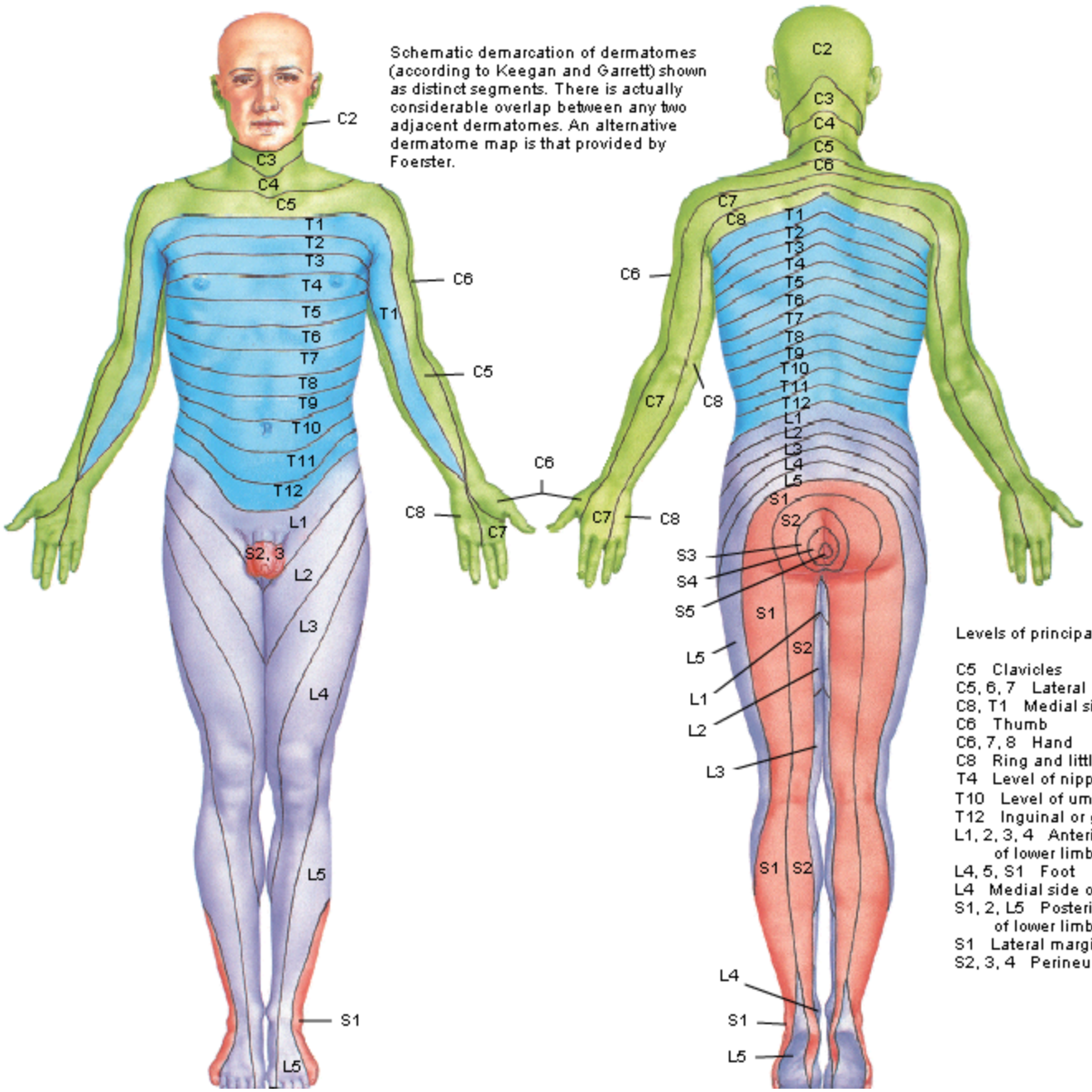

Schematic demarcation of dermatomes (according to Keegan and Garrett) shown as distinct segments. There is actually considerable overlap between any two adjacent dermatomes. An alternative dermatome map is that provided by Foerster.

Levels of principal dermatomes

C5 Clavicles
C5, 6, 7 Lateral parts of upper li
C8, T1 Medial sides of upper lir
C6 Thumb
C6, 7, 8 Hand
C8 Ring and little fingers
T4 Level of nipples
T10 Level of umbilicus
T12 Inguinal or groin regions
L1, 2, 3, 4 Anterior and inner su of lower limbs
L4, 5, S1 Foot
L4 Medial side of great toe
S1, 2, L5 Posterior and outer sur of lower limbs
S1 Lateral margin of foot and lit
S2, 3, 4 Perineum

Classification

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Classify patient

- Determine cause of problem
  - Postural
    - Inflammation of soft tissues
  - Dysfunctional
    - Adaptive Shortening
    - Strain or Sprain
  - Derangement
    - Disk
    - Facet joint
    - Stress Fracture

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Guide to Lumbar Spine Conditions

	Sprain/Strain	Dysfunction/ Postural	Derangement
ONSET	Sudden, simple move	Gradual	Sudden, simple move
PAIN	Severe ache, diffuse, spasm	Ache, intermittent	Sharp, burning, Localized or Radiating
MOBILITY	Reduced, movement increases pain	Reduced b/c of joint and CT stiffness	Guarded flexion, extension decreases pain
GOALS OF TX	Decrease pain Decrease spasm Restore ROM	Decrease pain Increase ROM Posture Strength/Flex	Decrease pain Centralize disc Prevention

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Lumbar Spine Conditions

- Low Back Muscle Strain
  - Acute (Overextension) and Chronic (Faulty posture)
- Facet Joint Dysfunction
  - Dislocation or Subluxation (Acute or Chronic)
- Low Back fracture
  - Compression, Stress, or Spinous and Transverse Processes
- Herniated Disc
  - Protrusion, Prolapse, Extrusion, and Sequestration
  - Local and Radiating Pain
    - Classic term “Sciatica”

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Lumbar Spine Conditions

- Spondylolysis
  - Unilateral defect in the pars interarticularis
- Spondylolisthesis
  - Bilateral defect in the pars interarticularis which causes forward displacement of vertebra.
- Spina Bifida Occulta
  - Congenital condition – spinal cord is exposed = delays in development.

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Sacroiliac Joint Conditions (note this is advanced)

- Sacral torsion
  - Forward or Backward torsion
- Ilium torsion, upslip, downslip, outflare, inflare
- Piriformis strain/trigger points

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Walk through it…What you are thinking.

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Unique risk factors for athletes

- High impact trauma:
  - football, rugby
- End range loading:
  - gymnastics, diving
- Overuse trauma:
  - impact loading: distance running
  - rotational loading: golf, baseball
  - prolonged sitting: travel

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Evaluation Techniques

- HOPS/HIPS
  - History, Observation/Inspection, Palpation, Special Tests
- Your first priority!
  - Establish the integrity of the spinal cord and nerve roots
  - History and several specific tests provide information (Dermatomes, Myotomes, Reflexes)

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Assessing the Low Back

- On-Field Assessment
  - Primary Survey
    - ABCs
    - Level of consciousness/Movement
    - Neurological system intact?
  - Secondary Survey
    - Pain, Dermatomes, Myotomes
    - ROM – only if no motor or sensory decrements
    - Further assessment on sidelines

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Assessing the Low Back

- Off-Field Assessment
  - HISTORY!!!!
  - Observation and Palpation
    - The Triad of Assessment
      - Asymmetry, ROM alteration, Tissue texture
  - Special Tests
    - Begin to be selective in you choices.
    - Classify tests as to their main findings
    - Use results of key tests to determine further testing

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Triad of Assessment

- **Asymmetry**
  - ASIS, PSIS, iliac crests, malleoli, feet
- **Range of motion alterations**
  - Standing and seated flexion tests
  - Single leg stance test (Stork)
  - Springing of facet and sacroiliac joints
  - Guarding of certain positions
- **Tissue texture abnormalities**
  - Muscles – “tootsie roll”

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Kinetic Chain

- Why do we need to assess the pelvis, hip and lower extremity?

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Foot conditions

- Over-pronation
  - **Hip flexion**
  - **Anterior pelvic tilt**
  - **Pelvic rotation/Tilt**
- Over-supination
  - **Hip extension**
  - **Hip external rotation**
  - **Pelvic rotation/tilt**

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Specific evaluation techniques

1. HISTORY!!!!
2. Alignment and symmetry
3. Lumbar spine active movements
4. Neurological Testing
5. Disc Pathology Tests
6. Extension mechanics
   - Prone assessment
7. Sacroiliac tests
8. Sitting forward flexion and hip flexion
9. Standing forward flexion and hip flexion
10. Flexibility testing
11. Feet alignment

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History

- Location of pain
- Onset of pain
  - Acute, chronic, or insidious
- Mechanism of Injury (MOI)
- Consistency of the pain
  - Constant vs. Intermittent pain
- Bowel and Bladder signs
- Changes in activity, surface, or equipment

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What positions bother you?

- Bending
- Sitting
- Rising from sitting
- Standing
- Walking
- Lying prone
- Lying supine

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Evaluation Techniques

- Observation/Inspection
  - Posture!
  - Range of motion
    - AROM
    - PROM
    - RROM
- Observe their mechanics as they enter the room, get on table, remove shirts or shoes

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Evaluation Techniques

- Palpation
  - This is your chance to “contain” the injury to specific structures.
  - Also allows for natural comparison of “normal” landmarks
- Muscular Tension
  - “Tootsie Roll Test”
- Ligamentous Tests
  - Spring Test

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Special Tests

- Are they malingering?
  - Hoover's Test
- Determine whether injury is associated with intervertebral disc, nerve root, dural sheath, or bony deformity.
- Positive tests for disc, nerve, or bony deformity ALWAYS warrant a referral to a physician

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Tests for Nerve Root Impingement

- Valsalva test
- Milgram test
- Kernigs/Brudzinski's test
- Straight Leg Raise – Affected and Well
- Quadrant test
- Slump test

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– Milgram and Hoover Straight Leg Raising Test

- Milgram test involves a bilateral straight leg raise that increases intrathecal pressure placing pressure on the disk and nerve roots
- The Hoover test utilizes a unilateral straight leg raise with a positive test indicative of malingering

Figure 25-29 & 30

- Pelvic Tilt Test
  - Anterior and posterior tilts that increase the pain on the side being stressed indicate irritation of the SI joint
  - Can also be performed from side-lying

Figure 25-35

– Reverse Straight Leg Raise
  - If pain occurs in low back an L4 nerve root irritation may be present
– Spring Test
  - Downward pressure is applied through the spinous processes of each vertebrae to assess anterior/posterior motion
  - Can also be performed on transverse processes to assess rotational movement
  - Useful to determine hypomobility or hypermobility of specific vertebral segments

Figure 25-38

– Prone Knee Flexion Test

- Comparison of apparent leg lengths w/ athlete prone long-lying and w/ knees flexed to 90 degrees
- If there is a short side it is indicative of a posteriorly rotated SI joint
- If upon flexing the knees the lengths equalize, the posteriorly rotated SI joint is indicated

Figure 25-39

- Tests Done in Side-lying
  - Posterior Rotational Stress Test
    - Pain on movement near PSIS indicates irritation of the SI joint
    - Localizes pain to a specific point - does not indicate direction of dysfunction

Figure 25-40

- Tests Done in Side-lying
  - Femoral Nerve Traction Test
    - Hip is extended and knee is flexed to 90 degrees
    - As the hip is extended pain occurs in the anterior thigh = nerve root impingement in the lumbar area
  - Piriformis Muscle Stretch Test
    - Flexing both hips to 90 degrees and lifting the top leg
    - Increasing pain indicates myofascial pain in piriformis muscle
    - Resisting hip external rotation may also elicit pain

Slump Test

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Lumbar Quadrant

- Standardize patient positioning
- Stabilize the pelvis
- Guide the patient into Left Rotation, left side flexion, extension
- Sustain for 5 seconds if needed
- Note end-feel, range, pain and resistance

Lumbar Spine Conditions

- Low Back Muscle Strain
  - Very common and self-limiting
  - Acute (Overextension) and Chronic (Faulty posture)
  - Pain increases with passive and active flexion and resisted extension
  - Key Evaluative techniques:
    - History and Palpation
    - Rule out neural involvement
    - Test PROM, AROM, and RROM

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Lumbar Spine Conditions

- Low Back fracture
  - Compression or Stress
  - Body, Spinous Process, and Transverse Processes
  - Localized or diffuse pain
  - Treatment doesn’t relieve symptoms
  - X-ray and MRI are definitive diagnoses

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Lumbar Spine Conditions

- Facet Joint Dysfunction
  - Inflammation, sprain, degeneration
  - Dislocation or Subluxation (Acute or Chronic)
    - “stuck open” or “stuck closed”
- Usually localized but may involve several segments
- May be associated with nerve root impingement
- Often times pain decreases with activity

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Facet Joint Dysfunction

- AROM
  - Flexion = “opening” and Extension = “closing”
  - Lumbar facet joints “open” on right side with left lateral flexion and left rotation
  - Lumbar facet joints “close” on right side with right lateral flexion and right rotation
- Prone assessment – elbows to hands
- Spring test
- Quadrant test

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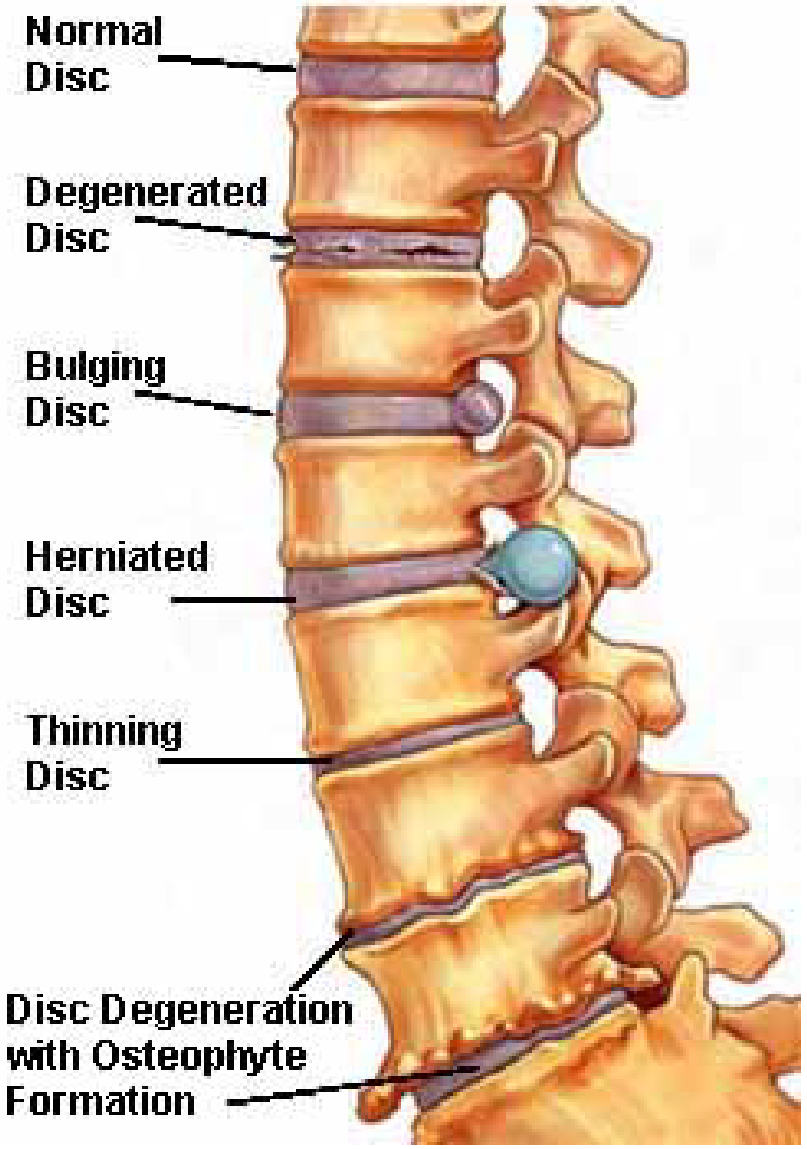
Examples of Disc Problems



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Lumbar Spine Conditions

- Herniated Discs
  - MOI: Overload (Direct or Indirect) or faulty biomechanics (or both)
  - **Protrusion, Prolapse, Extrusion, and Sequestration**
  - Pain usually aggravated by activity
  - Prolonged body position often increases symptoms
    - Patient may choose a position that relieves pain
  - Local and Radiating Pain
    - Reflexes and Sensory/Motor screening is essential
  - Definitive diagnosis comes from MRI

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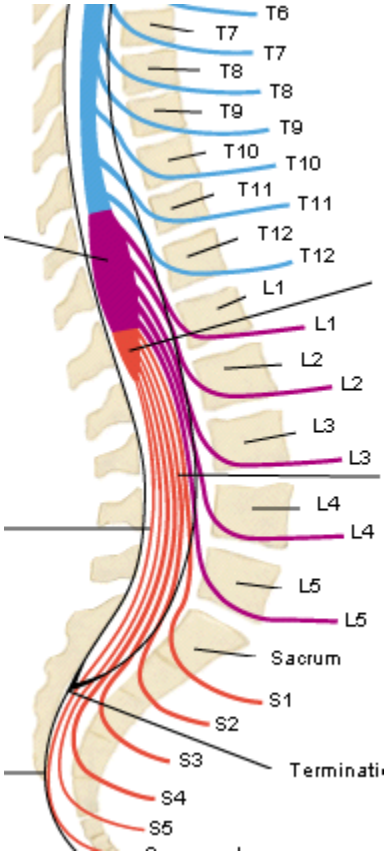
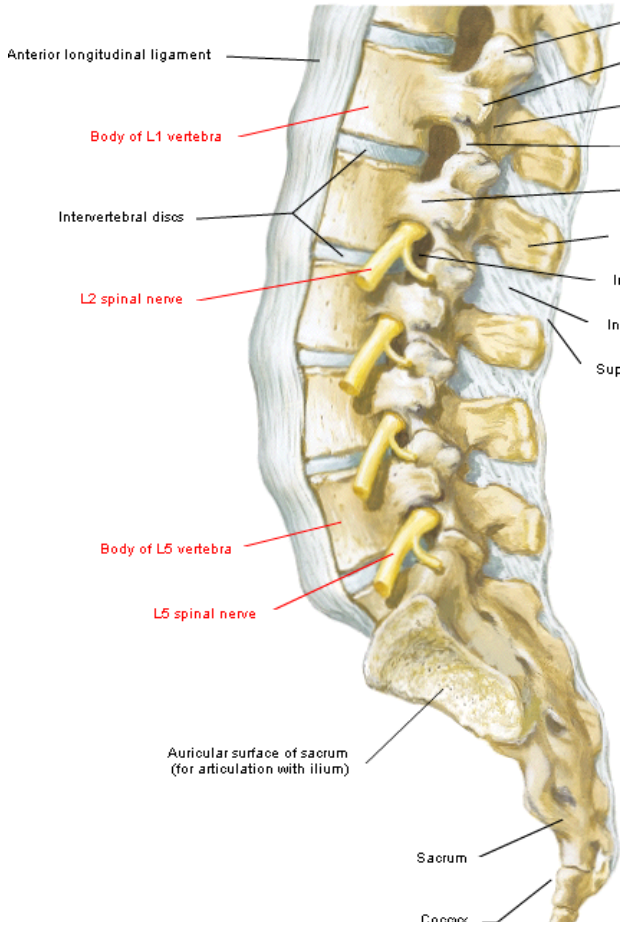
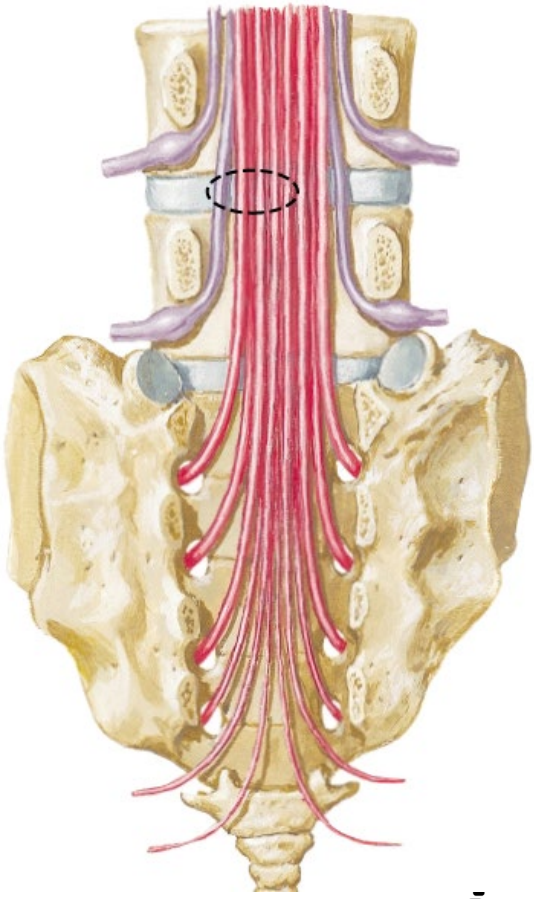
Disc and nerve root relationship







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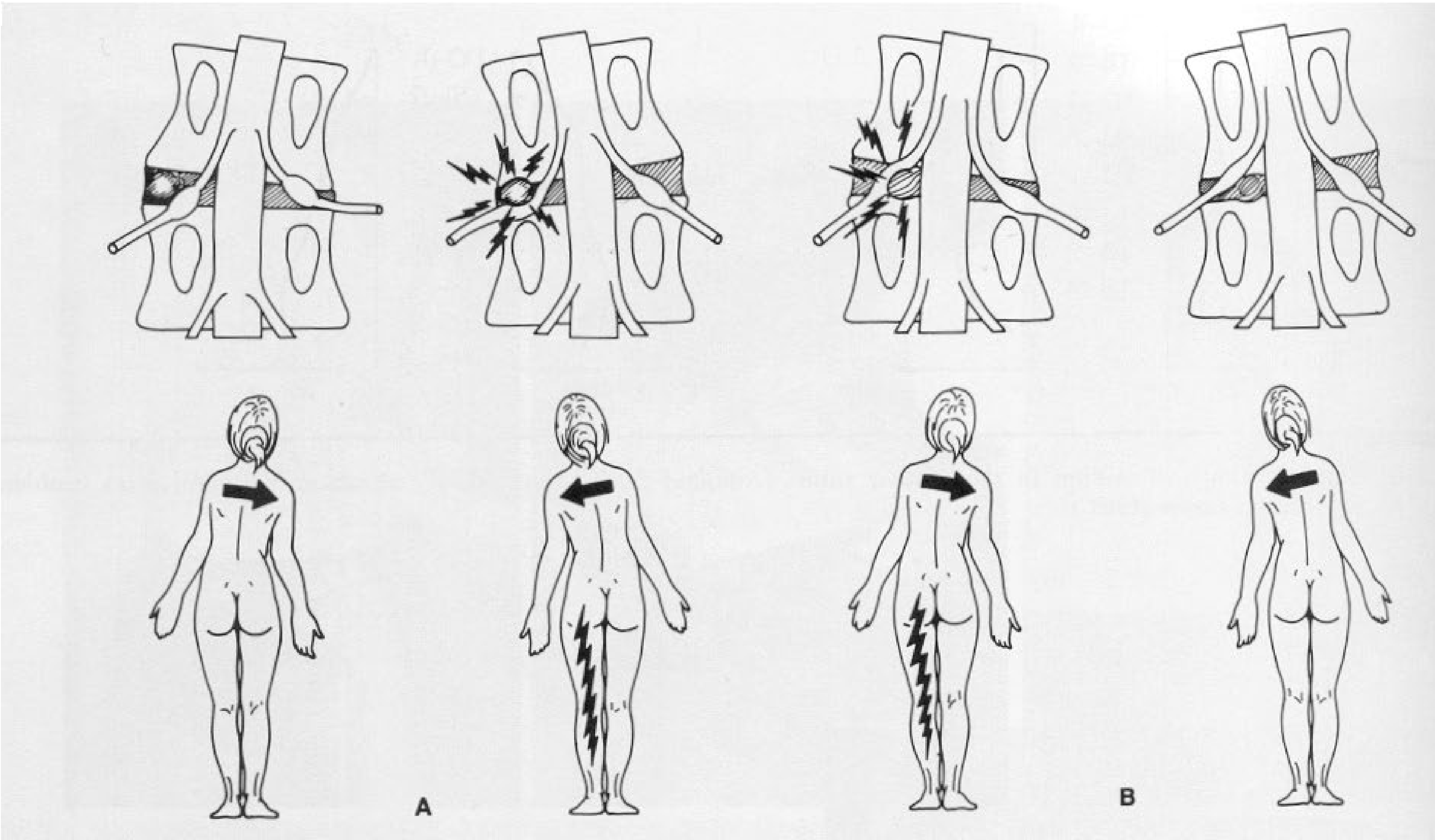

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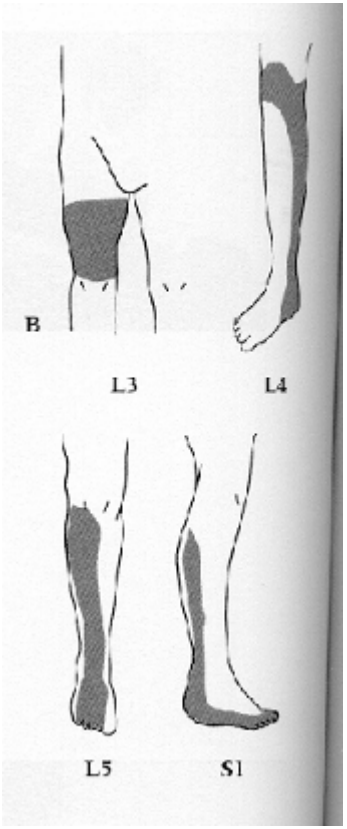
Neural Testing

- Dermatomes



- Myotomes
  - L1/L2 – Hip flexion
  - L3/L4 – Knee extension
  - L4 – Ankle dorsiflexion
  - L5 – Great toe extension
  - S1 – Eversion
  - S2 – Knee flexion

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Observation

- Posture
  - Plum line
- Motions
  - Flexion
  - Extension
  - Lateral flexion
  - Rotation

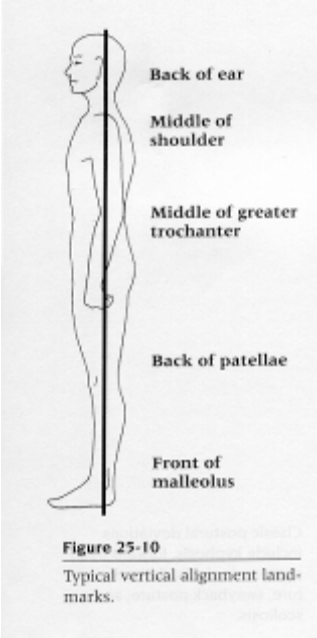
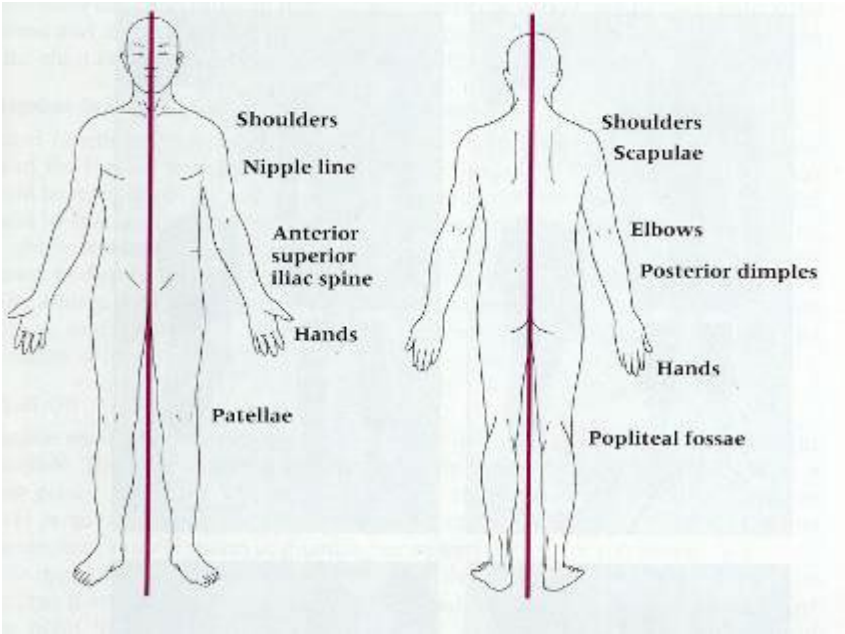
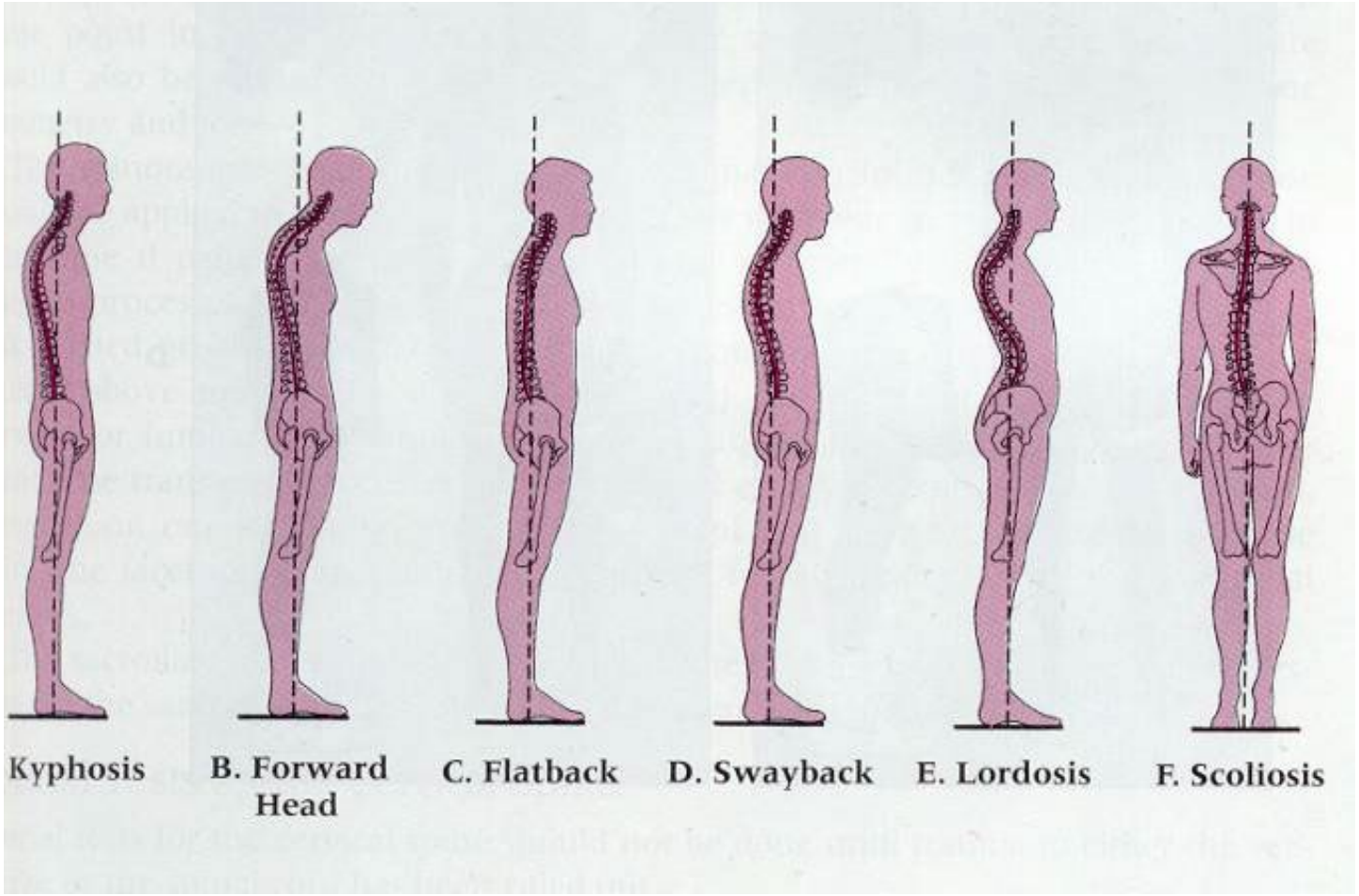


Figure 25-10

Typical vertical alignment landmarks.



Back Malalignments



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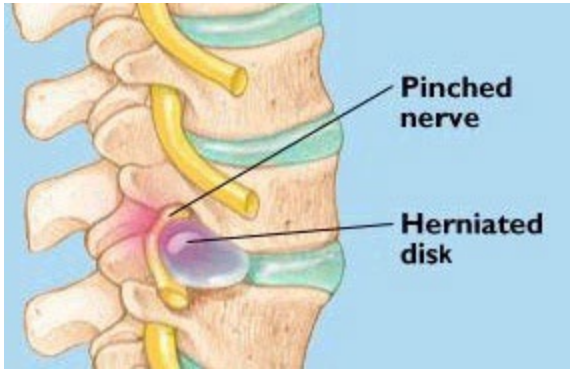
Discogenic Pain

- Special Tests:
  - Lower and Upper quarter screening
    - Dermatomes and Myotomes
  - Valsalva test
  - Milgram test
  - Well straight leg raise
  - Kernig's/Brudzinski test
  - Quadrant test



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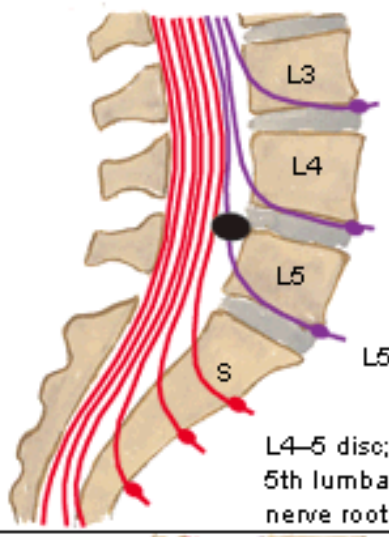
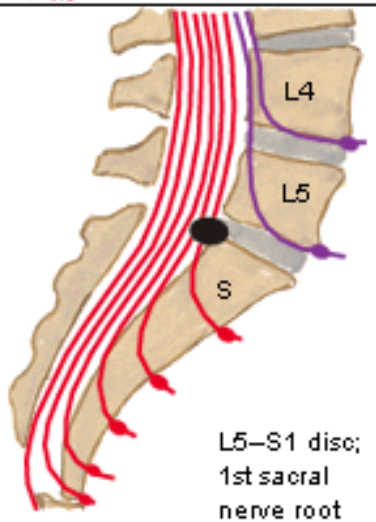
Clinical features of herniated lumbar nucleus pulposus

Level of herniation	Pain	Numbness	Weakness	Atrophy	Reflexes
 L4–5 disc; 5th lumbar nerve root	 Over sacroiliac joint, hip, lateral thigh and leg	 Lateral leg, first 3 toes	 Dorsiflexion of great toe and foot; difficulty walking on heels; foot drop may occur	Minor	Changes uncommon in knee and ankle jerks, but internal hamstring reflex diminished or absent
 L5–S1 disc; 1st sacral nerve root	 Over sacroiliac joint, hip, posterolateral thigh and leg to heel	 Back of calf, lateral heel, foot to toe	Plantar flexion of foot and great toe may be affected; difficulty walking on toes	 Gastrocnemius and soleus	 Ankle jerk diminished or absent

Lumbar Spine Conditions

- Sciatica
  - General term for inflammation of sciatic nerve
  - Sciatica is a result and NOT an injury in and of itself
    - Need to find what has caused the irritation
      - Disc, Muscle, Spondylopathy
  - Special tests:
    - Straight leg raise
    - Tension sign (Bowstrings)
    - Slump Test

Lumbar Spine Conditions

- Nerve Root Impingement/Dural Sheath Impingement
  - Special Tests:
    - Quadrant test
    - Femoral nerve stretch test
    - Kernig's/Brudzinski test
    - Slump test

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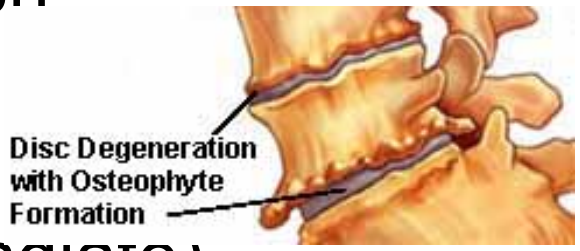
Lumbar Spine Conditions

- Spondylopathies
  - Mechanisms – Hyperextension
    - Onset – Insidious
    - Muscular imbalances
  - Pain usually localized (may radiate)
    - Increased during and after activity
  - Single leg stork stand
    - Unilateral – Pain with opposite leg
  - MRI or X-ray are definitive diagnoses



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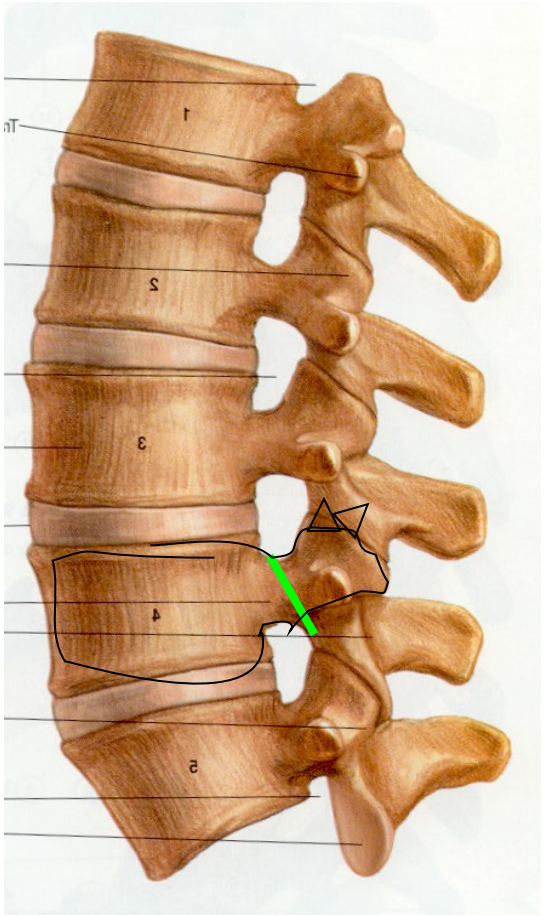
Spondylosis

- Spondylolysis
  - generally mean changes in the vertebral joint characterized by increasing degeneration of the intervertebral disc with subsequent changes in the bones and soft tissues.
  - Unilateral or bilateral **stable** defect in the pars interarticularis
  - “Collared Scottie dog” deformity



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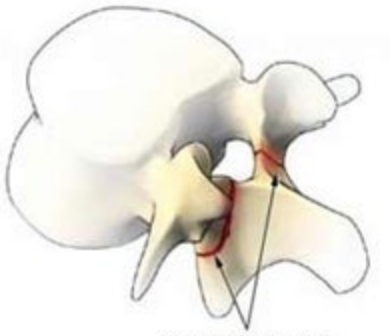
Spondylolisthesis

- Bilateral defect in the pars interarticularis which causes forward displacement of vertebra.
- “Decapitated Scottie dog” deformity
- “Step off deformity”
- Adolescents and women



Spondys

- Treatment:
  - REST and ice
  - Flexion is best.
  - Reduce extension moments.
  - Bracing sometimes a solution.

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Sacroiliac Conditions

- Hip, Ilium, and Sacral problems can stand alone

  OR

- Can be connected to low back symptoms.
  - Cause or effect?

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CAUSE or EFFECT?

- Pelvis or Sacral alignment
- Hamstring Tightness
  - Straight Leg Raise
  - 90/90 test
- Hip Flexor tightness
  - Thomas Test
  - Trigger points
- Piriformis tightness
  - IR of hip is limited
  - Trigger points

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Special Tests for Pelvis and Sacrum

- Alignment
  - Supine and prone
  - Prone extension
- Sitting forward flexion and hip flexion
  - Monitoring PSIS
  - Monitoring low back
- Standing forward flexion and hip flexion
  - Monitoring PSIS
  - Monitoring low back
- Long Sitting Test
- Pen Dot Test
- FABERE
- Gaenslen's
- Compression/Distraction
- Outflare/Inflare

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Pelvis and Sacral Conditions

PELVIS

- Upslip
  - ASIS and PSIS higher
- Anterior Rotation
  - ASIS lower, PSIS higher
    - Tight hip flexor, weak gluteus
- Posterior Rotation
  - ASIS higher, PSIS lower
    - Tight piriformis/gluteus and weak hip flexor

SACRUM

- Flexion – sulcus is deep
- Extension – sulcus is shallow
- Forward Torsion
- Backward Torsion

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