Interventional Pain Management in Low Back Pain

I KETUT SUYASA

General Surgeon, Orthopaedic Surgeon, Spine Consultant

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Low Back Pain

- Low back pain is a symptom not a disease.
- The pathologic basis for the pain may be something within the spine or lesion outside the spine.
Annual incidence was 2-5% with point of prevalence of 15-25%

About 80% of people will have back pain at least one time in their life.

Low Back pain is the number five reason to visit the doctor.

It is the number one reason for work related disability

The most common cause of disability in persons under the age of 45
# LBP: Risk Factors

Some conditions might be strongly, moderately or weakly associated with back pain.

<table>
<thead>
<tr>
<th>Strongly associated</th>
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</thead>
<tbody>
<tr>
<td>Prior history of back injury</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Job satisfaction/emotional distress</td>
</tr>
<tr>
<td>Heavy or repetitive lifting/heavy physical work</td>
</tr>
<tr>
<td>Prolonged sitting or standing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moderately associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
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<tr>
<td>Smoking</td>
</tr>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Height</td>
</tr>
<tr>
<td>Physical fitness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weakly associated or not associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Anthropometry</td>
</tr>
<tr>
<td>Lumbar mobility</td>
</tr>
<tr>
<td>Trunk strength</td>
</tr>
<tr>
<td>Radiographic structural abnormalities</td>
</tr>
</tbody>
</table>
SOURCE OF LBP

Cause
- Spondylogenic
- Neurogenic
- Viscerogenic
- Vascular
- Psychogenic

Temporal
- Acute
- Chronic
### SOURCE OF LBP

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spondylogenic</strong></td>
<td>Derived from the spinal column and its associated structures&lt;br&gt;Aggravated by activities, relieved by rest</td>
</tr>
<tr>
<td><strong>Neurogenic</strong></td>
<td>Tension, irritation, or compression of a lumbar nerve root</td>
</tr>
<tr>
<td><strong>Viscerogenic</strong></td>
<td>Derived from disorders of the kidneys or pelvic viscera, lesions of the lesser sac and retroperitoneal tumors&lt;br&gt;Not aggravated by activity and not relieved by rest</td>
</tr>
<tr>
<td><strong>Vascular</strong></td>
<td>Abdominal aortic aneurysms or peripheral vascular disease</td>
</tr>
<tr>
<td><strong>Psychogenic</strong></td>
<td>Pure psychogenic rarely seen in clinical practice&lt;br&gt;Need thorough investigation</td>
</tr>
</tbody>
</table>
Low Back Pain (Temporal)

Acute Low Back Pain

• < 6 week duration

Chronic Low Back Pain

• > 6 week duration
Mechanical and Non-Mechanical Pain in LBP

Pain with non-mechanical behaviour
Spontaneous, constant generalized pain with no clear anatomical focus, either unrelated to mechanical factors or a disproportionate exaggerated and sustained pain response to minor mechanical triggers.

Mixed presentation

Pain with mechanical behaviour
Pain that has a clear and consistent anatomical focus
Pain has a proportionate mechanical behaviour (provoked and relieved with specific activities and postures)

Infection  Gastro-Intestinal  Renal  Malignancy  Vascular  Reumatologic conditions

Vertebrae are bones that protect your spinal cord. They can be forced or locked out of their proper positions (mis-aligned).

Ligaments and muscles are supportive tissues that can be stretched, torn, or weakened.

Discs are shock absorbers that can bulge, rupture, or wear down.

Nerves, which carry the body's messages, can get stretched, pinched, or irritated.
### Differential: Mechanical LBP

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar Strain or Sprain</td>
<td>70%</td>
</tr>
<tr>
<td>Degenerative processes of disc and facets</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Herniated disc</strong></td>
<td>4%</td>
</tr>
<tr>
<td>Osteoporotic Compression Fracture</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Spinal Stenosis</strong></td>
<td>3%</td>
</tr>
<tr>
<td>Spondylolisthesis</td>
<td>2%</td>
</tr>
<tr>
<td>Traumatic Fractures</td>
<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Congenital disease</strong></td>
<td>&lt;1%</td>
</tr>
<tr>
<td>- Severe Kyphosis or Scoliosis</td>
<td></td>
</tr>
<tr>
<td>- Transitional Vertebrae</td>
<td></td>
</tr>
<tr>
<td>Spondyloysis</td>
<td></td>
</tr>
<tr>
<td>Internal Disc Disruption/Discogenic Back Pain</td>
<td></td>
</tr>
<tr>
<td>Presumed Instability</td>
<td></td>
</tr>
</tbody>
</table>

Nonmechanical spinal conditions
(1% OF ALL LOW BACK PAIN)

**Neoplasia**: multiple myeloma, metastatic CA, lymphoma, leukemia, spinal cord tumors, retroperitoneal tumors, primary vertebral tumors (0.7%)

**Infection**: osteomyelitis, septic diskitis, paraspinal abscess, epidural abscess, shingles (0.01%)

**Inflammatory arthritis**: Ankylosing spondylitis, psoriatic spondylitis, Reiter’s syndrome, IBD (0.3%)

Scheuermann Disease (osteocondrosis)

Paget Disease

Visceral Disease
(2% OF ALL BACK PAIN)

Disease of pelvic organs:
prostatitis, endometriosis, chronic PID

Renal Disease: nephrolithiasis, pyelonephritis, perinephric abscess

Aortic aneurysm

GI disease: pancreatitis, cholecystitis, penetrating ulcer

Mechanical LBP
(Herniated disk and Spinal stenosis)

Herniated disk

- Usually occurs in adults aged 30 to 55 years
- Sciatica, often associated with leg numbness or paresthesias, is a highly sensitive (95%) and specific (88%) finding for herniated disk
- Exacerbation of pain may occur with
  - coughing
  - sneezing
  - Valsalva maneuvers

Spinal Stenosis

- usually occurs in older adults
- characterized by neurogenic claudication
  - radiating back pain and lower extremity numbness
  - exacerbated by walking and spinal extension
  - improved by sitting
Approach to LBP

History & physical exam

Classify into 1 of 4:

• BAD: LBP from other serious causes
  • Cancer, infection, cauda equina, fracture
• LBP from radiculopathy or spinal stenosis
• Non-specific LBP
• Non-back LBP

Workup or treatment
DIAGNOSIS

Anamnesis

[Diagram of diagnostic process with nodes for Time, Activity, Position, Movement/Activities, Pain, Constant, Intermittent, Variability in intensity, What aggravates, Location of referred pain, Numbness, Paraesthesia, and yes/no questions about duration and specific aggravating factors.]
PATIENT HISTORY

“OPQRSTU”

Onset
Palliative/Provocative factors
Quality
Radiation
Severity/Setting in which it occurs
Timing of pain during day
Understanding - how it affects the patient
DIAGNOSIS

Physical Examination

- **Look** (gait, postural, alignment plane)
- **Feel** (Skin include sensoric, paravertebral muscle, procc spinosus, abnormal prominences)
- **Move** (Muscle strength, reflexes and neurological deficits)
- **SPECIAL TEST** (Straight leg raise test)
Evaluation begin with plain radiography (can reveal instability that apparent in an upright position)

CT-scan provide high resolution of bony injury in thoracolumbar traumatic injury

MRI is used to detect disk herniation, damage to posterior ligamentous complex, pathologic fracture or mass lesion in spinal canal
Laboratory studies

Labs are generally not necessary, but may be helpful if cancer or infection or visceral disease is suspected.

The following laboratory studies should be considered if there is concern for cancer or infection:

- CBC
- ESR/CRP
- PSA
- Alkaline phosphatase
- Serum immunoelectrophoresis
- Urine testing for light chains
Spinal stabilization system represented by 3 major subsystems. These subsystems consist of:

1. The passive, or osteoligamentous subsystem,
2. The active, or musculotendinous subsystem,
3. The neural control subsystem.
Estimates of the percentage of patients with low back pain arising because of spinal instability range from 13% to 30% of the total population of patients with Mechanical LBP.
Spinal Instability

- Significant decrease in the capacity of the stabilizing system of the spine to maintain the intervertebral neutral zones within the physiological limits so that there is no neurological dysfunction, no major deformity, and no incapacitating pain
  - *Segmental instability* to be an abnormal movement of one vertebra on another secondary to an increase in the size of the neutral zone
  - Clinical instability to be an observable signs and the symptoms of patients hypothesized to have a disruption of the spinal stabilization system
**Instability**

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior elements destroyed/unable to function</td>
<td>2</td>
</tr>
<tr>
<td>Posterior elements destroyed/unable to function</td>
<td>2</td>
</tr>
<tr>
<td>Relative sagittal plane translation of 2.5mm</td>
<td>2</td>
</tr>
<tr>
<td>Sagittal plane angulation 5 degrees</td>
<td>5</td>
</tr>
<tr>
<td>Neurological deficit</td>
<td>2</td>
</tr>
<tr>
<td>Disturbance of costovertebral area</td>
<td>1</td>
</tr>
<tr>
<td>Dangerous anticipated loading</td>
<td>1</td>
</tr>
</tbody>
</table>

The fracture is labeled as unstable when the count is 5 points or more.

- **Loss of Vertebral height > 50%**
- **Kyphosis > 20%**
- **Canal compromise > 50% (associated with persistent neurological deficit)**
- **PLC injury (associated with poorer outcome)**
Low Back Pain Management

NON OPERATIVE

OPERATIVE
NON OPERATIVE Management Program for Low Back Pain

- **Patient Education**
- **Controlled physical activity, bed rest, exercise**
- **Drug therapy: analgesic, NSAID, muscle relaxant and anti depressant**
- **Physical modalities: ice massage, hot packs, ultrasound, TENS**
- **Injection Therapy: 1% xylocaine, corticosteroid**
Pain management treatment options

- **Pharmaceuticals Oral →** NSAID, antidepressant (TCAs, SSRIs), Anticonvulsants, Local anesthetics, Opiates, Alfa adrenergic agents, Muscle Relaxants

- **Injections →** Epidural steroid injection, Selective nerve root block, facet joint block, facet rhizotomy, sacroiliac joint block

- **Radiofrequency ablation →** radifrequency neurotomy for facet and SI joint pain

- **Surgically implanted electrotherapy devices**
Clinical Algorithm for the management of chronic low back pain
Main goal: deliver medication in targeted fashion as close as possible to the area of pathology to maximize therapeutic effect and minimize the systemic side effects of corticosteroid administration.

Approach:

- Interlaminar
- Transforaminal
Interlaminar Approach

Most common technique utilized for lumbosacral analgesia

Major drawbacks

- Relatively poor distribution to ventral epidural space compared with targeted transforaminal approach
- Potential for dural puncture
- Previous back surgery patients → presence of epidural scar tissue may limit the distribution of the injected medication
Interlaminar epidural steroid injection (lannuccili)
Transforaminal approach

- Better delivery of a concentrated dose of medication directly to the affected nerve root
- Allows for more direct access of medication to the ventral epidural space than interlaminar approach
- Preferred in cases where there is higher risk for dural puncture with an interlaminar approach
Transforaminal epidural steroid injection (lannuccilli)
RISK AND COMPLICATION

<table>
<thead>
<tr>
<th>Complication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interlaminar or a transforaminal approach</td>
<td>Safe and well tolerated</td>
</tr>
<tr>
<td>Facial flushing and vasovagal reactions</td>
<td></td>
</tr>
<tr>
<td>Dural puncture and inadvertent misadministration of medication into the thecal space</td>
<td>Hypotension, paralysis, and incontinence</td>
</tr>
<tr>
<td>Epidural hematoma and abscess formation</td>
<td></td>
</tr>
<tr>
<td>Spinal cord infarction and paraplegia</td>
<td></td>
</tr>
</tbody>
</table>
Facet Medial Branch Block and L5 Dorsal Ramus Block

Performed in refractory centralized lower back pain that is felt to be related to facet joint arthropathy.

Number of facet joints treated determined by extent and distribution of pain.

The most common sites lumbar facet arthropathy → at L4/L5 and L5/S1, usually bilateral.
Innervation of the zygapophysial (facet) joints
High percentage of patients will have a false-positive response to medial branch blockade → perform test injections

Performed using a total of six separate injections (three on each side) to target the L3 and L4 medial branches and the dorsal ramus of L5 bilaterally.

Appropriate dose for bilateral L4/L5 and L5/S1 facet joints (six total injections) would be 80-mg triamcinolone (Kenalog) mixed with 4 mL of 0.5% Marcaine
Targeting the medial branch of the spinal nerve.

• Oblique view of the lumbar spine showing appropriate needle tip position to target the medial branch of the right L3 spinal nerve.
• Fluoroscopic target is the junction of the transverse process and superior articular process of the facet joint (i.e., the junction between the “ear” and the “nose” of the “scotty dog”
Medial branch block.
Anteroposterior (A) and lateral (B) views showing appropriate needle tip position to target the medial branch of the right L4 spinal nerve (superior) and dorsal ramus of the right L5 spinal nerve (inferior) for sensory blockade of the right L5/S1 facet joint.
Patients who consistently receive medial branch or dorsal ramus blockade of the facet joints after 2 to 3 treatment sessions may be considered for radiofrequency (RF) denervation (rhizotomy).

Analgesic effects of successful RF rhizotomy can last up to 12 months.

RF rhizotomy utilizes high-frequency electrical current to produce heat in the target tissues, resulting in thermal tissue destruction.
Radiofrequency rhizotomy
RISK AND COMPLICATION

Potential for injury to the motor nerve if the electrode tip is positioned too far anteriorly near the ventral ramus of the adjacent spinal nerve.

Patients will describe a sensation of burning pain radiating down the leg if the ventral ramus is affected during RF heating.
Percutaneous Laser Disc Decompression (PLDD)

- Percutaneous techniques provide an alternative to surgical treatment of herniation of lumbar discs.
- Can be divided into dissolution mechanisms (chymodactin), ablation (nucleotomy or surgery), and vaporization (laser) of the nucleus pulposus (NP).
PLDD
(Mechanism of Action)

- The concept of PLDD is based on the percutaneous introduction of an optical fiber into the intervertebral disc by means of a small-diameter needle and the administration of laser energy.
PLDD (Mechanism of Action)

- This permits the vaporization of a small amount of NP in the central part of the disc, significant reduction in intradisc pressure, and the disappearance of disc-related pain.
PLDD
(Procedure)

The laser is usually guided by the use of fluoroscopy which permits imaging of all planes combined with Computed tomography (CT) allows for guiding the position of the needle by visualizing the bony structures and soft tissue.
PLDD (Indication)

PLDD is an only slightly invasive technique and thus avoids the disadvantages of classical surgery (damage to lumbar muscles and soft tissue, duration of hospitalization, and convalescence), and the outcome is straightforward.

**Inclusion criteria**
- 1. Contained disc herniation demonstrated on CT or MRI
- 2. a. Neurological findings referring to a single nerve root,
  b. Leg pain of greater intensity than back pain,
  c. Positive straight-leg-raising test (Lasgue’s sign),
  d. Decreased sensation, motor response, and tendon reflex
- 3. No improvement after 6 weeks’ conservative treatment

**Exclusion criteria**
- Hemorrhagic diathesis
- Spondylolisthesis
- Spinal stenosis
- Previous surgery at the indicated disc level
- Significant psychological disorder
- Significant narrowing of the disc space
- Possibility of monetary gain (eg, from a work accident)
- Pregnancy
- Cauda equina syndrome
Nerve conduction velocity rates were significantly increased in the laser-treated group as compared with non-treated animals, and PGE2 and PLA2 levels were reduced.

The application of laser energy may cause damage to the intervertebral disc and neighboring tissue.
OUTCOME

- Most studies report a 75% success rate with PLDD (according to MacNab criteria:

  - Combining good (about 50%) and fair (about 25%) success rates, with 0.4 to 1% complications (particularly thermal and infectious discitis), and 5% recurrence.

Table 5: MacNab Criteria of Success of Response to Treatment (23)

<table>
<thead>
<tr>
<th>Good</th>
<th>No objective signs of nerve root damage.</th>
<th>Pain free</th>
<th>Relief of presenting symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No dependency-inducing medication, appropriate activity</td>
<td>Ability to return to normal work and activities</td>
<td>Able to return to modified work</td>
</tr>
<tr>
<td></td>
<td>No objective signs of nerve root damage</td>
<td>Objective symptoms</td>
<td>Additional operative intervention needed at the index level</td>
</tr>
</tbody>
</table>

Table 6: Modified MacNab Criteria (7.3)

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Good</th>
<th>Failure</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain free</td>
<td>Occasional nonradicular pain</td>
<td>Some improvement in functional capacity</td>
<td>Continued symptomatic symptoms</td>
</tr>
<tr>
<td>No restriction of mobility</td>
<td>Relief of presenting symptoms</td>
<td>Still handicapped and/or unemployed</td>
<td>Additional operative intervention needed at the index level</td>
</tr>
<tr>
<td>Relief of symptoms</td>
<td>Able to return to modified work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Still handicapped and/or unemployed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional operative intervention needed at the index level</td>
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</tbody>
</table>
Complications have included:

- Infectious and aseptic discitis
- Disc rupture
- Epidural hematoma
- Damage to the AF or nerve root

Gangi and coworkers reported that low back pain persists or worsens temporarily in 60% of patients.
Sacroiliac Joint Injection

Source of chronic lower back pain in 10 to 20% of patient

SI joint pain → dull, aching-type pain distributed over the buttock, anterolateral thigh, and groin region.

SI joint injections reserved as diagnostic therapeutic measure of last resort when medial branch blockade and epidural injections have been utilized with no clinical effect.
Sacroiliac joint injection
RISK AND COMPLICATION

Overall is a safe procedure

Associated with only minimal risk for bleeding and infection.

Reported cases of transient motor and sensory deficits in the ipsilateral leg soon after injection related to extra-articular injection and infiltration of local anesthetic around the adjacent sciatic nerve.
THERAPY of MSCs in LOW BACK PAIN

1. For cellular repair of degenerated disc
2. Restore cell population, elevate disc function and help reduce pain
Therapy with MSCs

- Induction of discogenic differentiation of MSC:
  - Growth Factors combined with conditioned culture mimicking in vivo tissue environment.
  - TGF-β, IGF-1, FGF-2, BMP-7 and NP-specific marker (GDF-5) can help inducting MSC differentiation into phenotype NP-like cells.
  - Direct contact culture with intervertebral disc cells
Therapy with MSCs

- Isolated with diisolasi iliac crest aspiration, then centrifuge
- Cultured in Dulbecco’s Modified Eagle medium with low glukosa
- Supplemented with growth factor and 10% human serum
- Use some ideal biomaterial as scaffold for MSCs that mimicking NP (hydrated gelatinous substance)
  - pentosan polysulphate-incorporated polyethylene glycol (PEG)
  - hyaluronan (HA)
  - ferulic acid-gelatin chitosan/glycerophosphate,
  - laminin-functionalized PEG
  - type II Collagen-hyaluronan
Surgical treatment

Indication

Failure on adequate conservative treatment

Instability:
>50% loss of height implies PLC injury
>30° Cobb kyphosis implies PLC injury

Progressive neurological deficit
## Surgical treatment

**Goal**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Stabilize the unstable spine</td>
</tr>
<tr>
<td></td>
<td>Restore/ improve sagittal balance</td>
</tr>
<tr>
<td></td>
<td>Decompress a progressive neural deficit</td>
</tr>
<tr>
<td></td>
<td>Protect intact or incompletely injured neural elements</td>
</tr>
</tbody>
</table>
Back pain rarely occurs because of a serious illness, and most people do not experience damage of the spinal cord. Many severe back pain improve within a few days-weeks; moderate symptoms can withstand for several months. Frequent recurrence of back pain is common, with 10% of patients having persistent symptoms within 1 year. However, most patients can resume their normal life. If a person did not do activities because of low back pain for a long time, it takes a longer time to be able to do normal activities.
**SUMMARY**

Fluoroscopy-guided injection treatments for chronic refractory LBP are safe, effective, and easy to perform interventions.

- Serious complications are rare.
- Use of image guidance and adherence to proper technique is important.
- The choice of injection technique should be governed by the patient’s clinical history and targeted physical exam findings.
THANK YOU