Low Back Pain
Sorting out the pain-generators

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Where is the pain coming from?

- How good are PM&R docs at hitting the bulls eye – correctly identifying the pain generator in patients with LBP?
  - One researcher says it can only be determined about 30% of the time – (Bogduk, 1995)
  - Primary care docs apparently can find the pain-generator 15% of the time – (Riddle 1998)
  - One orthopedic surgeon: can narrow it down to 3 entities 90% of the time: “spine, hip, or SI”. – (Sembrano, Spine 2008)
Where is the pain coming from?

- We’ve been called the “cardiologists of the spine”
- Hopefully we can improve at hitting the pain-generator bulls eye.
First rule out the big nasties
Discitis
L4-5
<table>
<thead>
<tr>
<th>Table 1. &quot;Red Flags&quot; for Serious Disease</th>
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<tbody>
<tr>
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<tr>
<td><strong>Cauda Equina</strong></td>
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<tr>
<td>Progressive neurologic deficit X</td>
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<tr>
<td>Recent bowel or bladder dysfunction X</td>
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<tr>
<td>Saddle anesthesia X</td>
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<tr>
<td>Traumatic injury/onset, cumulative trauma X</td>
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<tr>
<td>Steroid use history X</td>
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<tr>
<td>Women age &gt; 50 X</td>
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<tr>
<td>Men age &gt; 50 X</td>
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<tr>
<td>Male with diffuse osteoporosis or compression fracture X</td>
</tr>
<tr>
<td>Cancer history X</td>
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<tr>
<td>Diabetes Mellitus X</td>
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<tr>
<td>Insidious onset X</td>
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<tr>
<td>No relief at bedtime or worsens when supine X</td>
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<tr>
<td>Constitutional symptoms (e.g. fever, weight loss) X</td>
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<tr>
<td>Hx UTI/other infection</td>
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<td>IV drug use X</td>
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<tr>
<td>HIV X</td>
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<td>Immune suppression X</td>
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<td>Previous surgery X</td>
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</tbody>
</table>
Now what?

• Now that you’ve ruled out the big nasties

• Find the pain generator.

• What’s in your differential?
LBP DDx – most common ones

- Radiculopathy
- Facet joint
- Disc
- SI joint

- But, remember others
Table 3. Differential Diagnosis of Back Pain

<table>
<thead>
<tr>
<th>Systemic Causes</th>
<th>Axial Back Pain</th>
<th>Radiating Low Back Pain</th>
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</thead>
<tbody>
<tr>
<td>Aortic aneurysm</td>
<td>Dangerous local causes</td>
<td>Causes</td>
</tr>
<tr>
<td>Aortic atherosclerosis</td>
<td>Tumor</td>
<td>Disk herniation</td>
</tr>
<tr>
<td>Renal infection</td>
<td>Disk space infection</td>
<td>Spinal stenosis</td>
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<tr>
<td>Renal calculi</td>
<td>Epidural abscess</td>
<td>Arachnoiditis</td>
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<tr>
<td>Peritonitis</td>
<td>Fractures</td>
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<tr>
<td>Tumors</td>
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<tr>
<td>Subacute bacterial endocarditis</td>
<td>Other causes</td>
<td></td>
</tr>
<tr>
<td>Metabolic disorders:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porphyria</td>
<td>Osteoporosis with fracture</td>
<td>Osteoarthritis of the hip</td>
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<tr>
<td>Sickle cell disease</td>
<td>Spondylolisthesis:</td>
<td>Aseptic necrosis of the femoral head</td>
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<tr>
<td>Renal osteodystrophy</td>
<td>Congenital</td>
<td>Sciatic nerve injury due to pressure, stretch or piriformis muscle entrapment</td>
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<tr>
<td>Seronegative spondylitic arthritis:</td>
<td>Degenerative</td>
<td>Cyclic radiating low back pain--</td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>Traumatic</td>
<td>endometriosis on the sciatic nerve/sacral plexus</td>
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<tr>
<td>Reiter's syndrome</td>
<td>Tumor related</td>
<td>Intrapelvic masses--benign or malignant</td>
</tr>
<tr>
<td>Arthritis of ulcerative colitis</td>
<td>Sacroiliac joint dysfunction and arthritis</td>
<td></td>
</tr>
<tr>
<td>Psoriatic arthritis</td>
<td>Facet joint syndrome and arthritis</td>
<td>Peroneal (fibular) nerve entrapment</td>
</tr>
<tr>
<td>Other arthritis:</td>
<td>Internal disk disruption</td>
<td>at the fibular head</td>
</tr>
<tr>
<td>Diffuse Idiopathic Skeletal Hyperostosis (DISH)</td>
<td>Failed back surgery syndrome</td>
<td></td>
</tr>
<tr>
<td>Scheuermann's epiphisis</td>
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<tr>
<td>Rheumatoid arthritis--uncommon</td>
<td></td>
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<tr>
<td>Connective tissue disorders:</td>
<td></td>
<td></td>
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<tr>
<td>Marfan's syndrome</td>
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<tr>
<td>Ehlers-Danlos syndrome</td>
<td></td>
<td></td>
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<tr>
<td>Myopathy</td>
<td></td>
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<tr>
<td>Inflammatory radiculopathy AIDP/CIDP</td>
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</table>

U of M Guidelines for Acute LBP, 2005
Others

- Polymyalgia Rheumatic (PMR)
- Neuralgic Amyotrophy, Parsonage Turner Syndrome, or Lumbosacral Radiculoplexus Neuropathy
- Psych
  - Mind Body Syndrome
  - Tension Myositis Syndrome
  - Anxiety
  - Depression
Some anatomy review first
Patterns of pain
The most common differential diagnoses:

- Radiculopathy
- Facet
- Disc
- SI Joint
- LBP w no red flags
- Lumbar somatic dysfunction
- Central Stenosis
- Piriformis syndrome
- Myofascial
- Hip pathology
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial
- Radiculopathy

LBP w no red flags

Facet

Disc

SI Joint

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<table>
<thead>
<tr>
<th>Nerve root</th>
<th>L4</th>
<th>L5</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>![Pain Diagram]</td>
<td>![Pain Diagram]</td>
<td>![Pain Diagram]</td>
</tr>
<tr>
<td>Numbness</td>
<td>![Numbness Diagram]</td>
<td>![Numbness Diagram]</td>
<td>![Numbness Diagram]</td>
</tr>
<tr>
<td>Motor</td>
<td>Extension of quadriceps</td>
<td>Dorsiflexion of great toe and foot</td>
<td>Plantar flexion of great toe and foot</td>
</tr>
<tr>
<td>weakness</td>
<td>Squat and rise</td>
<td>Heel walking</td>
<td>Walking on toes</td>
</tr>
<tr>
<td>Screening</td>
<td>Knee jerk diminished</td>
<td>None reliable</td>
<td>Ankle jerk diminished</td>
</tr>
<tr>
<td>examination</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Reflexes</td>
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</tbody>
</table>
Lumbar Radiculopathy

• Prevalence: 13 - 44% of chronic LBP
  – (Pang 1998; Manchikanti 2001)
• Usually caused by disc protrusion or herniation, but consider facet synovial cyst, tumor, etc
• Dermatomal pain and/or paresthesia
• Straight Leg Raise (SLR) sign
  – Sensitivity = 85%; Specificity = 52%
  – For any lumbar radiculopathy, SLR was the only PE sign consistently reported to be sensitive for sciatica due to disc herniation (Vroomen 1999)
Lumbar Radiculopathy

- Crossed SLR (84% specific)
- Reverse SLR for L1-3
- Myotomal weakness
- Reflex reduction
  - Achilles, patellar, medial hamstring
- Sensory loss
- Can use EMG esp if MRI is non-revealing
Lumbar Radiculopathy

- History and location of symptoms are very important
- But, recall that other structures can refer pain into the leg
- SLR and crossed SLR – best of all exam findings per support in literature
- Strength, reflex, sensation loss corroborated with matched imaging findings yield best diagnostic results
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- LBP w no red flags
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- Facet
- Disc

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Facet joint pain patterns can be variable

-confirmed by >2 MBB; ”>50% pain reduction“
Facet Joint (zygoapophaseal – “z” joint)

- Prevalence
  - 42%  
    (Manchikanti, 2000)
  - 15-45%  
    (Schwarzer 1995)

- Provocative tests
  - Questionable validity and reliability

- Current research backing up H & PE items predicting good response with facet procedures:
  - Very lacking (Hancock 2007)
Facet joint quotes

• “No noninvasive pathognomic finding or constellation of findings can definitely distinguish lumbar z-joint mediated pain from other sources of low back pain. The diagnosis of lumbar z-joint pain remains one of exclusion and confirmation by analgesic injections.”
  – Dreyfuss and Dreyer (1997)

• “Facet clinical tests have limited or no diagnostic validity.”
  – Rubenstein (Best Pract Res Clin Rheum 2007)
Facet clinical tests


• Paraspinal tenderness was the *only* factor associated with a successful medial branch block

• “Facet loading” clinical test was correlated with facet MBB/RFN *failure*
Facet clinical tests

Laslett et al. Spine 2006

• The following predict ≥95% relief with facet injection or medial branch blocks.
  – age>50
  – Reduction of pain with sitting or walking
  – Onset of pain was paraspinal in location
  – Extension/rotation test POSITIVE
    • Ext/Rot test: Sensitivity: 100%; Specificity: 22%
  – Absence of centralization phenomenon
Facet: summary

- L/S paraspinal region but can refer to posterior thigh and calf
- > 50 yo
- Relief with recumbency
- + Facet loading test - controversial
- Lack of dermatomal LE sx
- Absence of centralization
- Paraspinal tenderness location
Facet: summary cont’d

• My opinion
  – I agree with previous slide
  – Worse with standing/walking
  – Worse with lumbar extension
  – Sometimes worse with return from L/S flexion
  – No objective signs of radiculopathy (unless concurrent)
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial LBP w no red flags
- Radiculopathy
- Facet
- Disc
- SI Joint
Internal Disc Disruption

- Healing
- Endplate Fracture
- Disc Degradation
Disc

- Vora, et al. (PM&R Clin N Am 2010)
  - Outer rings of annulus are innervated and have a blood supply
  - When the disc degenerates, the nerves grow into the inner annulus and even into the nucleus pulposus (Coppes, et al. Spine 1997)
Internal Disc Disruption

- Prevalence: 39% of pts with chronic LBP
  - (Schwarzer, Spine 1995)
- Deep aching axial discomfort
  - increased w mechanical stresses, i.e., sitting, forward flexion, riding in car
- Sitting, coughing, sneezing provoke pain
- High-intensity zone (HIZ) - annular tear - in the annulus fibrosis may be seen on T2 weighted MRI
**Disc**

- **Bogduk (J Manip Phys Ther 1995)**
  - Disc problems might be the most frequent cause of LBP
  - Collectively, lumbar facet joint pain, internal disk disruption and SI joint pain account for nearly 70% of chronic low back pain.

- **Schwarzer (Spine 1995)**
  - 92 consecutive pts with chronic LBP.
  - 39% of them fully met diagnostic criteria for internal disc disruption
    - Positive discography and CT-demonstrated internal disc disruption
• Laslett (Eur Spine J 2006)
  – In addition to the centralization phenomenon, 3 other clinical variables predict positive discograms:
    • Persistent pain between exacerbations
    • Moderate to major loss of spinal extension
    • Subjective vulnerability in the early part of lumbar flexion – the “neutral zone”
      – a region of intervertebral motion around the neutral posture where little resistance is offered by the passive spinal column. (Panjabi, J Spinal Disorders, 1992)
Disc

Hancock, MJ (Eur Sp J 2007)
• HIZ on MRI increases probability (LR 1.8-5.9)
• Reduced disc signal intensity on MRI (LR 1.6-4.0)
• Centralization phenomenon: the only clinical test found helpful for disc-related radicular sxs (LR 2.8)

Yrjama, M (Eur Sp J 1994)
• Vibration of the spinous process using an electric toothbrush reported to help predict a positive discography.
  – Sensitivity: 96%; specificity: 72% when pts w prolapsed discs and prior surgery were excluded
    • n=40
Disc

• McKenzie (1981) maneuvers → centralization: higher likelihood of a positive discogram
  – Sensitivity = 80-100%, specificity = 35-45%
    (Laslett 2005)
Disc: summary

- Deep aching axial discomfort - increased with mechanical stresses, i.e., sitting, forward flexion, riding in car
- Sitting, coughing, sneezing provoke pain
- MRI
  - HIZ – annular tear
  - Reduced signal intensity (dark disk - disc degeneration)
- Centralization phenomenon
- Pain between exacerbation episodes
- Pain reproduced with spinous process vibration
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial
- Radiculopathy
- Facet
- Disc
- SI Joint
- LBP w no red flags
-per intra-articular or ligament blocks
SI joint pain intensity maps:

van der Wurff, et al, 2006
Sacroiliac Joint Dysfunction

- Prevalence: ~14% (Bogduk 1995, Sembrano 2008)
- Usually pain localized to PSIS region; usually unilateral; worse with unilateral weight-bearing, stairs, position changes in bed
- Tender to palpation at PSIS region
- Positive FABER
- Other SI provocative tests
  - Anterior Compression and Distraction
  - Iliac Compression Test
  - Femoral drive or Thigh Thrust
  - Gaenslen test (flex one hip while hyperextend the other)
  - Yeoman's Test
  - PA iliac shear
Sacroiliac Joint Dysfunction

• Positive Stork test (Gillet test) – standing hip flexion to 90 deg – watch PSIS

• Subluxation or somatic dysfunction?
  – Pelvic landmark asymmetry (ileal rotation; sacral torsion, etc)
  – Standing & seated flexion test
  – Supine to long sitting test
  – Position of sacral base, ILA
Sacroiliac Joint Dysfunction

- Thigh Thrust
- Anterior distraction
- Iliac compression
- Gaenslen
- FABER
- Stork (Gillet)
- Yeoman’s
Sacroiliac Joint Dysfunction

van der Wulf, et al. (Arch PMR 2006)

- When ≥3 out of 5 provocative tests were +, SI was confirmed the pain generator 65%-93% of the time
- As confirmed by double intra-articular SI injections
- The provocative tests:
  - anterior SI compression
  - anterior SI distraction
  - thigh thrust
  - FABERs
  - Gaenslen
- For 3 or more + SI provocative tests
  - Sensitivity: 85%
  - Specificity: 79%
Sacroiliac Joint Dysfunction

MJ Hancock (Eur Sp J 2007)
- Using a composite (rather than 1 or 2) of pain-provocative tests
  - (sens: 80%; spec 75%; Likelihood Ratio (LR): 3.2
- A positive+ bone scan may increased the probability of the SI being a pain generator (LR 6.2)

Laslett, Man Ther 2005
- Suggests the following maneuvers with 3 or more positive tests: 94% sensitivity, 78% specificity
  - Thigh thrust
  - Distraction
  - Compression
  - Sacral thrust
  - Gaenslen’s
SI summary

• Usually pain localized to PSIS region or buttock
• Usually unilateral
• Worse with unilateral weight-bearing, stairs, position changes in bed
• Exam
  – Tender to palpation at PSIS region
  – + FABER
  – Anterior compression & distraction of SI
  – Thigh Thrust
  – Gaenslen’s
  – Stork (Gillet)
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial
- LBP w no red flags
- Radiculopathy
- Facet
- Disc
- SI Joint
Hip Pathology

- OA, Fracture, AVN
- Inguinal pain; worsened with WBing, internal rotation
- + FABERs
- pain with flexion with internal rotation in sitting
- Limited internal rotation
- Hip pain can refer to the back (Hoppenfeld 1976)
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Myofascial
- LBP w no red flags
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- Hip pathology
- Radiculopathy
- Facet
- Disc
Central Lumbar Stenosis

• Neurogenic claudication caused by central narrowing of the spinal canal
• Lower limb pain &/or paresthesia provoked by standing, walking, extension
• If severe: → cauda equina signs and symptoms
• Eased by sitting
• Usually neuro exam of LEs normal in sitting
• Narrow canal on MRI with corroborating symptoms
• Consider ruling out vascular LE claudication
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial

Radiculopathy
- Facet
- Disc

LBP
- w no red flags

SI Joint
Lumbar Somatic Dysfunction

• Osteopathic manual medicine diagnoses

• eg. L5 flexed, rotated, side-bent right
  – “FRS R”, etc

• Tight segments might be adjacent to hypermobile segment, causing pain
  – Motion segment: 2 adjacent vertebra & the disc in between
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial
- LBP w no red flags
- Radiculopathy
- Facet
- Disc
- SI Joint

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Piriformis Syndrome

- Possibly d/t forceful hip internal rotation or poor body mechanics
- Sciatic n. can be involved (sxs down leg) because the nerve sometimes pierces the piriformis muscle fibers
- Pain with hip internal rotation, adduction, and flexion
- Tender to palpation, even with radiation down leg
- SLR & dural tension signs can be + but usually very tender in buttock + limited and provocative hip PROM
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- LBP w no red flags
- Myofascial

Radiculopathy

- Facet
- Disc

SI Joint
Myofascial

- Generally, non-radicular pattern; diffuse, not provoked by extension-rotation. Diffuse tenderness to palpation sometimes
- Muscle imbalance: tight iliopsoas, hamstring, hip flexor.
Myofascial

• Rare instance of muscle strain:
  – acute injury; point tender, pain with resisted test and passive elongation; local warmth/edema; do well with ice

• Consider multifidi as confounding source of pain with facet joint attempted injections
  • Ackerman, et al Facet Inj.. Muscular origin? World Inst Pain 2004
The most common differential diagnoses:

- Piriformis syndrome
- Lumbar somatic dysfunction
- Central Stenosis
- Hip pathology
- Myofascial LBP w no red flags
- Radiculopathy
- Facet Disc
- SI Joint
References

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Questions or discussion?