A Physiatrist’s Approach to Low Back Pain

Ninad Karandikar, MD
Assistant Professor
Dept. of Physical Medicine and Rehabilitation
University of Kentucky

Objectives

- Discuss the relevant anatomy, history and physical exam in a patient with acute Low Back Pain
- Generate a Differential Diagnosis, based on history and physical examination
- Identify appropriate diagnostic tests as further work-up to confirm diagnosis
- Discuss Treatment Algorithms – conservative and invasive
Epidemiology

- 40% of people say they have had low back pain at some time in past 6 months
- Lifetime prevalence – 84%
- 80 – 90% resolve in 3 – 6 months
- 80 – 90% of health care costs come from the 10% who develop chronic back pain (> 6 months)

ANATOMY OF LBP: PAIN GENERATORS
**Innervated Structures**
- Vertebral bodies
- Facet joints (Medial branch of DPR)
- Annulus fibrosis (outer 1/3): the “shock absorber”
- Ligaments: ALL, PLL, Interspinous
- Musculature
- Nerve Roots

**Non-Innervated Structures**
- Inner 2/3 Annulus fibrosis
- Ligamentum flavum
- Nucleus pulposus

**Innervated Structures: Joints, Ligaments & Nerve Roots**
Innervated Structures: Muscles

History

Low Back Pain is a symptom not a disease

- Age
- Onset: Trauma?
- Location: Radiation?
- Duration
- Characterization
- Aggravating/relieving factors
- Constant/intermittent
- Associated symptoms
- Progress/Treatment so far
### Age in LBP

- **A: Alerts for Juveniles and Adolescents**
- **B: Alerts for Young Adults**
- **C: Alerts for Middle Age**

### Co-relating History with the Pain Generator Source

<table>
<thead>
<tr>
<th>History of Back Pain</th>
<th>Leg-dominant pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back-dominant pain</td>
<td>Aggravated by...</td>
</tr>
<tr>
<td>Flexion</td>
<td>Extension</td>
</tr>
<tr>
<td>Flexion</td>
<td>Walking (extension)</td>
</tr>
<tr>
<td>Minor Disk, sprain,</td>
<td>Nerve root</td>
</tr>
<tr>
<td>strain, spondylosis</td>
<td>Central stenosis</td>
</tr>
<tr>
<td>Facets</td>
<td></td>
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</tbody>
</table>
Red Flags (Associated Symptoms)

- Night /rest pain
- Fever with chills
- Bowel, bladder or erectile dysfunction
- Unexplained weight loss, h/o CA
- Duration greater than 6 weeks
- Age > 70
- Important clinical considerations
  - Immunosuppression, Intravenous (IV) drug use, prolonged use of corticosteroids
  - h/o Osteoporosis

DEFINITIONS
Mechanical Back Pain

- Low Back Pain generally triggered by an acute event
- Aggravated by specific activities e.g. bending, lifting, walking
- Relieved by rest/recumbency
- May radiate to buttock, hip, rarely thigh, rarely distal to knee
- NO ASSOCIATED NEUROLOGIC SIGNS e.g. weakness or numbness

Sources
- Disc, facet joint, nerve, ligament, muscle, instability

Non-mechanical Back Pain

- Generally no preceding acute event
- Constant pain at rest +/- night pain, no relief with recumbency/rest/change in position
- NO RADIATING LEG PAIN

Causes
- Referred pain e.g. abdomen/retroperitoneum
- Infection (bone, disc, epidural space)
- Neoplasm (primary/secondary)
- Inflammatory arthritides e.g. A.S./seronegative spondyloarthropathies
- Miscellaneous e.g. Paget’s disease
Mechanical Low Back Pain

- **Discogenic Pain**
  - Acute onset, s/p trauma (usually)
  - Often described as “Band-like” Back Pain
  - Exacerbated by Lumbar flexion
  - Initially intermittent, in 1-2 years, becomes constant (as disc space collapses/end plates are eroded), worsened with slightest of activity

- **Facet joint Pain**
  - Acute/subacute, trauma +/-
  - Referral to buttock area is common
  - Exacerbated with Lumbar extension
  - Usually relieved by sitting/walking/lying down
Radicular Pain

- Acute onset, s/p trauma (usually)
- Back Pain +/- for several years
- LEG Pain distal to the knee – usually sharp, shooting/stabbing
- In a DERMATOMAL/RADICULAR fashion
- Paresthesias
- Exam
  - SLR: strong ++
  - Associated findings e.g. weakness, atrophy, loss of reflexes

Lumbar Disc Pressure Map
Radiculitis vs. Radiculopathy

- Radicular pain, exam suggestive of nerve root involvement
- No neural compression on MRI
- Annular tears usually + (HIZ on MRI T2 imaging)
- With a tear, the nucleus pulposus is exposed causing an auto-immune mediated inflammatory cascade
- Inflammatory mediators: PGE2, COX 2, NO, IL, cytokines
- The inflammatory mediators cause neural swelling, alter their EP function and cause pain without specific mechanical compression

Claudication Pain

- Back pain for several years
- Leg pain is the most common “presenting incapacitating symptom”
- Usually Bilateral
- Vague: “heaviness, cramping, soreness” (multiple NR involvement & ischemic rather than an acute inflammatory component of the radiculopathy)
- Paresthesias common
- Usually initiated by walking, prolonged standing and walking downhill
- Relieved by sitting or bending forward

Sudden worsening = listhesis/HNP
Neurogenic & Vascular Claudication

<table>
<thead>
<tr>
<th></th>
<th>Neurogenic Claudication</th>
<th>Vascular Claudication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Pain</td>
<td>Back, Thigh, Calf, rarely in buttock area</td>
<td>Usually calf +/- buttock</td>
</tr>
<tr>
<td>Quality</td>
<td>Vague: radicular, cramping, “heaviness”</td>
<td>Sharp, cramping</td>
</tr>
<tr>
<td>Aggravating factors</td>
<td>Spine extension, Standing, Walking, especially downhill</td>
<td>Not affected by spinal position or by standing, but by walking or any leg exercise</td>
</tr>
<tr>
<td>Relieving factors</td>
<td>Flexed spine posture, lying down, sitting, slow relief</td>
<td>Stopping muscular activity even standing, quick relief</td>
</tr>
<tr>
<td>Skin / Vascular exam</td>
<td>Pulses +, no skin changes</td>
<td>Weak / absent pulses, atrophic skin changes</td>
</tr>
<tr>
<td>SLR</td>
<td>Mild + or negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Neurologic exam</td>
<td>+/- depending on severity</td>
<td>Negative</td>
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Instability

- Often-used term
- 2 definitions
  - Mechanical (Gross) Instability
    - Relative motion of one vertebrae on another seen on flexion/extension films
    - Requires evaluation by spinal surgeon
  - Micro-instability
    - Refers to very small movement caused by tissue damage, poor muscular endurance or poor muscular control
    - Contributes to Mechanical Low Back Pain
Myofascial Low Back Pain

- In the face of a non-focal neurologic exam, normal plain film, a normal MRI and continued low back pain, a diagnosis of myofascial pain must be considered.
- Treatment – antidepressants, trigger point injections, stretching, strengthening, ROM, aerobic exercise.

Radicular vs. Sclerotomal

- Radicular
  - Nerve compression pain from a nerve root is expressed in its single dermatome
- Sclerotomal
  - Pain arising from other pain-sensitive tissues of the vertebral joint complex (muscles, joints, ligaments) is expressed sclerotomally.
Radicular vs. Sclerotomal Pain

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Radicular Pain</th>
<th>Sclerotomal Pain</th>
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<tbody>
<tr>
<td>1. Radiation distal to knee</td>
<td>++</td>
<td>Usually -</td>
</tr>
<tr>
<td>2. Dermatomal pattern</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>3. Associated weakness, reflex loss, atrophy</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>4. Chiropractic manipulation</td>
<td>Less likely to help</td>
<td>Appropriate Indication</td>
</tr>
</tbody>
</table>

Referred pain

- SI joint pain: groin, trochanter & buttock
- Hip joint pain
- Abdominal organs
- Retroperitoneal organs
Physical Exam

- Gait: while walking into the room
- Examine every patient with LBP in a gown!!!
- Posture with standing
  - Bending forward
  - Leaning to one side
  - Weight bearing on one leg more than the other
- Spine deformity e.g structural/reactive scoliosis, kyphosis, lordosis

Palpation

- **Muscles**
  - Paraspinals, gluteals, piriformis, quadratus lumborum, TFL
- **Bony prominences**
  - Spinous processes
  - Facets
  - Iliac crest
  - Ischial tuberosity
  - Greater trochanter
ROM and Rhythm

- Flexion: 40 – 60 deg
- Extension: 20 – 35 deg
- Side bending: 15 – 20 deg
- Rotation: 15 – 20 deg
- Which range specifically reproduces the pain?

Neurological Exam

- Strength testing (MMT): 0 – 5
  - Hip flexors: L2/3
  - Quads: L3/4
  - Tibialis Anterior: L4
  - EHL: L5
  - Gastroc: S1
- Toe/Heel walking
- Reflexes: 0 – 4+ (clonus): Compare side to side
  - Knee (Patellar): L4
  - Tibialis Posterior: L5
  - Ankle (Achilles): S1
  - Medial Hamstring: L5/S1
Sensory Dermatomes

SPECIAL TESTS

To complete the physical exam in a patient with LBP, it is important to examine the following:

- Nerve Root tension signs
- Hip joints
- SI joints
- Lumbar facets
SLR (Straight Leg Raise)

- **Purpose:** stretch the sciatic nerve by elevating the lower limb
- Patient lies supine with his pelvis flat on the bed and in a neutral position
- Elevate the leg by cupping your hand below the patient's heel, slowly, with the knee locked in extension => ask the patient whether elevating the leg causes any *pain in the leg/foot below the ipsilateral knee*

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SLR (Straight Leg Raise)

- (+) if REPRODUCES SAME PATTERN OF LEG PAIN BELOW THE I/L KNEE; occurs between 30 – 70 deg of hip flexion
- Pain felt below < 30° elevation: Not sciatica, the sciatic nerve roots are not sufficiently stretched
- **Crossed SLR**
  - If pain is felt below the knee in the opposite (symptomatic) leg while the ipsilateral (asymptomatic) leg is being raised => highly specific for sciatica of the opposite leg (*crossed straight leg raising test*) - although it is a very insensitive test
  - C/L axillary disc herniation
SLR (Straight Leg Raise)

- Accuracy of SLR can be enhanced by the following maneuvers
  - If the patient feels pain on leg raising => lower the leg a few degrees => the pain should disappear/lessen
  - Then dorsiflex the foot in that position => reappearance/aggravation of the pain) suggests sciatica - Lasegue's sign

- Flex the knee: should relieve the pain
  - If patient still has pain with the knee flexed and if pain is increased on further hip flexion, ??? hip pathology vs. non-organic pain

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SLR (Straight Leg Raise)

- Bowstring sign
  - Flex knee till pain abates
  - Rest limb on shoulder
  - Pressure in the medial and lateral parts of popliteal fossa over the HS tendons and tibial and peroneal nerves
  - Pain over the nerves
  - No pain on pressure over the tendons
Sitting SLR (Straight Leg Raise)

- Often used when there is concern whether LBP is organic
- Positive Tripod Sign
- Very strong ++ test for root tension when considering non-organic pain

Special Tests

False negative SLR

- Large central disc herniation
- Proximal lumbar disc herniation
SLR Sensitivity & Specificity

<table>
<thead>
<tr>
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<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
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<tr>
<td>SLR</td>
<td>73.98</td>
<td>11.61</td>
</tr>
<tr>
<td>Crossed SLR</td>
<td>23.43</td>
<td>88.98</td>
</tr>
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Lumbar Facet Exam

- TTP laterally over the facet area
- **Loading lumbar facets causes pain**
  - Standing position
  - Extension
  - Lateral flexion
  - Causes pain +/- TTP
Special Tests (cont’d)

- SI joint Stress Tests
  - “Fig 4” test (FABER test)
  - Gaenslen’s test
  - Multiple other tests

Special Tests (cont’d)

- Ober’s test
- Assess tightness of TFL & IT band
Waddell’s Signs

- Indicates **symptom magnification** and nonorganic etiology of LBP
- **DOES NOT MEAN PATIENT IS MALINGERING**
- 3/5 of the following needed
  - Inappropriate tenderness (skin rolling)
  - Reproduction of pain with axial loading
  - Inconsistency with exam (SLR supine vs. sitting)
  - Regional sensory deficits
  - Overreaction to exam

Diagnostic Tests

- **Labs**
  - Usually not necessary unless suspect Rheumatologic process, Infection or Malignancy
  - CBC with differential
  - ESR/CRP
  - Urine for BJP
  - SPEP / UPEP
Imaging Studies

- Xrays
- MRI Scan LS spine, +/- Contrast ??
- EMG/NCV
- CT Scan, +/- Myelogram
- Bone Scan

X-rays: Indications

- Back pain in patients > 55 years old
- h/o violent trauma
- Persistent night/rest pain
- h/o CA
- Systemic illness/weight loss
- Associated morning stiffness, iritis, colitis, skin rash, urethral discharge
**X-rays**

- **Views**
  - AP/Lateral/Oblique
  - Flexion/Extension views

- **Demonstrate**
  - Bony anatomy
  - Alignment
  - Fractures
  - DDD/DJD
  - Rarely, CA
  - Instability
  - Spondylolysis
  - Listhesis
MRI Scan

- Mainly soft tissue pathology
- Also shows bony architecture
  - Disc: degeneration, herniation
  - Nerve roots: compression
  - Spinal stenosis: canal dimension
  - HIZ on T2: Annular tear
  - Intrudal lesions

MRI: Very sensitive not specific in determining source of pain

Definite Indications of MRI

- Neurologic deficit
- Clinical suspicion of HNP: Radicular symptoms + Signs of nerve root tension +/- neurologic deficit
  - Initially/after failed conservative care ??
- “Red flags”: clinical suspicion of CA/mets/infection
  - 8-12 weeks of persistent LBP, despite treatment
- Recurrent radicular symptoms suggestive of recurrent/residual HNP (failed back)
- Spinal stenosis ?? (relative indication)
When to Add Contrast?

- Suspect CA/mets
  - If mets: consider Bone Scan
- Infection ??
  - Role of Bone Scan
- Failed back syndrome
  - To differentiate a recurrent disc vs. scar infiltration
MRI

- MRI findings must be carefully correlated with a patient's clinical findings as disc abnormalities are common in asymptomatic patients

CT Scan

- Superior detection of bony detail
- Indications for plain CT
  - Contra-indication to MRI (pacemakers, orbital FB, mechanical valves ??, shrapnel ??)
  - Better visualize bony tumors (???)
  - Fractures
  - Rarely to assess fusion mass
CT Myelogram

- Usually a test ordered by a neurosurgeon
- Indications
  - C/I to MRI
  - Obese patients
  - Multiple herniations, polyradiculopathies
  - Decision making in spinal stenosis
  - Failed Back syndrome

Indications of Bone Scan

- Suspicion of multiple bony mets
- Early detection of bone infection (Indium Scan more specific for infection than Gallium/Technetium)
- Unexplained bone pain (especially in high-powered athletes: stress fractures)
Role of EMG/NCS

- Extension of physical exam
  - Localizes level of nerve root involvement
- Corelate anatomic findings with physiology
- Indications
  - Suspected radiculopathy / plexopathy, poor correlation between their radicular symptoms and neuroimaging
  - Multilevel disease on neuroimaging
  - Recurrent LBP after successful Tx

PUTTING IT ALL TOGETHER
Differential Diagnosis

- Lumbar strain / MPS
- DDD, DJD
- Facet arthropathy
- SI joint dysfunction
- Piriformis Syndrome
- Radiculopathy
- Neurogenic Claudication (Central canal stenosis)
- Spondylosis
- Spondylolysis
- Spondylolisthesis
- Ankylosing spondylitis
- Seronegative arthritis

Treatment

- Initial step: patient education and outlining treatment plan
  - Weight loss, in obese patients
  - Abdominal brace
  - Vocational issues – change jobs ??
- Start conservative
  - Except if any of the “red flags” are present
- Proceed with more invasive/aggressive techniques if conservative measures fail
Treatment

- Options
  - Complete Bed Rest (CBR)
  - PT
  - Medications
  - Interventional pain procedures
  - Surgery

Absolute Indications for Urgent Referral to a Neurosurgeon

- Bowel / bladder incontinence (Cauda Equina Syndrome)
  - A true surgical emergency
- Worsening neurologic deficit
- Suspected spinal cord compression
Other Indications for Urgent Referral to a Neurosurgeon

- Neurologic deficit that persists after 4-6 weeks of conservative therapy
- Persistent sciatica, sensory deficit or reflex loss after 4-6 weeks in a patient with positive straight leg raising sign, consistent clinical findings and favorable psychosocial circumstances
- Known Canal Stenosis with new radicular symptomatology and nerve root tension signs
- Failed Back Syndrome with recurrent symptoms suggestive of acute HNP

Indications of Complete Bed Rest

- Lumbar sprain/strain
- Acute radicular syndrome secondary to HNP
  - Maximum period of Complete Bed Rest is 48-72 hours
Physical Therapy

- Know which muscles to stretch and/or strengthen
- Physical Therapy can
  - Improve ROM
  - Reduce Pain & Spasm
  - Strengthen weak muscles
- Start with passive techniques
  - Active exercises not easily tolerated initially
  - Stretching, modalities including ice, heat, U/S, massage, TENS

Physical Therapy

- Lumbar stabilization
  - Strengthens abdominal muscles and lumbar paraspinals
  - Flexion based (Williams) vs. Extension-based (McEnzie)
  - If HNP: McEnzie extension exercises to centralize pain
  - If LCS: Williams flexion exercises
- Back School: prevent recurrent episodes
Therapy Prescription

- Name
- Diagnosis
- Therapy type (PT, OT e.g.)
- Instructions
- Frequency
- Duration
- Precautions
  - Avoid extension exercises with facet arthropathy
  - Weight bearing restrictions, if applicable

Medications

- NSAIDs
- Muscle relaxants
- Opioids
- Topical options
- Antidepressants (Myofacial Pain)
- Anticonvulsants (Neuropathic Pain)
Invasive Techniques

- **Trigger point injections**
- Indicated for myofacial pain
  - Lidocaine/Bupivacaine – 1cc per trigger point
  - Dry needling
  - Botulinum toxin – controversy over efficacy
  - Knowledge of anatomy is important to identify trigger points and avoid complications with injection

Interventional Pain

- **Spine Injections**
  - Facet blocks (MBB): RFA
  - Facet arthritis
  - Epidural steroids
  - Lumbar stenosis/? Acute HNP
  - SNRB
  - Acute disc herniation
  - SI joint, piriformis injections
- Discograms ?? / IDET
- Intra-thecal Morphine therapy
Indications for Pain Management Referral

- **Acute HNP**, radicular pain not controlled with adequate trial of meds, no significant neurologic deficit (SNRB v LES)
- Radicular pain from **canal stenosis**
- Chronic **DDD +/- acute exacerbation**
- **Recurrent HNP**
- **Failed Back Syndrome**

Algorithm

- **Establish Diagnosis**
  - 90% can be diagnosed with H&P alone
- **Start conservative**
  - Lifestyle modification (weight loss, smoking/EtOH cessation)
  - PT, NSAIDs, Muscle relaxants (if indicated)
    - Allow 6 – 8 weeks for treatment
- **Alter therapy as needed**
  - Aquatic therapy if land-based exercises fail or exacerbate pain
  - **Trigger point injections**
Algorithm

- Add medications as indicated, judicious use of opioids
  - Post-surgical, severe DDD, DJD
- Pain Management/Surgical referral, if indicated
- 10% become chronic pain syndromes
  - Long-acting opioids usually required
- Alternative treatment options
  - Osteopathic/Chiropractic referral
  - Accupuncture
  - Tai Chi, Pilates

![Algorithm Diagram]
Bibliography

- Low Back Pain: Medical Diagnosis and Comprehensive Management. Ed: Bornstein DG, Weisel SW 1989 WB Saunders