Evidence-based Update: Diagnosis and Treatment of Chronic Low Back Pain

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Epidemiology of Low Back Pain

- The fifth most common reason for all physician visits

- 60-85% of adults has low back pain during some point in their lives, 90% symptoms subsides within 6 weeks.

- 7.6% adult reported at least 1 episode of severe acute low back pain within 1-year period.

- Chronic low back pain: pain symptoms persist beyond 3 months, affecting 15-45% of the population.


Common Causes of Low Back Pain

- **Mechanical (80-90%)**
  - Muscle strain or ligamentous injury (65%-70%)
  - Degenerative disc or joint disease
  - Vertebra fracture
  - Congenital deformity (scoliosis, kyphosis, transitional vertebrae)
  - Spondylolysis
  - Spinal instability

- **Neurogenic (5-15%)**
  - Herniated disc
  - Spinal stenosis
  - Osteophytic nerve root compression
  - Annular fissure with chemical irritation of nerve root
  - Failed back surgery syndrome (arachnoiditis, epidural adhesions, recurrent herniation); may cause mechanical back pain as well
  - Infection (herpes zoster)

- **Non-mechanical spinal conditions (1-2%)**
  - Neoplastic (primary or metastatic) disease
  - Infection (osteomyelitis, discitis, abscess)
  - Inflammatory arthritis (rheumatoid arthritis and spondyloarthropathies, including ankylosing spondylitis, reactive arthritis, enteropathic arthritis)

- **Referred visceral pain (1-2%)**
  - Gastrointestinal disease (inflammatory bowel disease, pancreatitis, diverticulitis)
  - Renal disease (nephrolithiasis, pyelonephritis)
  - Abdominal aortic aneurysm

- **Other (2-4%)**
  - Fibromyalgia
  - Somatoform disorder (somatization disorder)
  - Malingering

_Cohen SP et al. BMJ 2008;337:a2167_
Examples of Common Causes of Low Back Pain (1):

Herniated nucleus pulposus:

2. Radicular symptoms may result from either chemical mediators released from degenerated discs or mechanical irritation.
3. Aggravated by prolonged sitting and forward flexion.

Cohen SP et al. BMJ 2008;337:a2167
Examples of Common Causes of Low Back Pain (2):

Spinal stenosis:

Types:
1. central spinal stenosis
2. foraminal stenosis

Causes:
1. osteophyte formation or spondylosis
2. spondylolisthesis
3. postsurgical changes
4. congenitally short pedicles

Symptoms:
1. back pain relieved by forward flexion and worsened with extension
2. leg pain with pseudoclaudication
3. with or without paresthesia and incontinence

Modified from Cohen SP et al. BMJ 2008;337:a2167
### “Red Flag” in low Back Pain

<table>
<thead>
<tr>
<th>Spinal cord compression and cauda equina syndrome</th>
<th>Cancer</th>
<th>Fracture</th>
<th>Spinal infection</th>
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</thead>
<tbody>
<tr>
<td>Cord compression with Upper motor neuron symptoms and signs:</td>
<td>Age &gt;50 years Cancer history Insidious onset Constitutional symptoms (fever, weight loss) Compression fracture</td>
<td>Age &gt;50 years Traumatic injury or cumulative trauma Steroid use history Diffuse osteoporosis</td>
<td>Diskitis, osteomyelitis, epidural abscess</td>
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<tr>
<td>Bowel and urinary incontinence, Increased muscle tone Increased DTR, Babinski sign</td>
<td></td>
<td></td>
<td>Immune suppression status (use of immune suppressants) Immunodeficiency virus (HIV) Intravenous drug use Steroid use history Constitutional symptoms (fever, weight loss) History of ongoing infection in other parts of body (skin, bloodstream, etc)</td>
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<tr>
<td>Cauda equina syndrome (lower motor neuron):</td>
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<tr>
<td>Bowel or bladder dysfunction Severe or progressive neurological deficit Saddle anesthesia</td>
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Spinal infection as a “Red Flag” of Low Back Pain

Right:
Infection showing T12-L1 spinal tuberculosis with bony destruction and abscess

Left:
Infection showing L4-5 pyogenic discitis with epidural abscess

Cohen SP et al. BMJ 2008;337:a2167
Metastatic Disease As a “Red Flag” of Severe Low Back Pain

L1 spinal metastatic disease with erosion of posterior cortex into spinal canal

Symptoms: local or radicular pain

Diagnosis: confirmed by MRI or CT scan

Cohen SP et al. BMJ 2008;337:a2167
Vertebral Body Fracture as a "Red Flag" of Severe Low Back Pain

L2 vertebral Fracture

Causes: osteoporosis, metastasis, trauma

Symptoms: local pain, radicular pain, watch for cord compression

Diagnosis: MRI, CT and X-Ray

Cohen SP et al. BMJ 2008;337:a2167
Cauda Equina Syndrome

Structure: “Horse-tail” contains the nerve roots from L1-5 and S1-5.

Causes: tumor, spinal stenosis or disc prolapse, inflammatory disease, trauma

Signs and symptoms (LMN):
1. bilateral leg pain and weakness
2. back pain may, however, be minimal
3. bowel and urinary incontinence
4. saddle anesthesia
5. bilateral absence of ankle reflexes

Diagnosis: confirmed by an MRI or CT scan

Physical Examination of Low Back Pain

**Neurological exam:**
- Dermatome
- Myotome
- Deep tendon reflex
- Babinski test

**Musculoskeletal exam:**
- Straight leg raising and crossed straight leg raising
- Femoral nerve stretching and crossed femoral nerve stretching
- Facet joint test
- Sacroiliac joint test
Lumbar and Sacral Nerve Dermatomes

- T10-T11: low abdomen
- T12-L1: groin
- L2: anterior thigh and lateral hip
- L3: medial thigh
- L4: medial lower leg
- L5: lateral lower leg
- S1: bottom of the foot
- S2: posterior thigh and calf

Main Nerve Root Supply to Lower Limb Muscles and Movement

L1, L2: iliopsoas, hip flexion

L3, L4: quadriceps femoris, knee extension

L4: tibialis anterior, ankle dorsiflexion

L5: extensor hallucis longus, big toe extension

S1, S2: gastrocnemius and soleus, ankle plantar flexion

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Straight Leg Raising Test for Lumbosacral Radiculopathy

1. To determine an underlying herniated disc at L5, S1 or S2.

2. When the leg is raised between 35 and 70 degrees, the L5 and S1 nerve roots may be stretched against an intervertebral disc.

3. Test positive if pain in the sciatic distribution is reproduced.

4. Sensitivity: 91%; Specificity: 26%

5. If raising the opposite leg causes pain (crossed straight leg raising): sensitivity 29%; specificity 88%


Crossed Straight Leg Raising (XSLR) Test

Increased sciatica on raising the opposite or "well" leg

1. Associated with herniated lumbar disc in 97% of patients.

2. Existence of herniated disc is proved in 90% of the myelogram

3. Predicts poor response to conservative management

4. Result of laminectomy is good, 91% of patients return to work

Distinguish between Tight Hamstring and Neurogenic Leg Pain

1. Lower the leg slightly to the point where the patient stops feeling pain or paresthesia in the leg, and then dorsiflexing the ankle.

2. If the pain is reproduced on dorsiflexion of the ankle after the hamstring have been relaxed by lowering the leg slightly, then the pain is neurogenic.

Femoral Nerve Stretch Test for High Lumbar Radiculopathy

1. To detect a underlying herniated disc at L2-L4 region, compressing on the L2-4 nerve roots

2. The tested leg is extended at the hip and flexed at the knee

3. Test positive if it produces pain in the groin or anterior thigh

4. Sensitivity: 84-95%

5. Crossed FNST: 95% patient with positive test (specificity) found to have lateral L4-5 disc protrusions causing L4 involvement

Spondylolysis Test

- Extension of the back in one-leg standing
- Positive if inducing pain in the back, indicates:
  1) stress fracture of the pars interarticularis, which may cause a spondylolisthesis
  2) facet joint pathology

Sacroiliac Joint Tests

**Patrick’s test:**
- Painful when compressing on the iliac bone: SI pathology
- Painful when compressing on the knee alone: hip pathology

**Sacroiliac distraction test:**
- Compressing on anterolateral aspect of the iliac crest bilaterally, toward the midline.
- Test positive if painful in SI region

Imaging is an Imperfect Science to Identify the Causes of LBP

• Identifying cause of LBP in only 15% of patients in the absence of clear disk herniation or neurological deficit.

• Degenerative spine change is very common:
  – Age 20-29: 10% women demonstrate X-ray evidence of disc degeneration.
  – Age > 40, 80% has spondylosis.
  – Age > 50, 84% of men and 74% of women demonstrate at least one vertebral osteophyte.

MRI Imaging for Low Back Pain

- MRI can be misleading in the diagnosis of the causes for low back pain.

- In asymptomatic patients:
  - 30% of adult have evidence of protruded disc on MRI,
  - Age > 60, MRI imaging reveals disk protrusions in 80% and degenerative spinal stenosis in 20%

- Benefit for early imaging: inconclusive.

Selection of Imaging Studies

• Plain X-Ray:
  – to check bony abnormality including fracture
  – disadvantage: alone will miss spinal stenosis and soft tissue conditions

• CT:
  – most sensitive for bony anatomy
  – when combined with myelogram
    • detect neural anatomy except spinal foramen,
    • useful when MRI cannot be obtained

• MRI:
  – superior to CT/myelgram in detection of spinal stenosis, disc, spinal foramen and extraforaminal condition
  – contraindicated: metallic implants, e.g. pacemaker, previous brain surgery with clips

Joint Practice Guideline from ACP and APS:

- Routine plain radiography, CT or MRI, do not improve the patients’ outcome
- Plain radiography is recommended for initial evaluation of possible vertebral fracture
- CT and MRI (preferred) reserved for
  - severe or progressive neurologic deficit, or underlying 2nd causes, e.g., spinal infection, cauda equina syndrome, cancer or tumor
  - persistent LBP and symptoms or signs of radiculopathy or spinal stenosis, and potential candidate for surgery or epidural steroidal injection

Pharmacotherapy for Low Back Pain: APS/ACP Practice Guideline

• **Good evidence for short-term pain relief:**
  – NSAIDs for acute and chronic pain.
  – skeletal muscle relaxants for acute pain relief.
  – tricyclic antidepressants for chronic pain.

• **Fair evidence for pain relief:**
  – acetaminophen: for acute and chronic pain.
  – tramadol
  – benzodiazepines
  – gabapentin (for radiculopathy)

• **Inconclusive:** opioids

• **Ineffective:** systemic corticosteroid (single shot, or short oral taper), no difference compared to placebo, through 1 month.

Pharmacotherapy for Low Back Pain

Comparison between classes of drugs:
– most lack of head-to-head comparison.
– acetaminophen is inferior to NSAIDs in chronic pain treatment.

Comparison within the same class of drug:
– most lack of head-to-head comparison.
– tricyclic is the only class among antidepressants shown to be effective
– effect of duloxetine and venlafaxine yet to be evaluated.

Interventional Pain Management for Low Back Pain

• Relief of acute or chronic severe and disabling pain which are refractory to conservative therapy or pain medications

• Common minimally invasive procedures
  – epidural injection (interlaminar, transforaminal, caudal)
  – facet intra-articular joint injection or facet joint nerve (medial branch) block
  – sacroiliac joint injection
Lumbar Interlaminar Epidural Injection

**Indication:** pain due to lumbar disc herniation or radiculitis.

**Recommendation:** Strong, for short-term (<6 months) relief.

**Efficacy:** Significant pain reduction in 75% patient after steroid/local anesthetics injection.

**Duration of pain relief per injection:** 2 weeks to 3 months per injection.

**Technical requirement:** 25-30% of needle misplacement without fluoroscopy guidance.

**Lack of evidence:** efficacy for long-term relief

Lumbar Transforaminal Epidural Steroidal Injection or Selective Nerve Root Block

**Indication:** chronic pain caused by lumbar disc herniation, radiculitis, spinal stenosis

**Recommendation:** strong recommendation for short term (< 6 months) or long term (> 6 months) for pain management

**Efficacy:**
1) 64-81% pain reduction; 60-63% disability reduction; 56% depression reduction.
2) Disc herniation and radiculopathy: 75% patient with >50% pain reduction over 80 weeks.

**Duration of pain relief per injection:**
1) Back pain: 2 weeks to 3 months.
2) Leg pain: up to 6 months

Caudal Epidural Steroidal Injection

**Indications:** chronic pain due to disc herniation, radiculitis, discogenic pain without disc herniation or radiculitis, post-laminectomy syndrome and spinal stenosis

**Recommendation:** strong, for pain relief short term and long term

**Efficacy:** > 50% pain reduction in 50-95% patients at 3 months, 50-86% at 6 month, 54-81% at 12 month.

**Frequency:** 3-4 injections per year to relieve 35-36 weeks, over a period of 52 weeks.

Referral Pattern of Lumbar Facet (Zygapophyseal) Joint Pain


**Lumbar spinal region**
- L1/2: 100%
- L2/3: 100%
- L3/4: 80%
- L4/5: 100%
- L5/S1: 78.9%

**Gluteal region**
- L2/3: 8.3%
- L3/4: 40%
- L4/5: 26.9%
- L5/S1: 68.4%

**Trochanteric region**
- L2/3: 16.7%
- L3/4: 10%
- L4/5: 7.7%
- L5/S1: 15.8%

**Groin region**
- L3/4: 10%
- L4/5: 7.7%
- L5/S1: 15.3%

**Posterior thigh region**
- L3/4: 20%
- L4/5: 7.7%
- L5/S1: 21%

**Lateral thigh region**
- L2/3: 8.3%
- L3/4: 20%
- L4/5: 15.4%
- L5/S1: 31.6%
Treatment for Lumbar Facet Joint Pain

- Responsible for 15-40% of chronic low back pain, and 3% of failed back (surgery) syndrome.

- Both intra-articular joint injection or medial branch nerve block are recommended by ASA/ASRA for the treatment of facet-mediated spine pain.

- Effect of facet medial branch nerve block lasts 3-12 months.

- In one RC-DB study, pain relief compared to a baseline after MBNB with local anesthetic with or without steroid:
  - At 3, 6, 12 months: 73%, 87%, and 73% reduction, respectively.
  - Average duration per block: 3.5 mo, number of blocks/yr: 3.5

ASA/ASRA. Practice guideline for chronic pain management. Anesthesiology. 2010; 112:810-33.
Lumbar Facet Joint (Medial Branch) Nerve Block

Left and Right L3, 4, 5 medial branch nerve block (Anterior-posterior View and Lateral View) With Contrast to Outline the L3, 4, 5 Medial Branch Nerves
Sacroiliac Joint Steroidal Injection

**Prevalence:** 10-30% in chronic back pain, 2% of FBSS

**Evidence of injection efficacy:**
- lack of systemic review and meta analysis data

In one placebo-controlled, double-blind study:
1) at 1 month, 5/6 corticosteroid-injected joints had >70% pain reduction vs. 0/7 joints with placebo injection
2) at 3 months, 62% injected joints remains improved
3) at 6 months, 58%.

Surgical Options for Chronic Low Back Pain

If degenerative disc disease:
Fusion with instrumentation

Decompression and fusion with instrumentation

Discectomy
Laminotomy
Laminectomy
Foraminotomy

Failed Back (Surgery) Syndrome

• **Outcome of Low Back Surgeries:**
  – Successful rate:
    • Initial surgery: 60% successful, or 40% unsuccessful
      – Successful rate drops to 30-40% at an average of 2-year follow-up
    – 19% required reoperation over the ensuing 11 years.
  • Successful rate:
    – 2\textsuperscript{nd} surgery: 30%
    – 3\textsuperscript{rd} surgery: 15%
    – 4\textsuperscript{th} surgery: 5%

Failed Back (Surgery) Syndrome

• Back pain occurs
  – immediately after the surgery:
    • Initial wrong diagnosis, technical error, poor patient selection due to psychological factor
  – within a few weeks after the surgery, after a temporary relief:
    • Infection
  – months after surgery:
    • Reherniation, inflammation of the nerve roots, epidural fibrosis, arachnoiditis
  – several years after the surgery:
    • Spinal instability (decompression or fusion surgery), spinal stenosis at previous surgical site or adjacent level

Treatment of Failed Back Syndrome

• **Oral pain medications**
  – Naproxen 250-500 mg bid
  – Celebrex 100-200 mg bid
  – Nortriptyline 25-150 mg qd, used with naproxen or celebrex

• **Physical therapy**
  – If no improvement, consider epidural injection

• **Spinal intervention**
  – Epidural injection: Lumbar (interlaminar and transforaminal), caudal
  – Facet joint nerve block or joint injection
  – Sacroiliac joint injection
  – Radiofrequency neurolysis: pain reduction as long as 3 yr
  – Spinal cord stimulation: in one systemic review, 50% pain reduction in 37.5% patients vs 11.5% patients receiving revision surgery. Effect was still better than re-operation at the 3-year follow-up.

• **Repeated surgery:**
  – Failure to relieve pain or perform daily living activity, in the presence of specific structural abnormality on a radiographic study
  – Significant progressive neurologic deficits
  – Loss of bowel or bladder control
  – Failure of fixation (hardware) device
  – Infection

Common Questions of Epidural Injection for Low Back Pain

• Question: How many injections allowed per year?
  – Undetermined. In academic setting, average 4.74 (0-20); in private practice setting, 6.9 (3-40)

• Question: How much steroid allowed per injection and per year?
  – Undetermined. Ideal dose and type of steroid yet to be determined

Summary for Low Back Pain Management

- Acute and chronic low back pain are very common, majority of the acute low back pain recovers by itself.

- Chronic low back pain diagnosis is based on accurate history inquiry, thorough physical exam including appropriate provocative tests, confirmatory imaging radiographic studies with plain films, CT/myelogram, and MRI scan.

- Selective fluoroscopy-guided pain procedures provide reasonable duration of pain relief for patients who suffer from severe and disabling pain before or after the low back surgery.
Thank You!

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