Lumbar Radiculitis & Radiculopathy

Western University
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Disclosure I have:

- No Commercial Interest or support
- No Financial relationships with outside individuals
- No Conflict of Interest
Objective

- Describe the pathophysiology of lumbar radiculitis & radiculopathy
- Describe role of multiple modalities in treatment of lumbar radiculitis & radiculopathy
- Determine how to assess risks factors and benefits, as well as alternatives of lumbar spine surgery
Cultural Barriers

- Language Barrier could led to delay
  - availability of translators crucial
- Personal Beliefs creating treatment issues
  - concern regarding P.T., OMM, medications
  - necessitates detailed explanations
- Ethno cultural Beliefs that delay treatment
  - concern regarding procedures at certain ages
Case

- 45 y/o RH Caucasian male c/o LBP with post axial radiation into top of right foot, with paresthesia in similar distribution and subjective paresis of EHL, no change reflexes. Pain increased with coughing and sitting, relieved with lying down.
Epidemiology – Back Pain

- Second leading cause of disability and work-related injury
- Affects 50 million Americans annually
- Most common health problem in 20-50 y/o
- 13 million US doctor visits annually
- Most lost productivity
- 175.8 million restricted days
- Annual prevalence 15-20%
- 70-80% world experience LBP
# PREVALENCE OF JOINT PAIN

Most common health problem 20-50 y/o  
Spine most common joint pain 45-64 y/o

<table>
<thead>
<tr>
<th></th>
<th>Joint Pain</th>
<th>Back Pain</th>
<th>Neck Pain</th>
<th>Joint Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>B,N,O</td>
<td>(Rate/ 100)</td>
<td></td>
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<td>7.0</td>
<td>16.6</td>
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<td>16.0</td>
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<td>15.8</td>
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<td>38.4</td>
<td>20.3</td>
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<tr>
<td>65—74 yrs</td>
<td>40.1</td>
<td>18.2</td>
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<td>28.1</td>
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<td>21.9</td>
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<tr>
<td>Black</td>
<td>15.5</td>
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<tr>
<td>Other</td>
<td>13.7</td>
<td>11.3</td>
<td>7.2</td>
<td>12.5</td>
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</table>
Anatomy- Where’s the pain?
The Spine - Disk Strength

- 1,000 Kg force slowly applied to the vertebral end plates would cause them to fracture far sooner than it would cause a disc to herniate.
- The load on a disc may be as little as 25 Kg in the supine position to 250 Kg in the seated flexed position.
- Plunges water in & out of NP.
Risk Factors
Most avascular tissue in human body

- Microtrauma, disuse, immobilization, obesity
- Sitting, postural stress, vibration, chemicals
- Driving, heavy lifting
  - Heavy work before 20 y/o for > 3 years
  - Exercise < 1 yr or > 15 yrs
- Less in moderate occupations
- Axial Loading model
Causes of LBP & RR

- Spine tumors
- Muscles, soft tissue
- Bones
- Joints
- Disk
- Nerve compression
- Nerve irritation
- Spinal cord compression
- Stenosis
  - Central, lateral, NF
Epidemiology

- 15% of primary CNS tumors are intraspinal
- Mostly benign vs intracranial
- Usually present by compression vs invasion
- Three main groups: extradural (55%) intradural extramedullary (40%) intramedullary (5%)
Extradural 55%

- Metastatic Disease
- Bony destruction
- Lung
- Breast
- Prostate
Spinal Epidural Metastases

- 10% of Cancer patients will have spinal involvement
- No treatment prolongs survival, may only help with pain and neurological deficits
- Usually hematogenous spread
- Distribution correlates with length of spinal segment. Thoracic 50-60%
Intradural extramedullary 40%

- Meningiomas
- Neurofibromas
- Lipomas
- Rare to have mets
Intramedullary 5%

- Astrocytoma (30%)
- Ependymoma (30%)
- Rare to have mets
Presentation

- **Pain**-most common Sinuverterbral Nerve
  - Type of pain depends on tumor location
  - Recumbent, nocturnal, Valsalva maneuvers
- **Weakness**-second most common
  - Type of weakness depends on location
- **Sensory** (including bowel and bladder)
  - dissociated sensory, aka Brown Sequard
  - decreased pain and temperature,
  - Intact light touch
Diagnosis

- History and Physical
- MRI with and without Gadolinium
- Myelography
- CT with and without contrast
- Metastatic workup
Management for Spinal Mets

- Treatment of primary disease
- With bony lesion-radiation
- With epidural mass- radiation or surgery
Indications for Surgery

- Controversy exists
- Need for diagnosis
- Unstable spine
- Deficit from compression and/or instability
- Failure of radiation
- Recurrence after maximum radiation
- Surgery alone is never the answer
Contraindications for Surgery

- Controversy exist
- Radiosensitive pathology
- Total paralysis greater than 24 hours
- Expected survival less than 4 months
- Diffuse spinal involvement
- Poor medical condition
Other Causes LBP
Soft Tissue

- Muscles, tendons and ligaments
  - Help to support and move the bones
- Painful
  - with over use but also with under use.
- Stretched with weight gain
- Irritated from vascular diseases caused by smoking and other abusive behavior
- Crushed or torn from injury or atrophied from sitting on the couch watching TV and eating chips
Facets

True synovial joints

- allow flexion and extension and tend to resist axial loads, side-bending and rotation

When the loads exceed the capacity of the joints the body will try to compensate

- facets they will thicken over time
- bony spurs will be added by the body to take up the additional strain
Facets

- Body aids facets - Hypertrophy.
- Narrowing central canal & foramen compresses nerves
- Erosion of the synovial surface
  - Back pain with movement esp. extension
  - Decreased blood & nutrient supply
  - Causing ischemia - felt as neurogenic claudication or radiculopathy
Disk

- Vesalius first described the intervertebral disc in 1555.
- Its association to postaxial pain was described by Lasegue in 1870
- First monograph being published in 1933 by Mixter and Barr
- **Very good nerve supply** and a **poor blood supply**
Pathophysiology
Disk

- “Herniated disc” or nucleus pulposus
  - Compress a nerve directly causing pain
  - Chemical irritant leading to an inflammatory reaction
  - Referred irritation: irritate the nerves to the disc, joints, muscles and skin
Herniated Disk

- May not leave the confines of the annulus
- Annulus may be torn, stretched or just chemically irritated from a nucleus pulposus that has degenerated and lost its water content
  - Prostaglandins, leukotrienes, histamines
  - Sinuvertebral nerve

Cartilage
Once destroyed is not repaired
Hunter 1743
Pain

Heat Pressure Cold Chemical Complex

Phospholipids  Lysosomes

Arachidonic acid  Histamine

Lipoxygenase  Bradykinin Kinins

SRSA Leukotriene B2  cyclooxygenase (COX 1-3)

Prostaglandins  Thromboxanes

Free rad  Inflammation erythema edema pain loss of function
Herniated Disk

With time the entire disc is irritated, chemosis spreads

- to the bones, causing Modic changes
- facets causing hypertrophy and loss of synovium
- to the nerve roots causing radiculopathy
- to the innervating nerves causing sprouting, discogenic & other pain
- to the muscles causing spasms and pain
Other Causes of LBP & RR

interrelationship of neuro muscular skeletal system

- Surrounding structures may play a role
- Skin causes pain
- Internal organs can cause pain
- Nerves from skin, muscles, tendons, ligaments, joints and bones travel to the spine before going to our brain to be perceived
- If these structures are inflamed nerves sprout & pain is felt at lower threshold
- Nerves can be inflamed without other causes
  - Diabetes
  - peripheral neuropathy
FORAMEN

- Smallest at L5-S1 w/largest nerve root, largest at L1-2
- Connective tissue, lig. flavum, arteries, veins, lymphatics, sinuvertebral nerve
- Spinal nerve forms lateral
- Motor root ant. inf. in foramen
  - Nerve, dura, arachnoid occupy 35-45% space
SINUVERTEBRAL NERVE

Major sensory supply to lumbar spine from spinal nerve before splits into ant. & post. divisions (rami)

Joins sympathetics

- enters canal through foramen, around pedicle to mid PLL divides & anastomosis with opposite side and levels

Innervates PLL, superficial annulus, epidural blood vessels, ant. dura mater, NR dural sleeve, post. vertebral periosteum, Posterior disc

Lateral disc: ventral & grey rami

Anterior disc: afferent sympathetics

Referred Somatic Pain: Regional, Dull, Aching, Gnawing
POSTERIOR PRIMARY RAMI

From spinal nerve after it splits into ant & post Rami

Posterior Rami (division) splits into medial & lateral branch

- Medial supplies two ipsilateral facets
- surface lig. flavum
- dorsal muscles
  - multifidus, intertransversarii mediales, interspinales, fascia, interspinous lig., blood vessels, periosteum
- Lateral sacrospinalis muscles, lumbar skin
Obtaining the history and examining the patient is the most reliable way to determine the site of the pathology.
History

Where is the pain? Back or Leg
Is there any paresthesia? Where?
Is there any weakness? Where?
When did it start?
How did it start?
What makes it worse?
    Activity, inactivity, valsalva, walking, sitting
What makes it better?
Radicular Pain

- Pain + changes in sensation or weakness should be addressed more aggressively
  - not necessarily with surgery
- Amount of s/sx determine ultra-early surgery
- Even bowel and bladder changes are not the sine qua non of surgery - but they should not be taken lightly
- Bladder changes affected by pain, bowel changes caused by pain medication
  - Sig. Bladder distention & incontinence: **Worry**
  - Bowel incontinence & loss of tone: **Worry**
  - Ask when symptoms started, under what circumstances
Radicular Pain

Pain that is improving and less than 3 months or greater than 6 months and stable does not respond best to surgery
LBP & RR Workman’s Comp

Back or radicular pain related to a workman’s compensation injury responds 90% of the time to any therapy

Out of work for greater than 6 months only 50% ever return to work

After 1 year 25%
After 2 years ~0%
Pain Pattern

Pain exacerbated with **valsalva** maneuver it may be a herniated disc

Pain increased with **walking** is usually **stenosis** leading to **claudication**

Pain increased with **extension** or palpation then it may be the **facets**
  marked reduction in interspinous movement

Tenderness to percussion over the midline rule out an **infection** even if there is not antecedent event or cancer.
Pain Pattern

Pain upon awakening can be facet disease or a mass.

At the end of the day usually is from the muscles, tendons and ligaments. This is from poor posture, overuse, or stretching poorly conditioned structures.
Physical Exam

Mental status
Cranial nerves
Upper extremities
Tenderness
Bending, Patricks, FABERS
Motor: standing, resistance
Reflexes don’t lie
Sensation pin prick, position
SLR
Physical Exam

Pain, paresthesia and paresis should be confined to a specific myotome and dermatome for a herniated disk with a radiculopathy.
Physical Exam

Normal: central stenosis w/claudication since this is an intermittent ischemia
Normal: facet disease, discogenic disease and cancer
Any amount or distribution of pain, paresthesia or give way weakness when muscles, tendons or ligaments are involved solely or partially
Physical Exam L4

**DERMATOME**
- Anterior
- Posterior

**MYOTOME**
- Anterior
- Posterior

**SCLEROTOME**
- Anterior
- Posterior

**DERMATOME**
- Anterior lower leg
- Lateral knee
- Medial ankle

**MYOTOME**
- Thigh abductors
- Thigh flexors
- Thigh rotators
- Leg extensors
- Foot dorsiflexors
- Foot supinators
- Spine extensors
- Spine rotators

**SCLEROTOME**
- Bones
  - Level vertebra and periosteum
  - Iliac wing
  - Femur (medial and lateral)
  - Tibia (medial plateau and lateral epicondyle)
  - Talus
- Joints
  - Facet
  - Hip
  - Knee
  - Ankle
- Ligaments
  - Anterior longitudinal
  - Posterior longitudinal
  - Ligamentum flavum
  - Interspinous
Physical Exam L5

**DERMATOME**
- Anterior
- Posterior

**MYOTOME**
- Anterior
- Posterior

**SCLEROTOME**
- Anterior
- Posterior

**DERMATOME**
- Lateral calf
- Dorsum of foot
- Large toe-plantar surface

**MYOTOME**
- Thigh abductors
- Foot dorsiflexors
- Large toe extensors
- Spine extensors
- Spine rotators

**SCLEROTOME**
- Bones
  - Level vertebra and periosteum
  - Greater trochanter
  - Posterior iliac wing
  - Pubis
  - Proximal fibula
  - Distal anterior femur
  - Talus
  - Mid-foot
  - Large toe
  - Posterior proximal and distal

**Joints**
- Facet
- Sacroiliac
- Hip
- Knee
- Ankle
- Toe

**Ligaments**
- Anterior longitudinal
- Posterior longitudinal
- Ligamentum flavum
- Interspinous
Physical Exam S1

DERMATOME
Anterior  Posterior

MYOTOME
Anterior  Posterior

SCLEROTOME
Anterior  Posterior

DERMATOME
Small toe
Medial calf
Sole of foot

MYOTOME
Thigh abductors
Thigh rotators (lateral)
Leg flexors
Toe extensors
Foot plantar flexors

SCLEROTOME
Bones
Sacrum
Pubis
Femur
Tibia
Talus
Mid-foot
Middle toes

Joints
Sacroiliac
Knee
Ankle
Toe
Dermatome Overlap
# Physical Exam Lumbar

<table>
<thead>
<tr>
<th>Level</th>
<th>Muscles</th>
<th>Actions</th>
</tr>
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<tbody>
<tr>
<td><strong>L2,3,4</strong></td>
<td>iliopsoas</td>
<td>flex hip</td>
</tr>
<tr>
<td>L3, 4</td>
<td>adduct magnus</td>
<td>adduct thigh</td>
</tr>
<tr>
<td><strong>L3, 4</strong></td>
<td>quads</td>
<td>knee ext</td>
</tr>
<tr>
<td><strong>L4, 5</strong></td>
<td>tibialis ant</td>
<td>dorsiflex ankle</td>
</tr>
<tr>
<td>L4, 5, S1</td>
<td>gluteus medius/min</td>
<td>abduct thigh</td>
</tr>
<tr>
<td><strong>L4,L5, S1</strong></td>
<td>EHL</td>
<td>grt toe ext</td>
</tr>
<tr>
<td><strong>L5, S1</strong></td>
<td>post tibialis</td>
<td>foot inversion</td>
</tr>
<tr>
<td><strong>L5,S1</strong></td>
<td>hamstrings (l)</td>
<td>knee flex</td>
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<tr>
<td>S1, L5,S2</td>
<td>glut max</td>
<td>ext thigh</td>
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<tr>
<td><strong>S1, 2</strong></td>
<td>gastroc</td>
<td>plantar flex ankle</td>
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<tr>
<td>S2,3</td>
<td>flex dig</td>
<td>plantar flex toes</td>
</tr>
<tr>
<td>S2,3,4</td>
<td>anus, sphincter</td>
<td>rectal tone</td>
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</tbody>
</table>
Autonomic Nervous System

Sympathetic
  T3- L2(3)

Parasympathetic
  CN III, IX, X
  S2-4
Key Sensory Landmarks

C4  top shoulders AC  L3  medial above patella
C5  lateral elbow  L4  medial malleolus
C6  thumb  L5  dorsum MT grt toe & 2nd
C7  middle finger  S1  lateral plantar
C8  little finger  S4-5 peri-anal
T4  nipples
T6  xiphoid
T10  umbilicus
Reflexes

Reflexes don’t lie
Changes in reflexes usually signify that a nerve is being compressed
S1-2 Achilles
L3-4 Patella
C5-6 Bicep
C7-8 Tricep
Reflex Testing in SC Injury

All standard DTRs should be tested

Abdominal Reflex: T8-T12
Cremasteric Reflex: L1,2
Bulbocavernosus Reflex: S2,3,4
Rectal contraction to sensation: S2,3,4
LBP & RR

Given that the vast majority of people have problems unrelated to a disc and physical findings that are vague or follow multiple dermatomes other types of diagnostic tests must be entertained.
Tests

MRI
CT scan
Myelogram
Xrays F/E
EMG
SSEP
discogram
DIAGNOSTIC TESTS

X-ray - fracture or spondylololithesis
Ligamentous laxity as a cause of back pain can be documented with flexion and extension x-rays.
X-rays - pedicle invasion or replacement, cancer
Tests

A bone scan – metastasis
Positive in infection, fractures or degenerative arthritis.
A CT-scan is an excellent test to demonstrate bone anatomy such as stenosis in the lateral recess, in the foramen or centrally. CT myelogram considered by some as the “gold standard” for all types of pathology. Invasive test requiring a short outpatient stay. Not show intrinsic cord changes.
Tests

MRI test of choice for diagnosis spinal disease.
Disc pathology
Bone changes of swelling, infection, stenosis and joint changes
Rapid distinction between different soft tissues
stenosis due to disc, facet or ligament
Directed therapy
When symptoms are not clear, multidermal, diffuse hindrance when multiple changes appear.
MRI

Radiographic studies only show changes in anatomy, they do not necessarily demonstrate pain.
Additional Tests

EMG/NCV of spine & both extremities
  can often help distinguish between specific radicular findings and peripheral neuropathies

SSEP
  Spinal cord abnormality - contusion, demyelination, stenotic compression or intrinsic mass
Provocative Tests

When the symptoms still do not coincide with the clinical findings or imaging studies.

Invasive discogram- is a disk symptomatic?
Discogram

Performed by an experienced physician
Include the nature, extent, distribution of reproduced pain
Ability of the disk to accept the dye
Morphology of the disk on x-ray or CT-scan
Measure pressure
Must show areas of no reproducible pain, unless chemical irritation is wide spread.
Neuroscan

- Nerve conduction sensory exam
- 95% sensitive
- Tests pathologic A-delta fibers to exactly localize pain to dermatome
- Test malingerers
Treatment

When to do surgery?
When not to do surgery?
Who gets better?
Surgery for back pain?
Surgery for radicular pain?
SNRB- xylocaine and steroid
  xylocaine acts almost instantly to produce numbness or other paresthesia in the nerve root distribution thereby covering the pain if the correct level has been selected
  two days later, the steroid starts to relieve the inflammation and pain
    maximum at 2 weeks
Unlike the ESI, the SNRB is very specific, placing the treating medication exactly at the problem
ESI

Stenosis or when multiple areas of coverage are needed without multiple injections

Injected ventral to treat painful annular tears

May not reach the intended nerve root and thus fail to help in the management of the symptoms.
Facet Injections

Joints responsible for the back pain and rarely leg or groin pain

Responds even temporarily, and there was no spillage then the patient may benefit from a facet rhizotomy

deadens the ABNORMAl medial branch of posterior primary rami in the joint, not the nerve root responsible for movement or sensation

may only be temporary lasting a little as 6-18 months.
Treatment surgery or not
TREATMENT NON-OPERATIVE

Improving the overall health of the body
Attempt weight loss
Cessation of smoking
Relief of stress
Decreasing the axial load and avoiding twisting and turning
NOT prolonged bed rest
LBP & RR

The most important decision in treatment is deciding the cause.
Treatment

The course of action for one melody of the back may exacerbate another.

The anatomical basis of the pain as well as the chemical nature of the pain and associated painful structures must be addressed *simultaneously*. 
Treatment

Symptomatic, angulated or compressing bone fractures are treated with bracing or fusion.
Muscle Treatment

Sole source of back and even radicular pain
Unused muscle shrink or atrophy, become tired toward the end of the day, hurt with normal use and can not support the spine leading to further degeneration of the disk and facet
Spine stabilizing exercises done on a daily basis helps to rid the body of this very common aliment.
Medication

Non-sedating muscle relaxants
  continuously for two weeks no longer
  Longer use makes the muscles dependant and weak
  leading to further loss of tone and pain

Anti-inflammatory
  pain and muscle irritation.

Physical therapy
  ice early on in the first two weeks
  later warm moist heat for 30 minutes at a time 4-5 times per day. The use of heat for greater periods of time can promote muscle tissue swelling and of course worsen the problem
Manipulation, massage, ultrasound and muscle stimulation therapy help the spasms associated with muscle disease.

OMT reduces need for adjunctive therapy. Works if normally respond to adjunctive therapy.
Scientific Data

RCT: OMM effective

Cochrane data base:
Cochrane.org/cochrane/revabstr/AB004249.htm

National Guidelines Clearing House
Guidelines.gov/summary/summary.aspx?
doc_id=3803&nbr=3030&string=neck+and+"upper+back"
Scientific Data England
April 2006 Journal of Royal Society of Medicine, Ernst and Canter- stated based upon systematic review, the effectiveness of spinal manipulation for any condition, except for back pain, is not an effective intervention. Because of potential side effects, it cannot be recommended for use at all in clinical practice.

There was no systematic assessment of the literature pertaining to the hazards of manipulation, including comparison to other therapies. Hence, their claim that the risks of manipulation outweigh the benefits, was not supported by the data analyzed.

Literature Review: OMT significantly reduced low back pain (effect size, -0.30; 95% confidence interval, -0.47 - -0.13; P = .001)

OMT is as good as allopathic therapy and uses less medicine and physical therapy for LBP.

OMT …for Chronic LBP: RCT

- 455 pts: OMT (n=230) v Sham OMT (n=230)
  - And US v sham US
- 6 Rx over 8 wks
- Measure outcomes at 12 weeks
- Conclusion: Pts receiving OMT were more likely than pts receiving sham OMT to achieve moderate (P<.001) and substantial improvements (P=.002) in LBP at 12 weeks
OMT pts more likely to be very satisfied with low back care throughout study (P<.001)

OMT Pts used less prescription drugs during 12 weeks (P=.048)
OMT Associated With Reduced Analgesic Prescribing and Fewer Missed Work Days in Patients With Low Back Pain: An Observational Study
February 2014, Vol. 114, 90-98
J. Prinsen, PhD; K. Hensel, DO, PhD; R. Snow, DO, MPH

### AOA CAP Program- 1013 records

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)³</th>
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<tr>
<td>Age, y, mean (SD)²</td>
<td>44.7 (15.9)</td>
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<tr>
<td>BMI, mean (SD)²</td>
<td>29.6 (8.1)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>415 (41.0)</td>
</tr>
<tr>
<td>Female</td>
<td>598 (59.0)</td>
</tr>
<tr>
<td>Comorbid Disease</td>
<td></td>
</tr>
<tr>
<td>Neurologic disease</td>
<td>91 (9.0)</td>
</tr>
<tr>
<td>Spondylolisthesis</td>
<td>65 (6.4)</td>
</tr>
<tr>
<td>Connective tissue disease</td>
<td>50 (4.9)</td>
</tr>
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### Function

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<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory/Proprioception (n=831)</td>
<td></td>
</tr>
<tr>
<td>No loss</td>
<td>729 (87.7)</td>
</tr>
<tr>
<td>Some loss</td>
<td>102 (12.3)</td>
</tr>
</tbody>
</table>

| Motor (n=854)             |         |
| No loss                  | 636 (74.5) |
| Some loss                | 218 (25.5) |

### Deep Tendon Reflex

|                          |         |
| Ankle (n=814)            |         |
| Normal                   | 744 (91.4) |
| Reduced                  | 70 (8.6)  |
| Knee (n=829)             |         |
| Normal                   | 755 (89.0) |
| Reduced                  | 93 (11.0)  |

### Body Area

<table>
<thead>
<tr>
<th>Body Area</th>
<th>Patients, No. (%)</th>
<th>Number of OMT Sessions, mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Session OMT</td>
<td>No OMT²</td>
</tr>
<tr>
<td>Lumbar</td>
<td>576 (56.9)</td>
<td>437 (43.1)</td>
</tr>
<tr>
<td>Thoracic spine</td>
<td>411 (40.6)</td>
<td>602 (59.4)</td>
</tr>
<tr>
<td>Sacrum/pelvis</td>
<td>440 (43.4)</td>
<td>573 (56.6)</td>
</tr>
<tr>
<td>Rib</td>
<td>261 (25.8)</td>
<td>752 (74.2)</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>256 (25.3)</td>
<td>757 (74.7)</td>
</tr>
</tbody>
</table>

### Measure

<table>
<thead>
<tr>
<th>Measure</th>
<th>1 Session OMT (Mean (SD))</th>
<th>No OMT² (Mean (SD))</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual analog scale a</td>
<td>2.87 (2.2)</td>
<td>2.76 (2.0)</td>
<td>.2638</td>
</tr>
<tr>
<td>Straight-leg raising b</td>
<td>8.69 (6.8)</td>
<td>6.25 (3.5)</td>
<td>.0092</td>
</tr>
<tr>
<td>No. days off work</td>
<td>2.08 (10.6)</td>
<td>5.84 (7.1)</td>
<td>.0001</td>
</tr>
<tr>
<td>No. days worked, limited duties</td>
<td>2.26 (9.8)</td>
<td>3.76 (9.8)</td>
<td>.0001</td>
</tr>
</tbody>
</table>

### Medication

<table>
<thead>
<tr>
<th>Medication</th>
<th>Patients, No. (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonopioid analgesia</td>
<td>208 (63.0)</td>
<td>.0199</td>
</tr>
<tr>
<td>Muscle relaxant</td>
<td>192 (58.2)</td>
<td>.2947</td>
</tr>
<tr>
<td>Opioid</td>
<td>53 (16.1)</td>
<td>.0001</td>
</tr>
<tr>
<td>Oral steroids</td>
<td>17 (5.2)</td>
<td>.0481</td>
</tr>
<tr>
<td>Injection</td>
<td>37 (11.2)</td>
<td>.0052</td>
</tr>
<tr>
<td>Analgesic, opioid, and nonopioid</td>
<td>217 (65.8)</td>
<td>.0036</td>
</tr>
<tr>
<td>Any medication</td>
<td>259 (78.5)</td>
<td></td>
</tr>
</tbody>
</table>
OMT reduces pain more than expected from placebo effects alone.

Results have the potential to last beyond the first year of treatment.

Clinically relevant effects of OMT were found for reducing pain and improving functional status in patients with acute and chronic nonspecific LBP and for LBP in pregnant and postpartum women 3 months after treatment.

- AOA Task Force on the Low Back Pain Clinical Practice Guidelines American Osteopathic Association Guidelines for Osteopathic Manipulative Treatment (OMT) for Patients With Low Back Pain
- JAOA, 116 (8): 536-549 (2016)
LBP JAMA, 2017; 317 (14): 1451

- Spinal manipulation therapy caused modest improvements in pain & function at up to 6 weeks
  - Paul Shekelle, M.D., Ph.D., of the West LA VA reviewed previous studies to assess the effectiveness and harms associated with spinal manipulation compared with other nonmanipulative therapies for adults with acute (six weeks or less) low back pain.
  - 26 RCTs, 15 RCTs (1,711 patients) moderate-quality evidence of SMT significant improvements in pain
  - 12 RCTs (1,381 patients) moderate-quality evidence of SMT significant improvements in function
  - No RCT reported any serious adverse event
  - Clinician performing SMT, type, study quality, SMT w/ or w/o package of therapies unknown
Summary Data

Many published RCTs, reviews, national clinical guidelines but controversy outside OM regarding the evidence for or against efficacy of spinal manipulation for spine pain

aLBP: SMT > short-term MOB, diathermy, faster recovery than PT

cLBP: SMT = NSAID

SMT > placebo and general practitioner care (NEJM 1999)

SMT > PT & home back exercise in both the short and long term

SMT > sham SMT in the short term

SMT > short and long term when compared with placebo, or McKenzie therapy, medical care, PT management, soft tissue treatment & back school

SPORT: Surgical vs Non-Surgical Treatment

- Surgical & nonsurgical care of intervertebral disk herniation same improvement in symptoms of low back and leg pain
- Treatment effect of surgery for intervertebral disk herniation was less
- Surgery better versus nonsurgical treatment of degenerative spondylolisthesis and lumbar spinal stenosis

Sitting

Do not sit in 90°
Sit 135° body-thigh reclining posture with feet on floor
Slouched over desk highest rate of wear and tear

Tested in positional MRI
Bashir A. RSNA 2006 Annual Meeting
Physical Therapy Strategy

Pain Control
- Back First Aid
  - Trial of Extension McKenzie Exercises
  - Trial of Traction
  - Basic Stabilization Exercise Training
Medication
- NSAIDs
- Non-Narcotic Analgesics
- Corticosteroids
- Muscle Relaxants
Epidural Injection
- Selective Nerve Root Injection
- Facet Injection
Joint Treatments

Lumbar osteoarthritis
  facet blocks and rhizotomies
  rid the joint of the chemical irritation reaction
NSAID
Aquatic exercises 95 degrees F
  relieve gravitational stress on the joint
  rebuild the muscles to support the spine
  takes pressure off facets
  warm water increases blood flow improving outcome
  cold water aggravate chronic back spasms
Lumbar OA

If does not improve over time and if the pain becomes disabling then in order to possibly improve the condition maybe only 50%, back fusion may be contemplated.

Usually does not relieve the pain.

- can cause other problems and pain.
TREATMENT OPERATIVE osteoarthritis

Non-surgical 15% of the people will have a decrease in symptoms, 70% will have no changes, and 15% will have an increase in their symptoms with no severe deterioration.

Surgery - 50% will have an improved post-operative course, 40% will have slight to no improvement, and 10% will be worse.

Removal of the facet and synovium followed by fusion is the surgical treatment for isolated facet disease.
Omega-3 EFAs (eicosapentaenoic acid and decosahexaenoic acid)

250 patients- questionnaire at ~ 75 days.
78% 1200 mg and 22% 2400 mg.
59% discontinued prescription NSAID medications for pain.
60% overall pain improved
60% joint pain improved
80% satisfied with improvement
88% would continue to take fish oil
No significant side effects reported

Maroon JC, Bost JW. Surg Neurol. 2006 Apr;65(4):326-31
Disk Disease

Not all people with herniated discs have symptoms
Not all people who have symptoms require surgical intervention
Large herniated discs of the lumbar spine have been demonstrated to decrease, or resolve with conservative therapy

Leg & back, +EMG, SLR, all signs, treated with back school, spine stabilization, strengthening, flexibility, ESI/SNRB 96% good/excellent outcome Saal and Saal, 1989, *Spine*, 14:431-437

Leg & back pain, weakness, SLR, Extruded HNP, followed 8-77 months, treated as above, all (n=11) without pain and signs Saal,Saal, Herzog, 1990, *Spine*, 15:683-686
Physical Therapy Changes

- 48 pts: Acute leg pain, not requiring immediate surgery. Any signs or symptoms
- HNP: filling AP diameter of canal 1 = <1/4; 2 = 1/4-1/2; 3 = >1/2
- 1-48 months later: With PT, ESI, NSAID
- HNP ↓ in size >75% (GrIII) [67%pts], 50-75% (GrII), <25% (GrI)
- 81% decreased 50% or greater! 89.3% successful treatment. 11% who were not controlled by treatment disks were either unchanged or larger

Intra-Disc-Distraction

- Increase negative pressure to maximum, release to half, then start again
- Pulsating negative pressure
- Draws in fluids, nutrients and oxygen
Psychological Approaches

- Most beneficial if chronic pain to reduce pain-related interference, depression and disability (R Kearns et al 2006 Health Psychology)
HNP Options

OMT/PT McKenzie exercises
Traction
Magnets, mattress
IDET
MSC
Percutaneous Fusion
Disk Regeneration

- Needs blood supply
- Replace cells or rebuild structure
- Stem cells studied in numerous clinical applications from neurodegenerative diseases to cardiac insufficiency.
- Mesenchymal Stem Cells (MSCs) possess capacity to differentiate into nucleus pulposus-like cells capable of synthesizing a physiological, proteoglycan-rich extracellular matrix characteristic of healthy disks
- Change pressure inside disk
Studies of Disk Regeneration


- Disc regeneration can be induced by axial dynamic distraction in the moderately degenerated rabbit intervertebral disc. Unglaub F, Guehring T, Omlor G, Lorenz H, Carstens C, Kroeber MW. Z Orthop Ihre Grenzgeb. 2006 Jan-Feb;144(1):68-73 The decompressed rabbit intervertebral discs showed signs of tissue recovery at the cellular and histological levels after temporary disc distraction.


- Intradiscal injection of hematopoietic stem cells in an attempt to rejuvenate the intervertebral discs. Haufe SM, Mork AR. Stem Cells Dev. 2006 Feb;15(1):136-7 (Humans showed no improvement in outcome)
Future is Here

- Gel mix reintroduces nucleus cells to disc
- 3 components: protein laminin-111 that has been chemically modified, & 2 polyethylene glycol (PEG) hydrogels that attach to modified laminin
- Gel holds cells in place
- Solution solidifies after 5 min, sets in 20 min

http://www.medicalnewstoday.com/articles/263496.php

March 14, 2017 SpinalCyte the 1st injection clinical trial of CybroCell fibroblasts for spinal disc regeneration. Procedure under 15 minutes using a local anesthetic, Patient discharged in 1 hour.
The Future

- H&P
- PT, Meds, OMT
- Neural-scan, IDD
- MRI
- Intradiscal injection of patient’s own incubated bone marrow obtained mesenchymal stem cells embedded in collagen gel and injected into disk (Richardson S. U of Manchester Regenerative Medicine)
- Augmented with IDD
Operative Treatment HNP

Best outcome, the history has to correspond to the anatomical and physical findings
Onset of radicular pain could begin under most circumstances, even without apparent etiology
Major complaint should be of radicular pain. It may or may not be associated with paresthesias or paresis
Operative HNP

Radiographic findings should demonstrate disc pathology at the level of the dermatomal or myotomal symptoms. I DO NOT Operate for LBP
HNP Sx

Herniated disc could affect both of the nerve roots.

The herniated discs do not have to be large, but just "large enough" to deform the nerve root or thecal sac.

Location Of Nucleus Pulposus Herniation

A. Central
B. Centrolateral
C. Lateral
D. Intraforaminal
E. Far Lateral
HNP Sx

All of the treatments for back disease

Disk does not return to the healthy young non diseased state

Comparable to removing a splinter. Not only mass removed, the inflammation is allowed to subside
Surgery is an art.

The anatomy and pathology is interpreted in the surgeon's mind prior to the operation and must match what is actually seen.

One level microdiscectomy incision is usually 2 cm. in length (longer in more robust individuals).

Disk continues to degenerate after nucleotomy.

Need to RESTORE morphology and function.
Prodisc II
Charite
Bryan
Artificial disk attorneys
POST TREATMENT CARE

It is very important to maintain chronic back care after the acute treatment process
Back care is life long
Daily exercise routine
Proper back posture with sitting and lifting
During the immediate post operative period leg stretching exercises are needed to try to reduce scar tissue. Sometimes at surgery anti-scar medicine is used. However, scar tissue still may form. It’s occurrence and extent cannot be predicted
Despite post operative care herniations reoccur!
References

Question 1

- The three main areas of spine tumors are extradural, intradural extramedullary, and intramedullary. The % ratio of distribution is:
  A. 5, 5, 90
  B. 90, 5, 5
  C. 55, 40, 5
  D. 5, 40, 55
Question 2

Which is true about herniated nucleus pulposus of the lumbar spine?

A. A herniated disk always leaves the confines of the annulus
B. The blood supply to the nucleus pulposus is good
C. The nerve supply to the nucleus pulposus is poor
D. Radicular pain may only be from chemical irritation due to herniated nucleus pulposus
Question 3

The sinuvertebral nerve:

A. Innervates the posterior longitudinal ligament, superficial annulus, epidural blood vessels and anterior dura
B. Is from the spinal nerve after it splits into anterior and posterior divisions
C. Does not refer pain in a radicular distribution
D. Is the major motor supply to the lumbar spine
The posterior primary rami of the spinal nerve:

A. Is the major motor supply to the extensor hallucis longus
B. Is from the spinal nerve before it splits into anterior and posterior rami
C. Innervates the facets, dorsal muscles, and lumbar skin
D. Does not refer pain in a radicular distribution