Physical Assessment of the Patient with Low Back Pain

Maxim S. Eckmann, M.D.
Professor of Anesthesiology and Pain Medicine
UT Health San Antonio, Texas, USA

Faculty Disclosure

	Nothing to disclose
	Yes, as follows: X

Honoraria/Expenses	
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Goals and Objectives

- Outline an approach for organizing causes of low back pain (LBP)
- Apply organized approach to LBP to select and interpret physical exam maneuvers and assessments
- Recognize differential evaluation of LBP sources to include:
  - Acute vs Chronic LBP
  - Assessment of “Red Flags”
  - Myofascial LBP
  - Facetogenic LBP
  - Sacroiliac Pain
  - Radicular LBP
  - Discogenic LBP
  - Vertebral/Sacral Fracture Pain
  - Referred Pain
  - Non-specific LBP

Impact of Low Back Pain (LBP)

- Fifth most common reason for all physician visits (USA).
- Prevalence
  - 25% report at least 1 day LBP in last 3 months
  - 7-8% report severe LBP in last year
  - 75-85% lifetime prevalence in industrialized society
- Cost
  - $26 billion direct health care costs 1998, now >$80 billion
  - 2% of workforce compensated for LBP
  - 5% of patients w/back pain disability account for 75% of the total costs.

J Bone Joint Surg Am. 2018;100:368-74

Factors Associated with Low Back Pain

- Heavy lifting
- Twisting and bending
- Physical activity
- Obesity
- Arthritis and osteoporosis
- Pregnancy
- Age > 30 years
- Bad posture
- Stress and depression

Predictors of Delayed Recovery

- Depression / Anxiety
- Passive coping
- Job Dissatisfaction
- Significant Disability
- Disputed Compensation Claims
- Somatization
- Emotional Distress

General Assessment

Physiologic Effects of Acute Pain, Generally Absent in Chronic Pain

- Metabolism increased
  - Poor healing
  - Muscle breakdown / weakness
- Cardiovascular
  - Tachycardia, HTN
- Decreased Movement
  - Increased risk of thromboembolism
  - Further deconditioning
- Respiratory Derangement
  - Tachypnea
  - Atelectasis
- Adrenal axis
  - Sodium and water retention
- Gastrointestinal
  - Reduced motility
- Immunological
  - Decreased NK cell count
  - Neurogenic inflammation

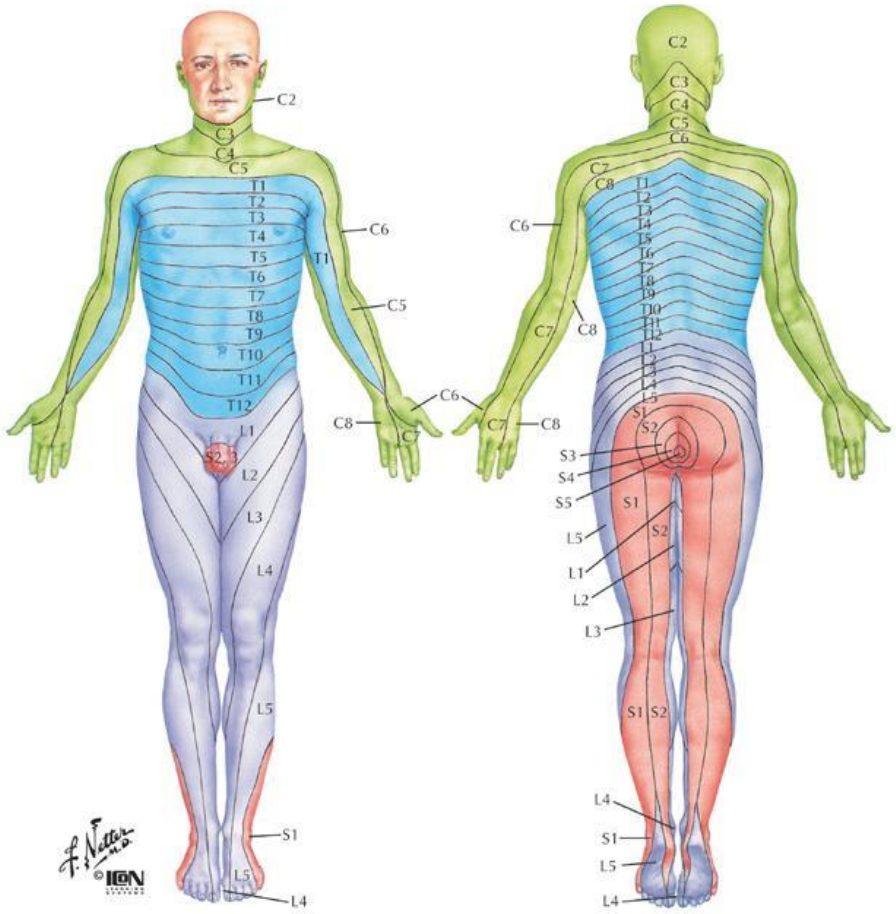
Detecting Pain: Pain Behavior

- First described by Fordyce as denoting the verbal and nonverbal behaviors exhibited by pain sufferers that serve to communicate the fact that they are experiencing pain.
- Examples:
  - Limping, guarding, grimacing, moaning.
- Origin:
  - 1) Nociceptive input, spinal reflexes, involuntary
  - 2) Operant conditioning (later)

Geriatrics, 1978 Jan;33:59-62

Neuroanatomy: Cutaneous Dermatomes

- Clavicle
  C4
- Thumb
  C6
- 4th, 5th finger
  C8
- Nipples
  T4
- Umbilicus
  T10
- Medial 1st Toe
  L4
- Lateral Foot, 5th Toe
  S1



Levels of principal dermatomes

C5	Clavicles
C5, 6, 7	Lateral parts of upper limbs
C8, T1	Medial sides of upper limbs
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 surfaces of lower limbs
L4, 5, S1	Foot
L4	Medial side of great toe
S1, 2, L5	Posterior and outer surfaces of lower limbs
S1	Lateral margin of foot and little toe
S2, 3, 4	Perineum

Neuroanatomy: Cutaneous Dermatomes for Referred Pain

- Central Diaphragm
  C4
- Lungs
  T2-T6
- Heart
  T1-T4
- Aorta
  T1-L2
- Esophagus
  T3-T8
- Pancreas, Spleen
  T5-T10
- Somach, Liver, GB
  T6-T9
- Adrenals
  T8-L1
- Small Intestine
  T9-T11
- Colon
  T10-L1
- Kidney, Ovaries, Testes
  T10-L1
- Ureters
  T11-T12
- Uterus
  T11-L2
- Bladder, Prostate
  S2-S4
- Urethra, Rectum
  S2-S4

Visceral Diseases referring pain to the low back

- Peptic ulcer
- Pancreatitis
- Nephrolithiasis
- Pyelonephritis
- Prostatitis
- Pelvic infection or tumors
- Aortic dissection

Consideration for consultation: Specific Problems to Target

- Axial Pain
  - Myofascial
  - Tendinous / Ligamentous
  - Facet Joint
  - Vertebral
  - Sacroiliac
  - Discogenic
- With Neurologic Sx
  - Radiculitis / Neuroforaminal Stenosis
  - Spinal canal stenosis
  - Piriformis Syndrome
  - Lumbar Post-Laminectomy Syndrome

Axial low back pain: History

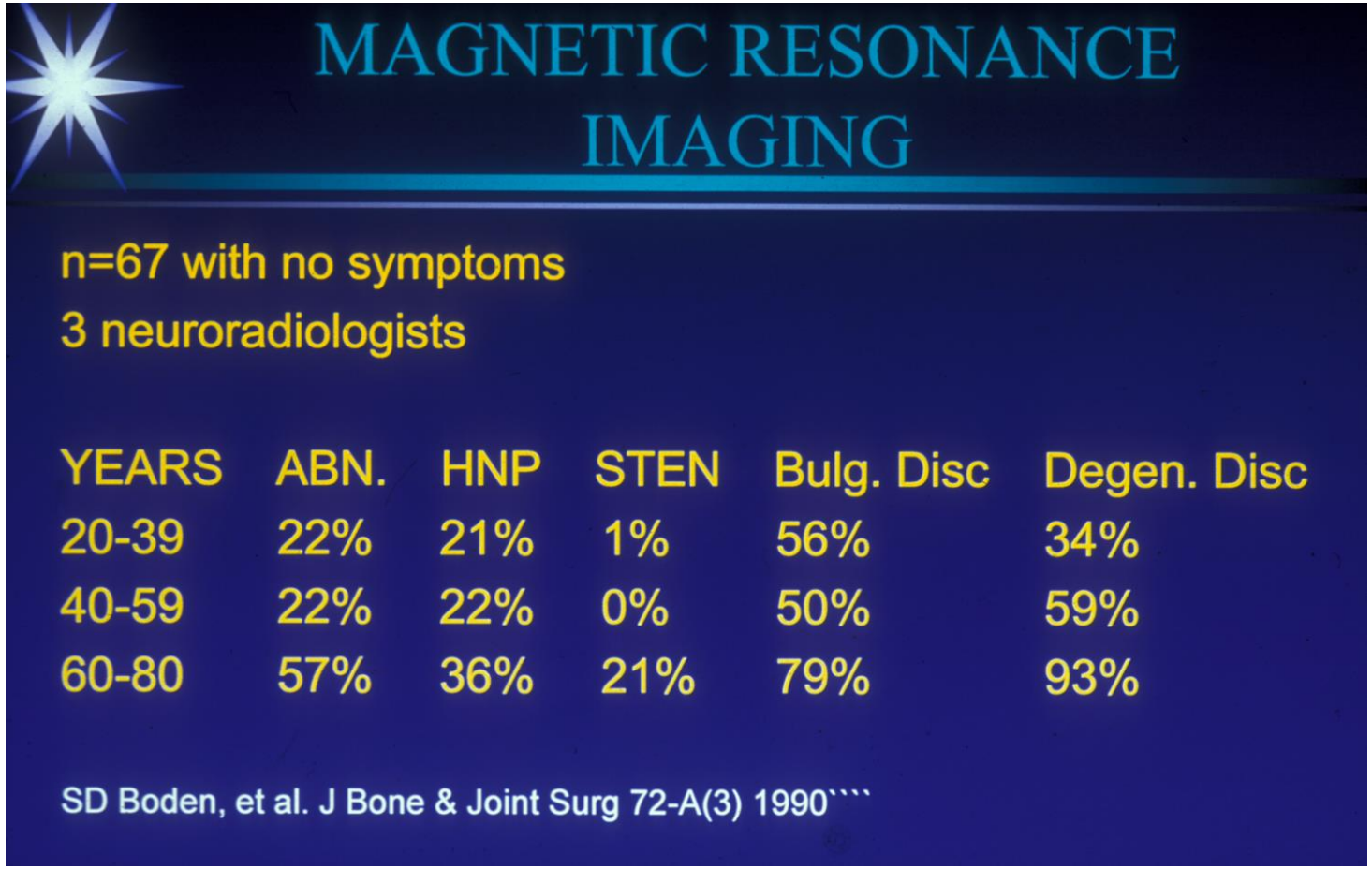
- Mechanism of Injury
  - Specific Injury (e.g. T-bone MVA)
  - Indolent course
- Radiation
  - Above knee (e.g. sacroiliac pain, facet pain)
  - Below knee, dermatomal (e.g. L5 radiculopathy)
  - Below knee, non-dermatomal (e.g. spinal stenosis, CRPS)
- Quality (key words: burning, shooting, tingling)
- Timing / Precipitating factors
- Psychosocial problems/stressors

Summary of Common Physical Exam Maneuvers for LBP

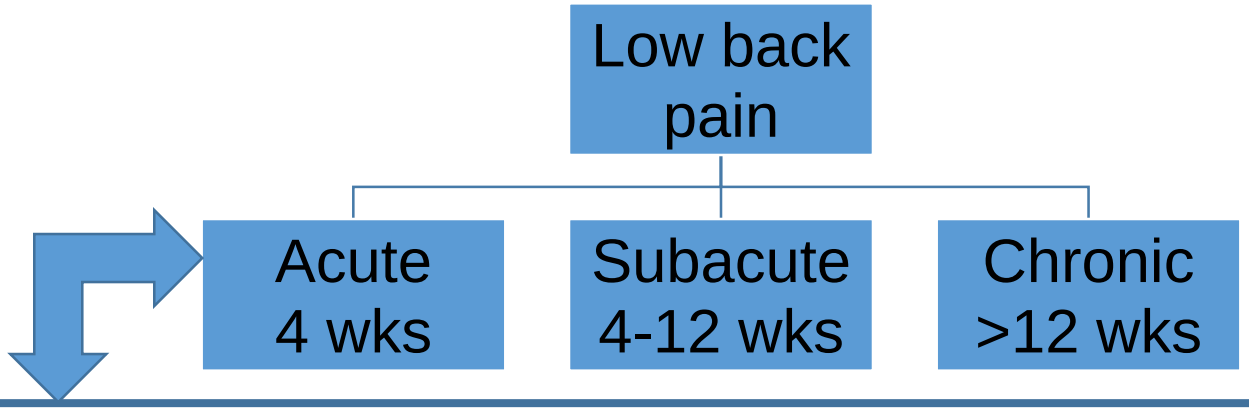
- Gait
  - Identify potential problems below the spine
- Neurological
  - Sensation, Strength (L5 extensor hallicus longus)
  - Reflexes: L4 (patellar), L5 (biceps femoris), S1 (ankle)
- Quadrant loading / Prone hip extension (facet joints)
- Segmental tenderness / trigger points (facet / myofascial)
- Faber / Gaenslen tests (hips/SIJ)
- Straight leg raise (SLR) test / Crossed SLR (radiculitis)
  - SLR 91% sensitive / Crossed SLR 88% specific *

**Spine.* 2000;25:1140-7.

Radiologic Imaging:
Importance of Clinical Correlation

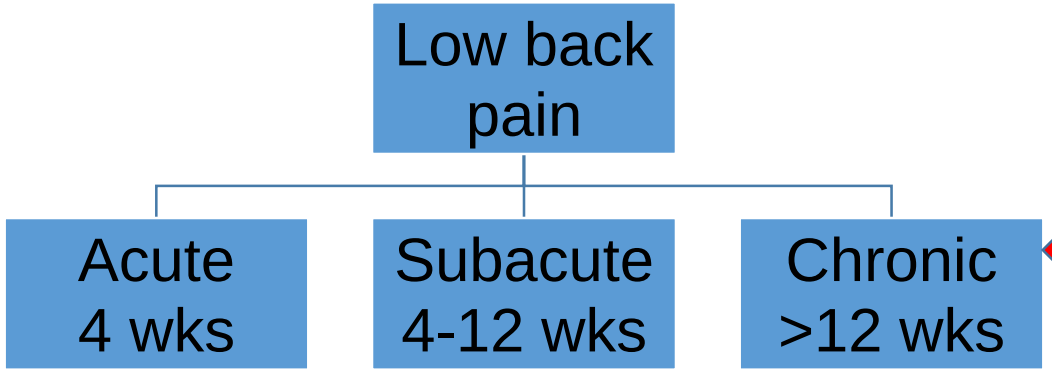


Acute versus Chronic Pain



- 50 to 75% recover in 4 weeks
- 90% recover in 6 weeks
- Functional outcome depends more on patient behavior than on the medical treatment
- Keys to Recovery
  - Maintain function
  - Manage psychosocial distress
  - Be as active as possible
  - Return to work as soon as possible

Acute versus Chronic Pain



- 30% of patients report at least moderate pain 1 year after acute episode
- 20% of patients report significant activity limitations

“RED Flags”

Red Flags

- “Red Flags” are symptoms suggestive of serious underlying pathology.
  - In isolation – not very predictive, guidelines vary
- Screening questions for acute LBP, or chronic LBP with change in symptoms
- Present in about 1-4% of cases.
  - Fracture (5-6%)
  - Malignancy (1-2%) esp. metastasis from prostate, breast and lung
  - Infection (1%) osteomyelitis, discitis, abscess
  - Cauda Equina Syndrome (0.4%)
  - Ankylosing spondylitis : 0.3%

- If serious cause of LBP is suspected, further workup is warranted
  - Imaging
  - Laboratory assay

Eur Spine J (2016) 25:2788–2802

J Bone Joint Surg Am. 2018;100:368-74

Associations of Serious Back Pain Etiology

- Fracture
  - Trauma
  - Age > 50y
  - Age > 70y
- Malignancy
  - H/o cancer
  - Unexplained weight loss
  - Pain awakens from sleep
  - Age > 50 y
  - Age > 70 y
- Infection
  - Fevers, chills, sweating
  - Recent infection
  - Pain awakens from sleep
  - Persistent night sweats
- Cauda Equina Syndrome
  - Recent loss of bowel control
  - Recent loss of bladder control
- Over 16 international guidelines and 46 symptoms/signs exist.

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Predictive value of risks, symptoms, signs

	No. (%)	Sens. *(%)*	Spec. *(%)*	PPV†	NPV†	PLR†	NLR†	Probability of Diagnosis *(%)*
Fracture	554 (5.6)							
Age of >50 yr	410 (4.1)	74	32.9	6.1 (5.6-6.7)	95.5 (94.8-96.2)	1.1 (1.05-1.16)‡	0.79 (0.69-0.91)‡	6.1
Age of >70 yr	171 (1.7)	3.9	80	8.4 (7.2-9.7)	95.2 (94.7-95.6)	1.55 (1.36-1.76)‡	0.86 (0.82-0.91)‡	8.4
Trauma	137 (1.4)	24.7	88.6	11.3 (9.7-13.3)	95.2 (94.8-95.7)	2.17 (1.86-2.54)‡	0.84 (0.81-0.89)‡	11.4
Malignancy	159 (1.6)							
Age of >50 yr	114 (1.2)	71.7	32.6	1.7 (1.4-2.1)	98.6 (98.1-99.0)	1.06 (0.96-1.17)	0.87 (0.68-1.11)	1.7
Age of >70 yr	36 (0.4)	22.6	79.5	1.8 (1.3-2.5)	98.4 (98.1-98.7)	1.1 (0.82-1.47)	0.97 (0.9-1.06)	1.8
Pain awakens from sleep	88 (0.9)	55.4	41.8	1.5 (1.2-1.9)	98.3 (97.8-98.7)	0.85 (0.83-1.1)	1.07 (0.9-1.27)	1.4
Unexplained weight loss	13 (0.1)	8.2	95.6	3 (1.7-5.1)	98.5 (98.2-98.7)	1.87 (1.1-3.17)‡	0.96 (0.92-1.01)	3.0
Cancer	49 (0.5)	32	95.6	10.5 (8-13.8)	98.9 (98.6-99.1)	7.25 (5.65-9.3)‡	0.71 (0.64-0.79)‡	10.6
Infection	120 (1.2)							
Fever, chills, or sweating	14 (0.1)	11.7	93.2	2 (1.2-3.5)	98.9 (98.6-99.1)	1.71 (1.04-2.81)‡	0.95 (0.89-1.01)	2.0
Pain awakens from sleep	69 (0.7)	57.5	41.8	1.2 (0.9-1.5)	98.8 (98.4-99.1)	0.99 (0.85-1.15)	1.02 (0.82-1.25)	1.2
Persistent sweating at night	21 (0.2)	17.5	86.1	1.5 (1-2.4)	98.8 (98.6-99.1)	1.26 (0.85-1.86)	0.96 (0.88-1.04)	1.5
Recent infection	29 (0.3)	24.2	97.4	10.2 (7.1-14.5)	99.1 (98.8-99.2)	9.31 (6.63-13.07)‡	0.78 (0.7-0.86)‡	10.2
Cauda equina syndrome	36 (0.4)							
Recent loss of bladder control	8 (0.1)	22.2	90.4	0.8 (0.4-1.7)	99.7 (99.5-99.8)	2.31 (1.25-4.27)‡	0.86 (0.72-1.03)	0.9
Recent loss of bowel control	5 (0.1)	13.9	95	1 (0.4-2.5)	99.7 (99.5-99.8)	2.78 (1.23-6.3)‡	0.91 (0.8-1.03)	1.1

J Bone Joint Surg Am. 2018;100:368-74

Increased value of considering multiple factors

	Sens. (%)	Spec. (%)	PPV†	NPV†	PLR†	NLR†	Probability of Diagnosis (%)
Fracture							
Combination 1: trauma and age of >50 yr	14.8	94.2	13.1 (10.6-16.0)	94.9 (94.4-95.4)	2.54 (2.05-3.16)‡	0.90 (0.87-0.94)‡	13.1
Combination 2: trauma and age of >70 yr	5.2	98.7	20.4 (14.3-28.1)	94.6 (94.2-95.1)	4.35 (2.92-6.48)‡	0.96 (0.94-0.98)‡	20.5
Malignancy							
Combination: unexplained weight loss and cancer	2.5	99.8	14.3 (4.7-33.6)	98.4 (98.2-98.7)	10.25 (3.6-29.21)‡	0.98 (0.95-1)	14.3
Infection							
Combination: fever, chills, or sweating, and a recent infection	7.5	99.4	13.8 (6.9-25.2)	98.9 (98.6-99.1)	13.15 (6.66-25.97)‡	0.93 (0.88-0.98)‡	13.8
Cauda equina syndrome							
Combination: recent loss of bladder control and recent loss of bowel control	8.3	97.2	1.1 (0.3-3.4)	99.7 (99.5-99.8)	3 (1.01-8.92)‡	0.94 (0.85-1.04)	1.2

J Bone Joint Surg Am. 2018;100:368-74

When to Refer to Specialist / Surgeon

- Bladder/bowel dysfunction
- Hypoesthesia over the perineum
- Rapidly progressing neurological dysfunction
  - Loss of strength/sensation
  - Hypo or Hyperreflexia
- Failed non-operative therapy in presence of known HNP, severe stenosis, spinal instability

Myofascial LBP

Myofascial Pain Syndrome (MPS)

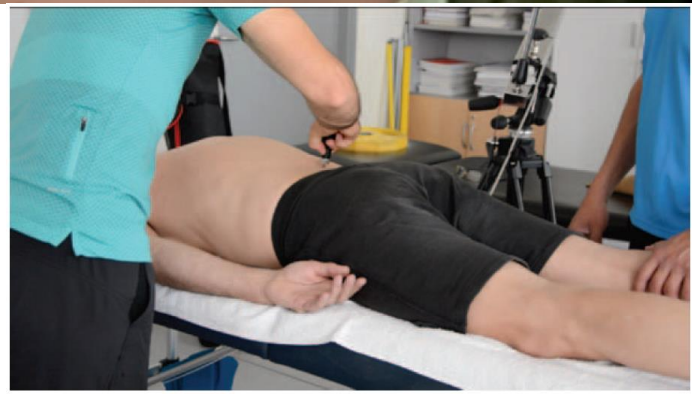
- Sensory, motor or autonomic signs, and symptoms originated by hyperirritable nodules in a taut band of skeletal muscle.
- Estimated lifetime prevalence 85%.
- These taut bands reflect myofascial trigger points (MTrPs).
- MTrPs radiate in characteristic patterns upon stimulation.
  - Treatment focuses on returning muscle bands to normal working length.
  - May be found in association with spine pain, possibly due to spontaneous motor endplate activity, stiffness, or central sensitization.
- Tender points, in comparison, characteristically do not radiate.

Calvo-Lobo et al. Medicine (2017) 96:10

Examination of MTrPs

Muscle Direction

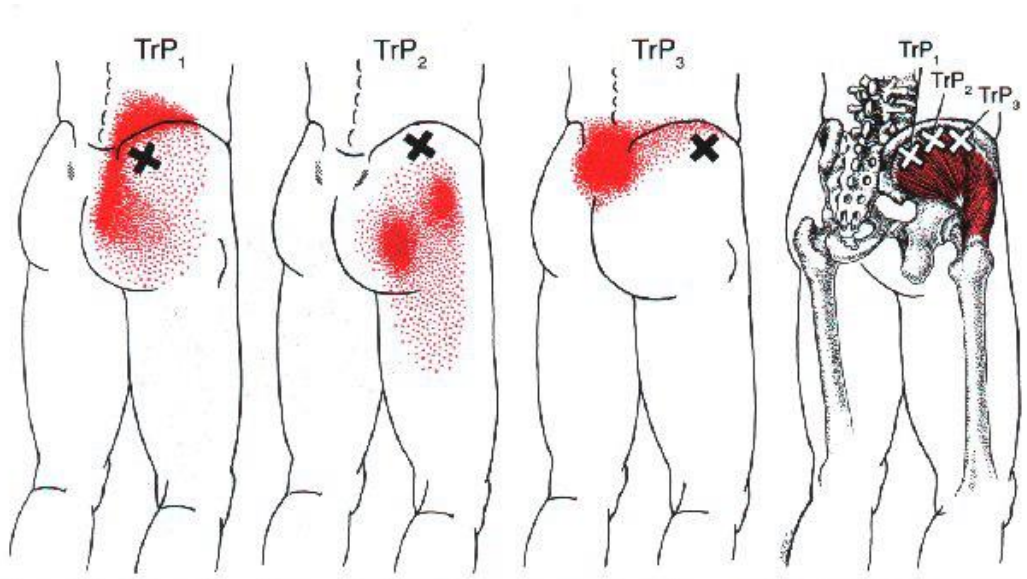
Finger Movement



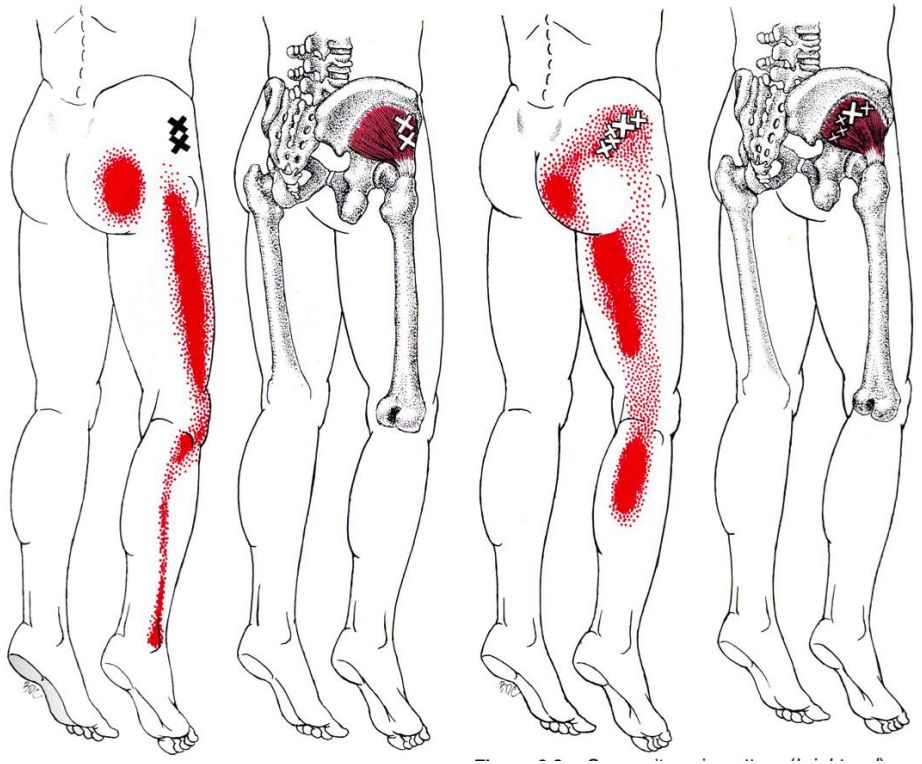
Pressure Pain Threshold Testing (PPT)
e.g. kg/cm^2

Referral Patterns for the Low Back / Lower Extremities

Gluteal

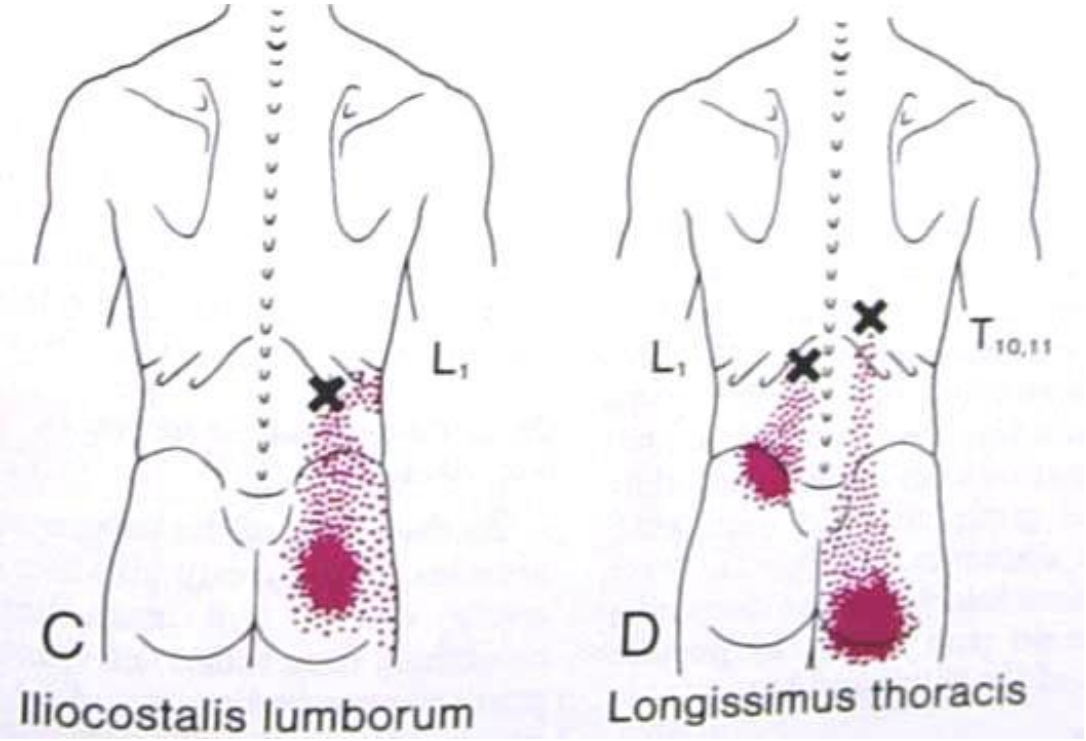


Tensor Fascia Latae

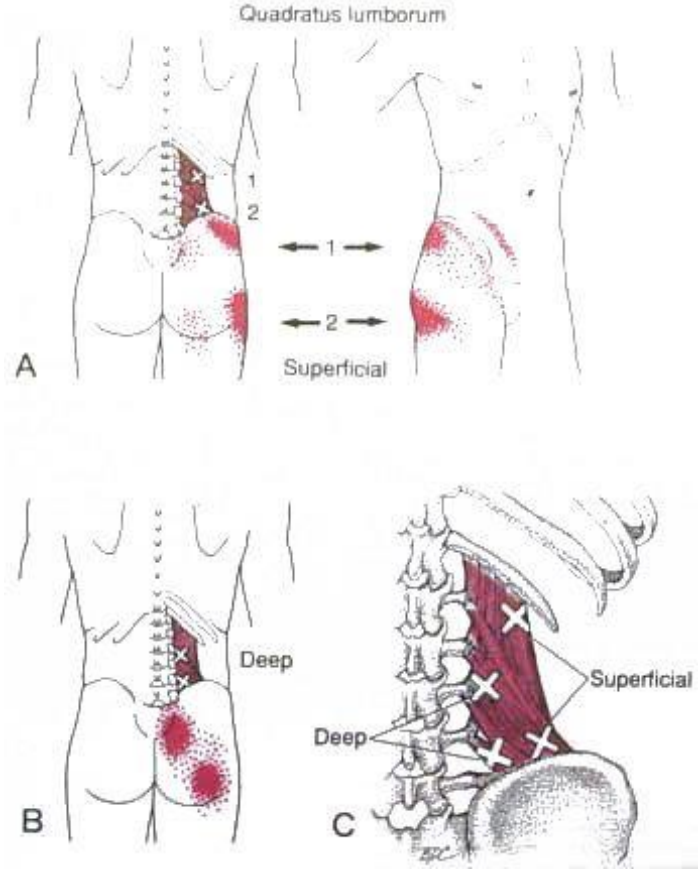


Referral Patterns for the Low Back / Lower Extremities

Extensor Muscles

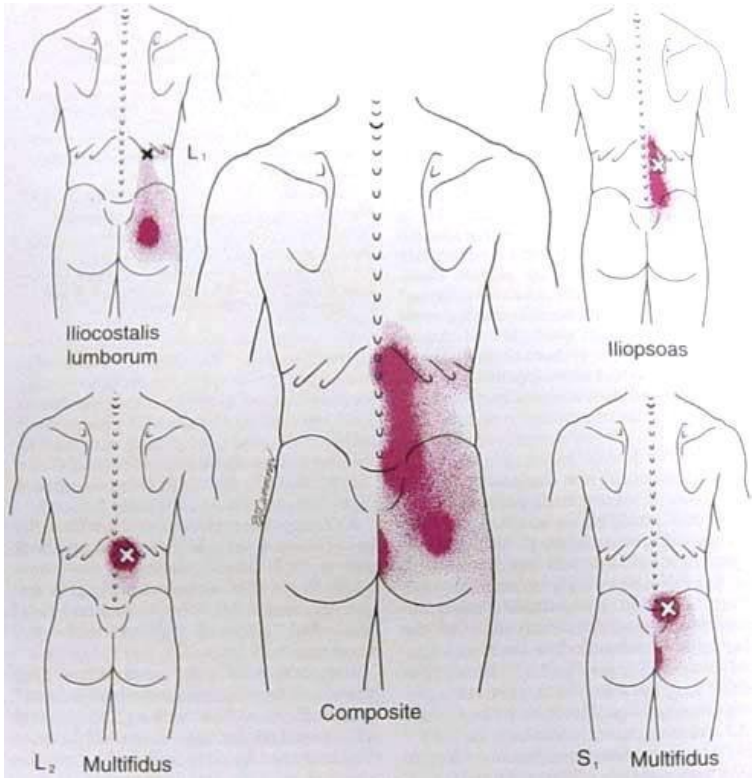


Quadratus Lumborum

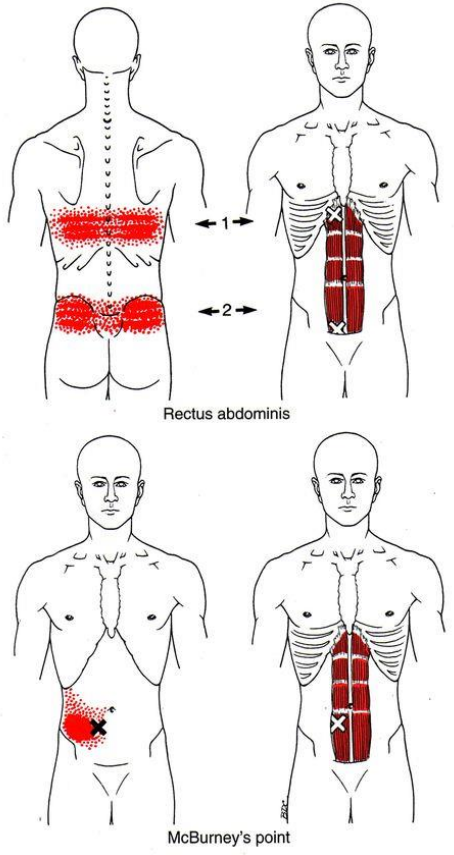


Referral Patterns for the Low Back / Lower Extremities

Multifidi and Others



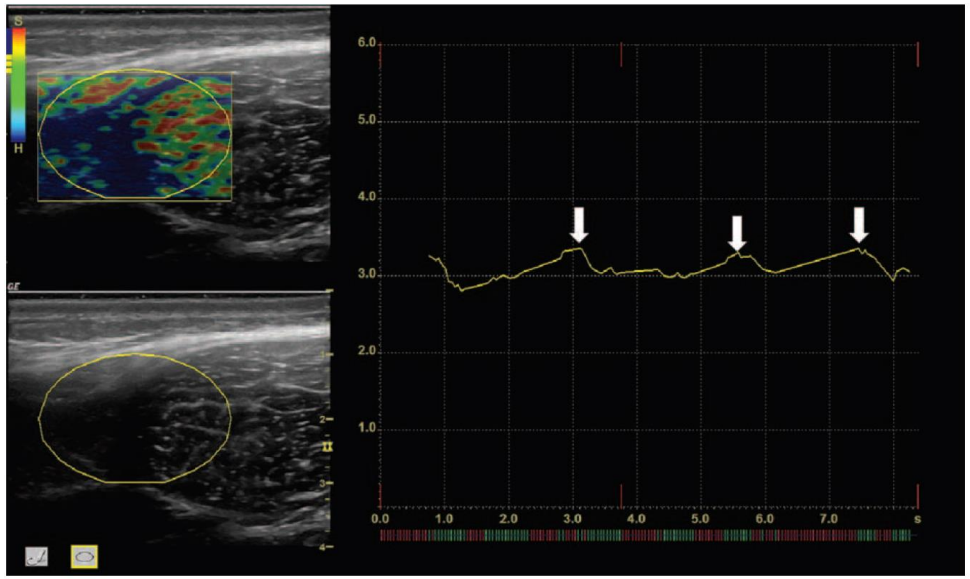
Rectus Abdominis



Quantitative Testing for MPS?

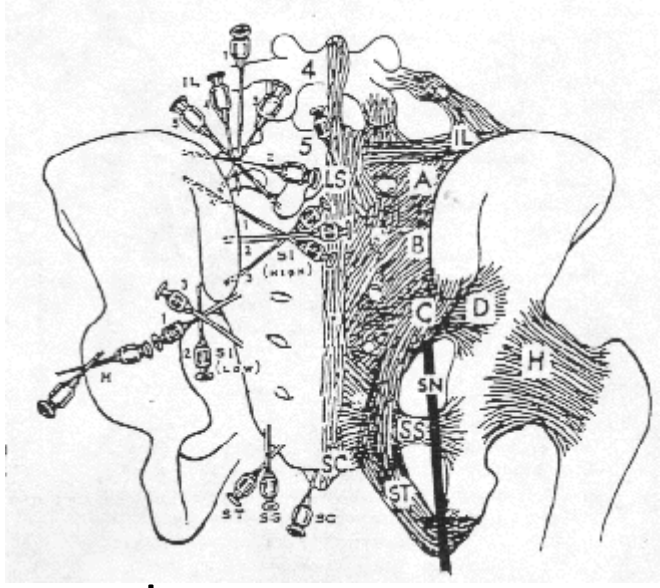
Sonoelastography and PPT difference between active MTrPs, latent MTrPs, and control points.

Outcomes	Active MTrPs (n = 20)	Latent MTrPs (n = 20)	Control points (n = 20)	ANOVA *P* (F)	Bonferroni correction *P* (mean difference)		
					A–L	A–C	L–C
Sonoelastography*	2.92 (0.35)	2.50 (0.22)	2.22 (0.40)	<0.001 (21.371)	0.001 (0.41)	<0.001 (0.69)	0.034 (0.27)
PPT, kg/cm^2	2.97 (0.82)	3.56 (0.77)	4.49 (0.90)	<0.001 (16.562)	0.091 (−0.59)	<0.001 (−1.51)	0.003 (−0.92)



Calvo-Lobo et al. Medicine (2017) 96:10

Axial Pain: Tendinous / Ligamentous pain

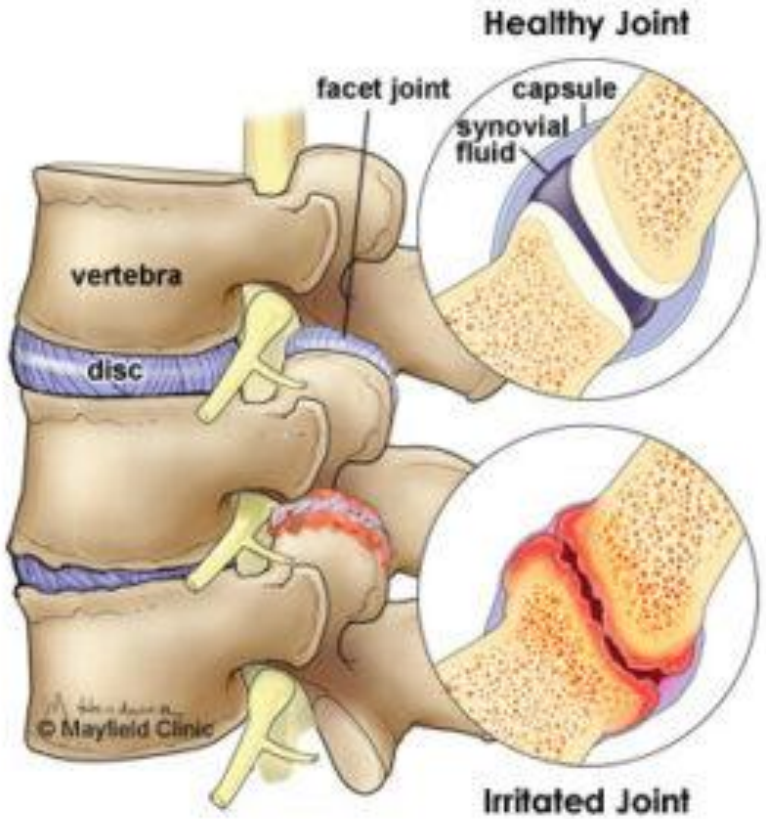


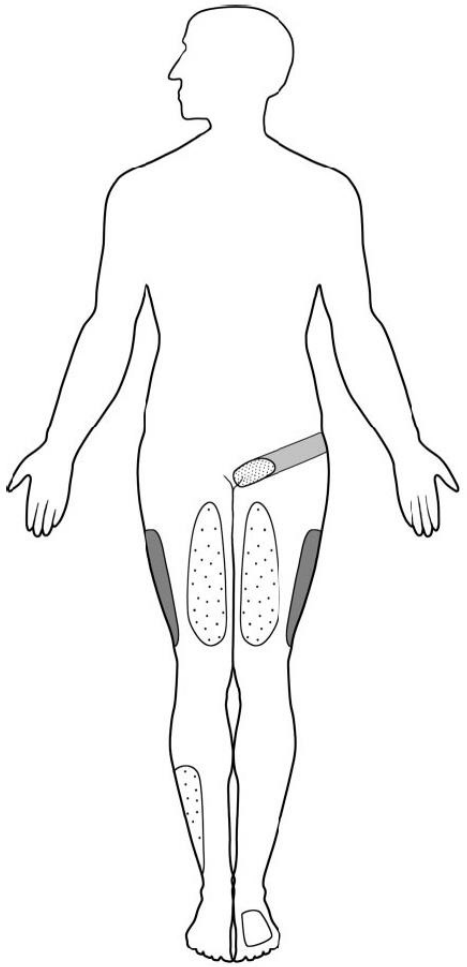
- Ligaments
  - Part of the spine stabilization system
  - Disc annulus / facet capsule / spinal ligaments
  - Embedded mechanoreceptors in ligaments important in maintenance of proper posture and muscle coordination
- Diagnosis
  - Difficult to differentiate from other sources of pain
  - Suspect in radiographically unremarkable spines.
- Treatment
  - Conservative / non-pharmacologic / pharmacologic
  - Bed rest / inactivity not recommended

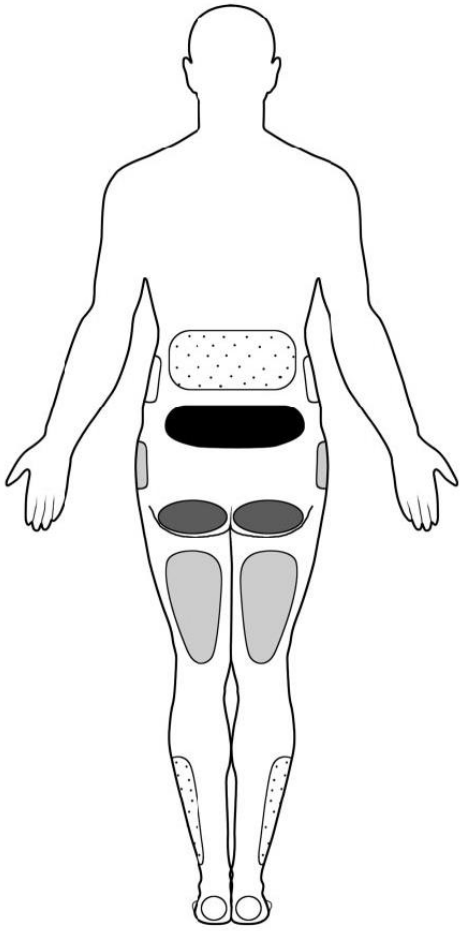
Am J Sports Med. 2008 Jul;36(7):1347-57.
Spine. 2004 Oct 1;29(19):2126-33.
Eur Spine J. 2006 May;15(5):668-76.

Facetogenic LBP

Clinical Presentation




Anterior

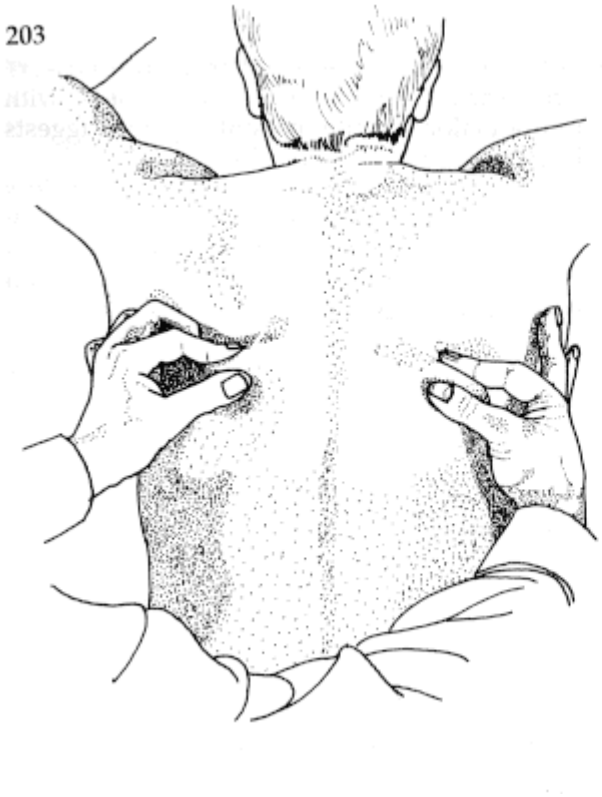

Posterior

Diagnosis of Lumbar Facet Pain

- Prevalence: 5-42% depending on the study. Increases with age.
- Classic Symptoms / Signs / Risk Factors
  - Axial (Unilateral) Pain
  - Radiation: lower facet joints - buttock, thigh, groin, and sometimes lower leg
  - Radiation: upper lumbar facet joints - flank, hip, groin, and lateral thigh.
  - No nerve root tension sign
  - Increased pain with back extension, quadrant loading (but can with flexion)
  - Paraspinal Tenderness
  - Age >65
- Contemporary studies have had difficulty confirming these signs/symptoms as predictive.
- Significant Referral Pattern Overlap
- Diagnosis confirmed with controlled diagnostic blocks

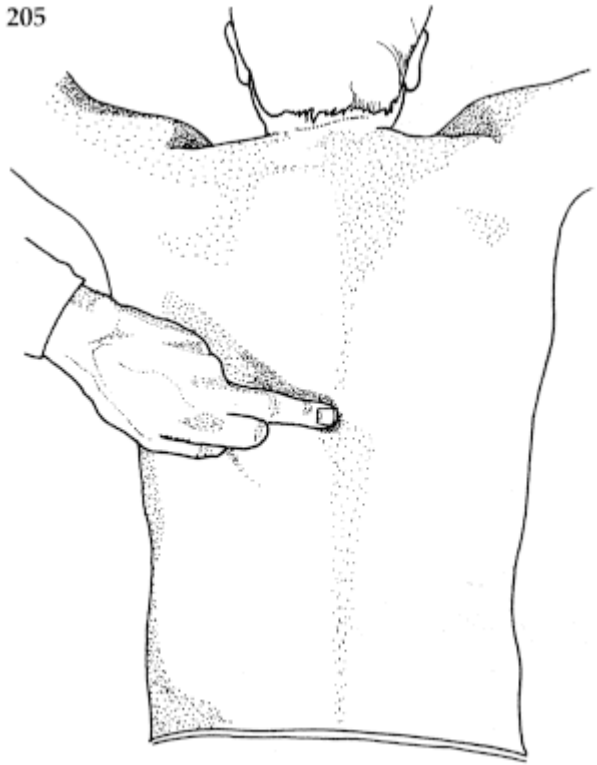
Anesthesiology 2007; 106:591–614

Exam – Facetogenic Pain vs Other Sources

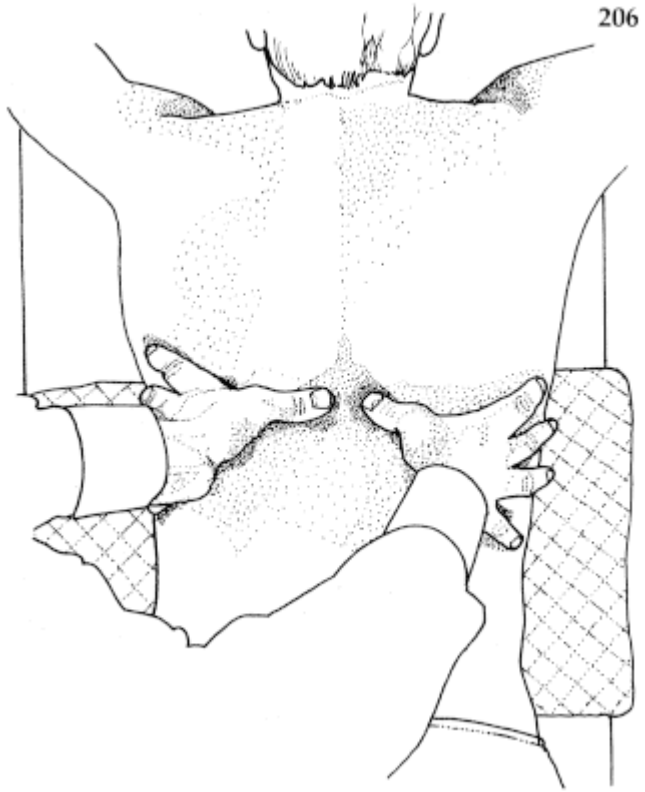


Evaluate for Superficial Tenderness

Examine muscles

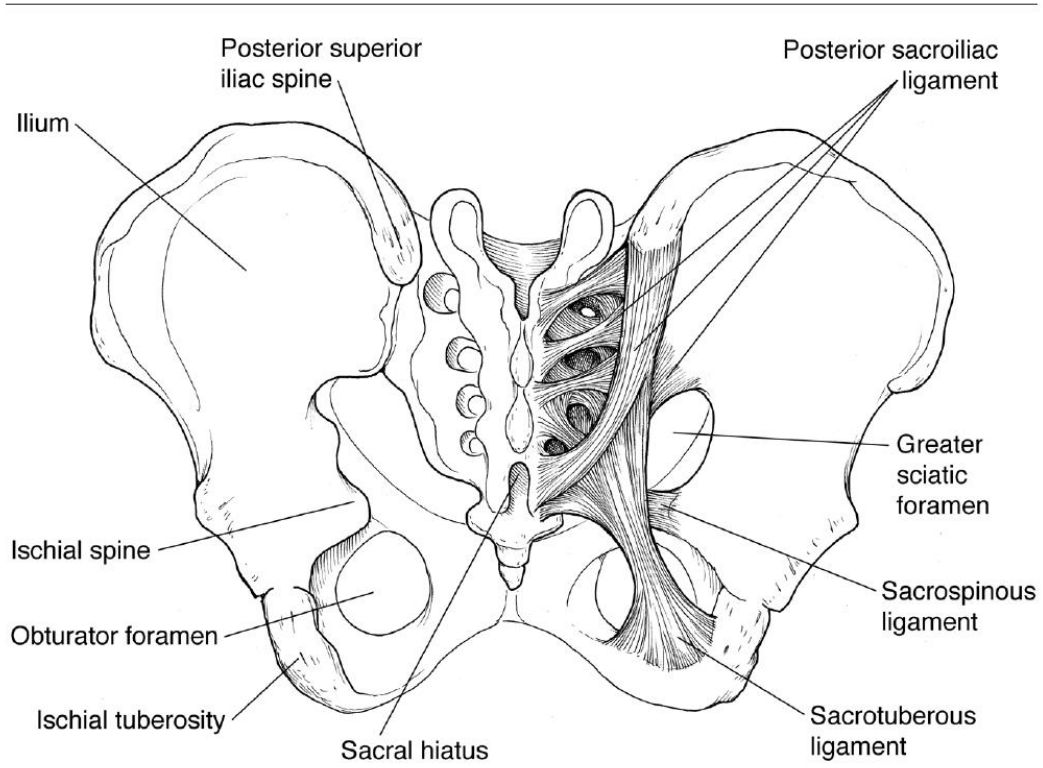


Find Spinous Process



Slow, deep pressure

Sacroiliac Pain



Axial Pain: Sacroiliac Pain

- Incidence:
  - 12% of low back pain
- Diagnosis
  - Physical exam maneuvers
    - Poorly predictive (~60%)
    - Sacral sulcus tenderness
    - Faber / Gaenslen tests
  - Diagnostic injections
    - Also inconsistent
    - Capsule leakage

SIJ Provocation Maneuvers and Symptoms

Table 2
Sensitivity and Specificity of Major Diagnostic Tests Used to Identify Those With Intra-articular Sacroiliac Joint Pain[1,2,13,15-17]

Test	Sensitivity	Specificity
Sacroiliac joint pain	+ + + +	+
Groin pain	+	+ + +
Buttock pain	+ + + +	+
Indicating posterior superior iliac spine as pain source	+ + + +	+ +
Abnormal sitting posture	+	+ + + +
Pain lessens with NSAIDs	+ +	+ +
Pain lessens with exercise	+ +	+ + + +
Pain lessens with manipulation	+ + +	+ + + +
Gillet's test	+ +	+ + +
Patrick's test	+ + +	+
Gaenslen's test	+ + +	+ +
Sacral sulcus tenderness	+ + + +	+
Midline sacral thrust	+ + +	+ +
Bone scan	+ +	+ + + +
Computed tomography	+ + +	+ + +

Sensitivity/specificity scale: + = 0-25%; + + = 26%-50%; + + + = 51%-75%; + + + + = 76%-100%

J Am Acad Orthop Surg 2004;12:255-265

TABLE 1 Differential diagnosis

I. Piriformis Syndrome

II. Hip joint pathology
  a. Fracture
  b. Avascular necrosis
  c. Osteoarthritis
III. Discogenic pain
IV. Zygapophysial joint pain
V. Rheumatoid arthritis
VI. Ankylosing spondylitis
VII. Myofascial pain
VIII. Lateral trochanteric bursitis
IX. Referred pain
X. Malignancy
XI. Visceral referred pain
XII. Radiculopathy

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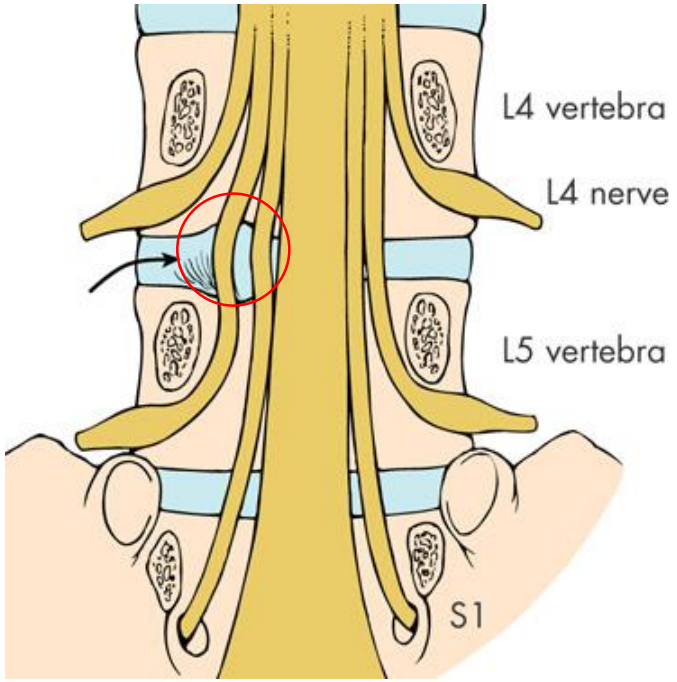
Sacroiliac Pain and Spondyloarthropathies

Adult Seronegative Spondyloarthropathies: Disorders With the Highest Degree of Sacroiliac Joint Involvement[11]

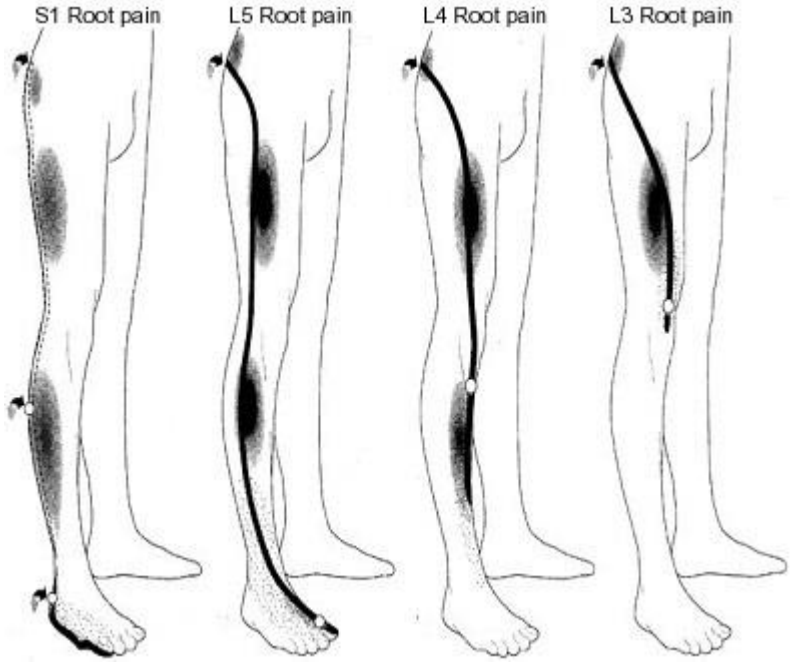
Characteristic	Ankylosing Spondylitis	Reactive Arthritis (Reiter's Syndrome)	Psoriatic Arthropathy
HLA-B27 frequency	90%	60% to 80%	50%
Sacroiliitis	Almost 100%	<50%	Approximately 20%
Symmetry of sacroiliitis	Symmetric	Asymmetric	Asymmetric
Typical age of onset	Adult <40 yr	Young to middle aged	Young to middle aged
Peripheral joint involvement	Approximately 25%	Approximately 90%	Approximately 95%
Type of onset	Gradual	Acute	Variable
Eye involvement	30%	Common	Occasional
Skin or nail involvement	None	Common	Almost 100%
Infectious agents as triggers	Unknown	Yes	Unknown
Sex ratio	M:F = 3:1	Mostly males	Males = Females

J Am Acad Orthop Surg 2004;12:255-265

Radicular, Ischemic, and Neuropathic Pain



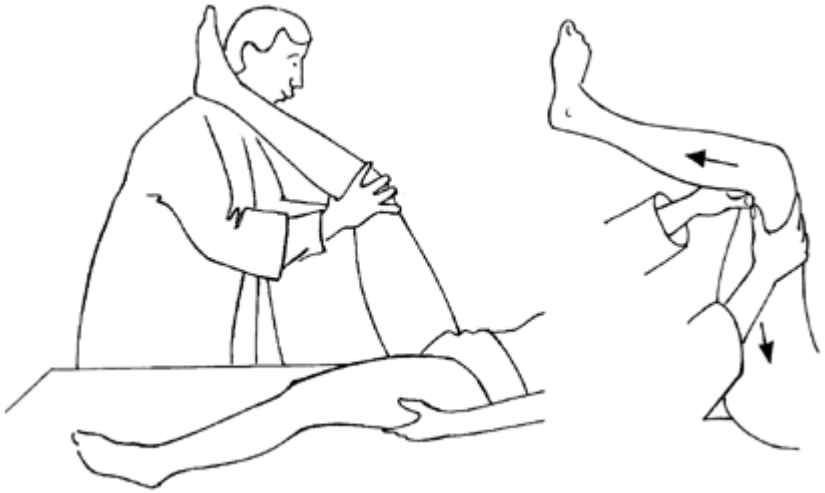
Neuropathic Pain: Radiculitis / Radiculopathy



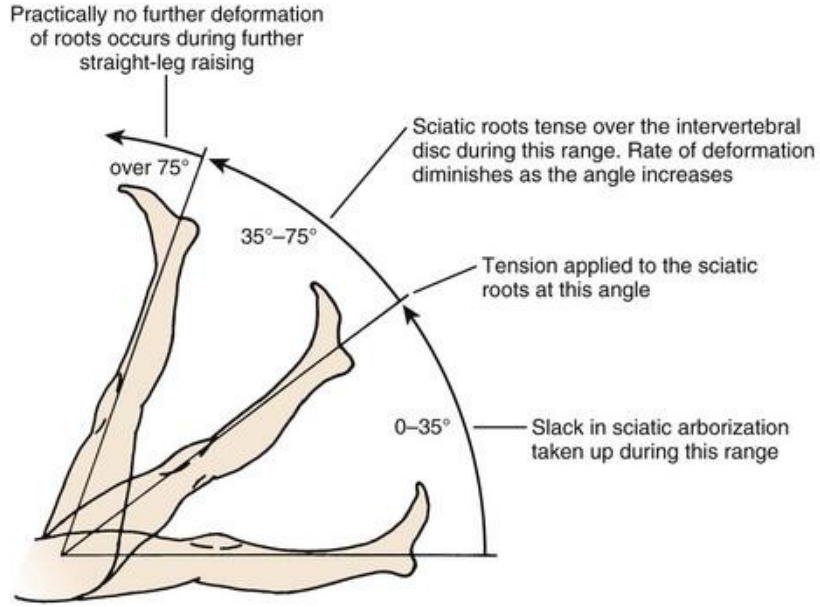
- Causes
  - Disc Herniation
  - Disc leakage
  - Spondylosis
  - Tumor invasion
- Diagnosis
  - History / neurologic exam
  - Straight leg raise (SLR) / Crossed straight leg raise
    - SLR 91% sensitive / Crossed SLR 88% specific
  - Seated Slumped Root Test exceeds SLR sensitivity in some studies
  - Motor Exam, include Extensor Hallicus Longus (L5), Reflexes (L4-S1)
  - Sensory Exam (light touch, pinprick)

Examinations for Lumbar Radiculitis

Slump Test



Bowstring

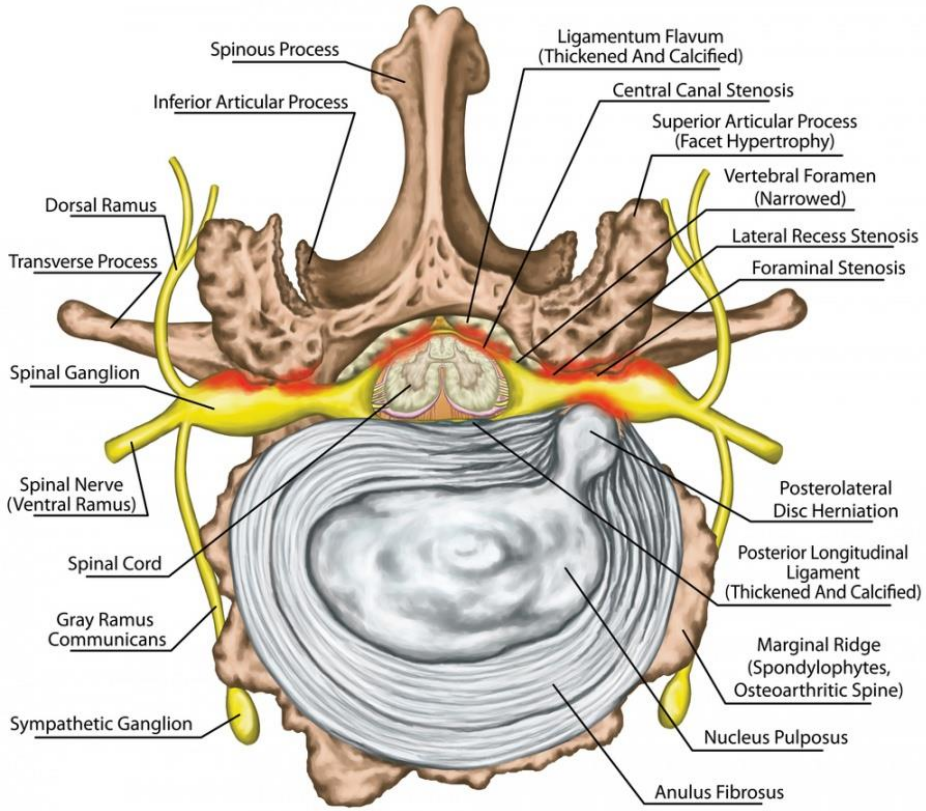


Straight Leg Raise

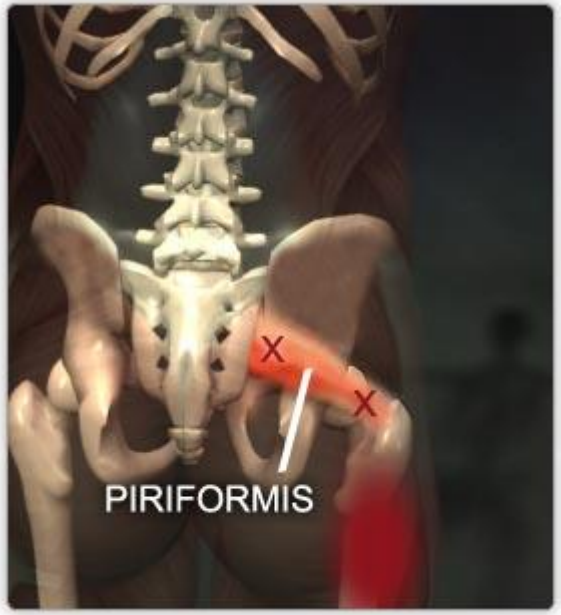
Lasegue's Sign

Neuropathic Pain: Spinal (Canal) Stenosis

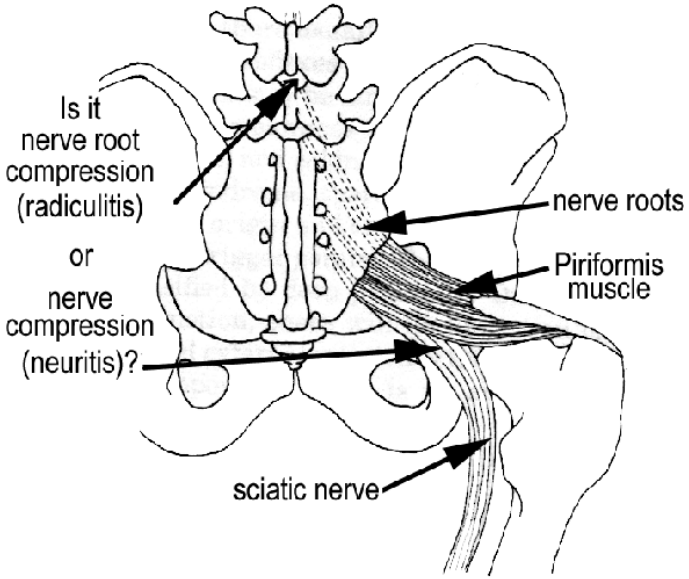
- Etiology
  - Central Disc Herniation
  - Ligamentum Flavum Hypertrophy
  - Spondylosis
  - Tumor invasion
- Diagnosis
  - Similar to workup for radiculopathy
  - History of neurogenic claudication
  - Radicular symptoms without radicular signs
    - i.e. SLR test can be negative
- Treatment
  - Same as for radiculitis
  - May require surgical intervention



Neuropathic Pain: Piriformis Syndrome



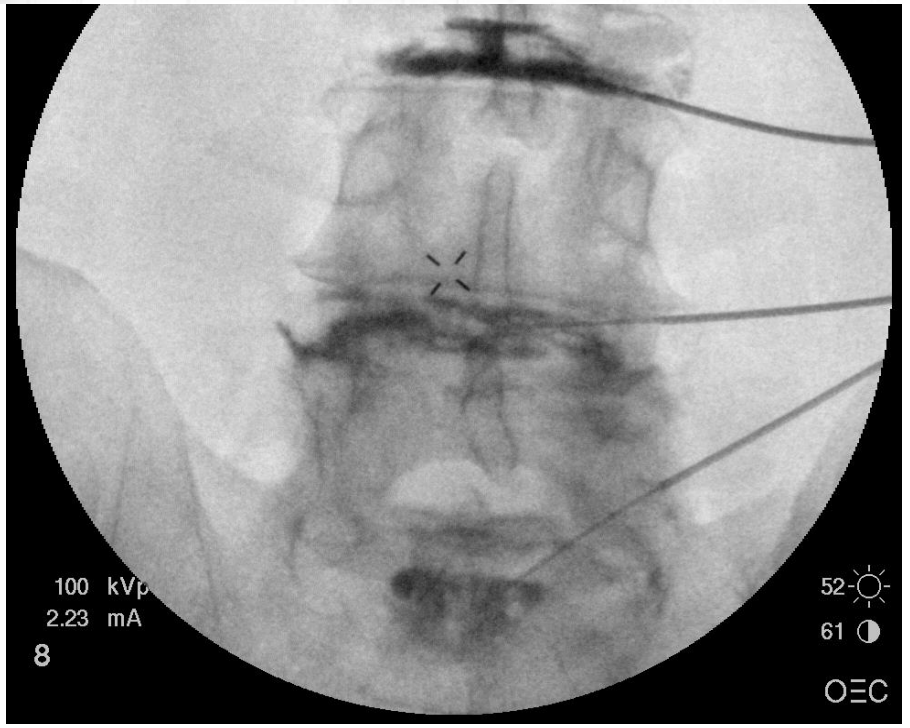
- Etiology
  - Piriformis muscle tightening /irritation
  - Sciatic nerve runs in close proximity (or through)
  - Pressure on sciatic nerve imitates radiculitis
  - May be associated with sacroiliac joint dysfunction
- Diagnosis
  - Direct palpation of trigger point
- Treatment
  - Piriformis stretching
  - Piriformis trigger point injection



Pain of the Anterior Spine Elements, Disc and Vertebral Body

Axial Pain: Discogenic Pain

- Incidence:
  - Up to 39% of low back pain
  - More common in early adulthood
- Etiology
  - Pain from annulus – fissure leading to ingrowth of nociceptive nerves
- Diagnosis
  - No well validated physical exam maneuvers
    - Manual shear test ?
  - Provocative Discography is the gold standard confirmatory test



Clin J Pain. 2006 Jun;22(5):468-81.

Axial Pain: Vertebral Pain

- <u>Pathologic fractures</u>
  - Osteoporosis
  - Tumor invasion / metastases
- <u>Diagnosis</u>
  - Tuning fork test – used but not well validated
  - Plain films
  - CT scan
- <u>Treatment</u>
  - Promote mineralization
    - Bisphosphenates
  - Vertebral Augmentation
  - XRT

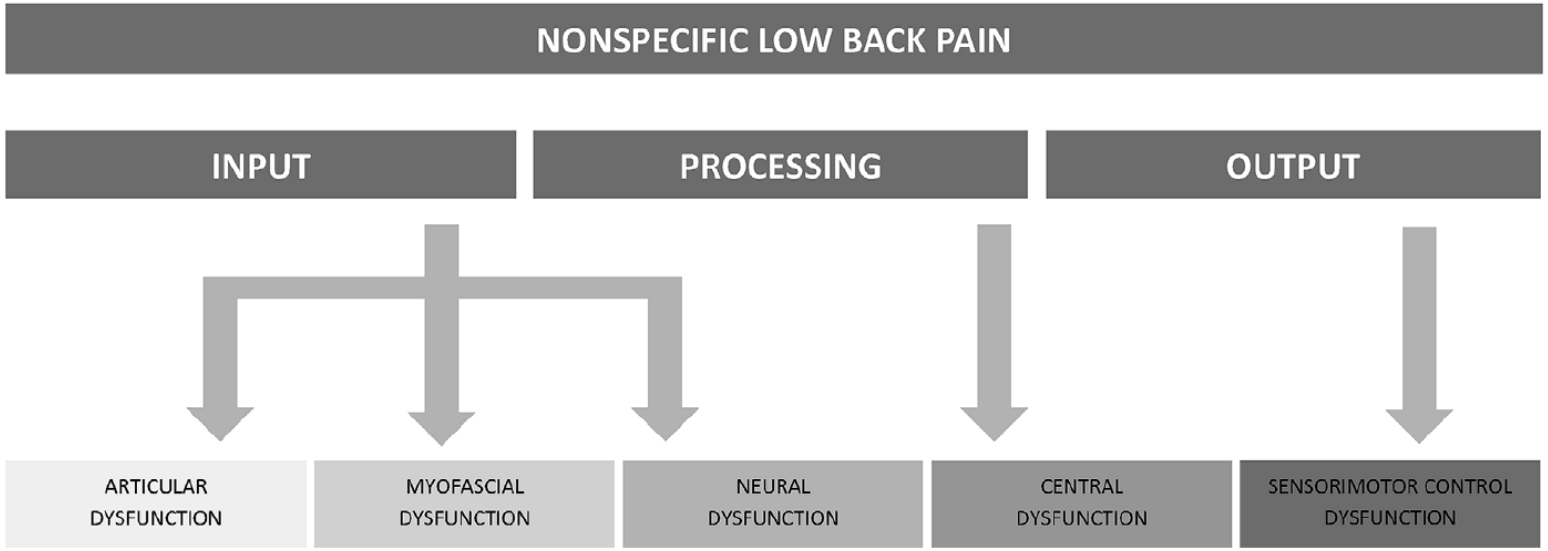
N Engl J Med. 1996 Feb 22;334(8):488-93.
Acta Radiol. 2007 Feb;48(1):89-95.

Non-Specific Low Back Pain (NSLBP)

NSLBP - Features

- Over 80% of LBP complaints cannot be attributed to a specific disease or anatomic abnormality.
- Pragmatic Classification
- Heterogeneous population
  - Cognitive and affective components
  - Course of recovery
- Several different etiologies proposed
  - Functional/Anatomical
  - Neurologic/Central
  - Sensorimotor
- Conservative Management, including PT; non-opioid medical therapy

NSLBP – Proposed Etiologies



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Definitions of the dysfunction patterns.

Dysfunction pattern	Definition
Articular dysfunction pattern	Low back disorders in which you presume the dominant cause of nociception/pain refers to an articular structure dysfunction (facet joint, capsuloligamentous structure, disc, etc.)
Myofascial dysfunction pattern	Low back disorders in which you presume the dominant cause of nociception/pain refers to a myofascial structure dysfunction (muscle, fascia, tendon, etc.)
Neural dysfunction pattern	Low back disorders in which you presume the dominant cause of nociception/pain refers to a neural structure dysfunction (nerve root, peripheral nerve, etc.)/neuropathic pain
Central dysfunction pattern	Low back disorders in which you presume the dominant underlying cause is not related to a structural cause, but refers to a pain processing dysfunction (e.g. hyperalgesia due to central sensitization)
Sensorimotor control dysfunction pattern	Low back disorders in which you presume the dominant underlying cause refers to a sensorimotor control dysfunction, whereby a continuous source of nociceptive or neuropathic input remains

Summary

- Be vigilant for serious causes of LBP such as malignancy, infection, fracture etc.
- Evaluate Neurologic Symptoms, Signs, other Red Flags
  - Combination of multiple Red Flag symptoms may be of more help
  - Serious causes of LBP may require specialist referral
- Understand benefits and limitations of physical exam maneuvers
  - Avoid over-utilization of imaging
  - Diagnosis may need modification over longitudinal course of care

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