



SPAULDINGTM
REHABILITATION NETWORK



MASSACHUSETTS
GENERAL HOSPITAL



NEWTON-WELLESLEY
HOSPITAL



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Nonspecific Low Back Pain Evaluation and Treatment Approaches

Dana Kotler, MD

Instructor, Harvard Medical School
Director, Cycling Medicine Program
Spaulding Rehabilitation Hospital
Newton-Wellesley Hospital

 @DanaKotlerMD



Disclosures

- None



Back pain: Implications

- It's annoying
- It's getting in the way of recreational activity
- It's getting in the way of necessary daily activity
- Other systems are not functioning
- Psychosocial ramifications
- Economic cost

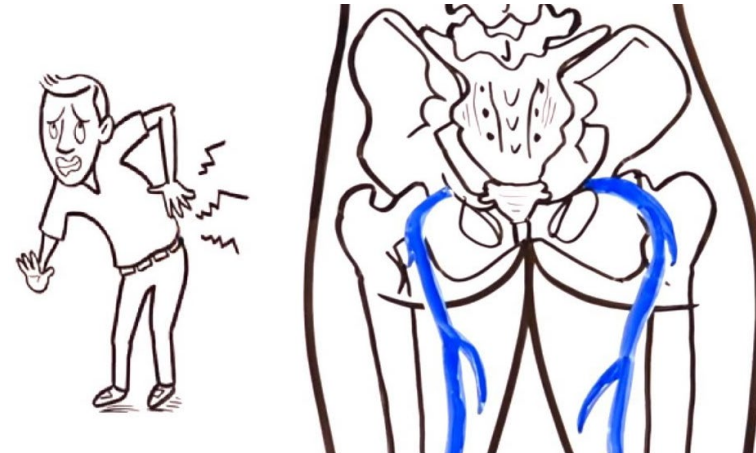


Image: Dr. Mike Evans

Back pain: Implications

- Low back pain is the leading cause of long term disability worldwide.
- Lifetime incidence is 58-84%
- 11% of men and 16% of women have chronic low back pain.
- Back pain accounts for 7% of PCP consultations and results in the loss of 4.1 million working days a year.
- More than 30% of people still have clinically significant symptoms after a year after onset of sciatica.

GUIDELINES

Low back pain and sciatica: summary of NICE guidance

Ian A Bernstein *musculoskeletal physician and general practitioner*¹, Qudsia Malik *senior research fellow*², Serena Carville *associate director*², Stephen Ward *guideline development group chair, consultant pain physician*³

¹London North West Healthcare NHS Trust and Gordon House Surgery, London, UK; ²National Guideline Centre, Royal College of Physicians, London NW1 4LE, UK; ³Department of Pain Medicine, Brighton and Sussex University Hospitals NHS Trust, Brighton, UK; Correspondence to: I A Bernstein ian.bernstein@nhs.net

Goals of a doctor visit

- **Diagnosis**

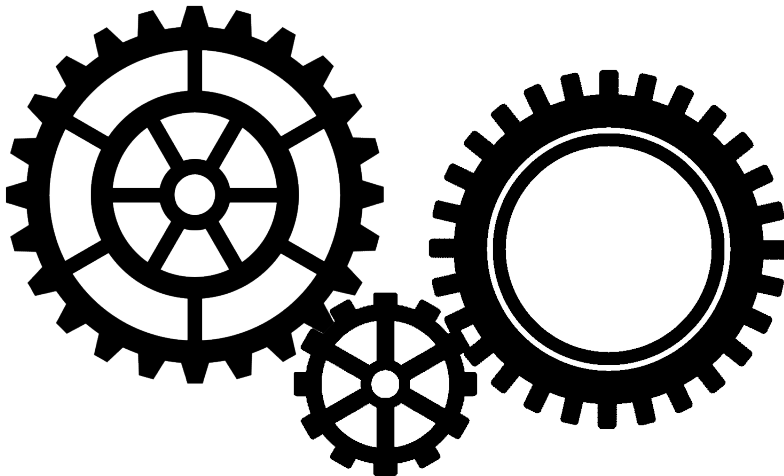
- Not as easy as it sounds
- May not be “injury” as much as chronically altered mechanics
- Patient understanding of mechanism

- **Treatment plan**

- Realistic:
 - Symptom management
 - Return to functional activity
- Unrealistic:
 - “Cure”
 - “Make my pain go away”
 - “Be like I was when I was 20”
 - “*Fix me*”

Many moving parts!

- Need a clear diagnosis, taking into account biomechanical contributors.



DIAGNOSIS

- Main problem
- Underlying pathology, if known/suspected
- Superimposed issues

*Where do we start??
What does the
literature say?*

- **Simple:** Acute disc herniation
- **Complex:** Right L4 radiculopathy with underlying central and foraminal stenosis related to facet hypertrophy, ligamentum flavum thickening, with compensatory abnormalities in biomechanics resulting in intra-articular and extra-articular hip pain

Diagnosing Low Back Pain

- Multi-specialty Team
 - Primary care
 - Physiatrist (PM&R)
 - Spine Surgeon
 - Physical Therapist
 - Complementary providers
 - Massage therapist
 - Acupuncturist
 - Chiropractor



Non-specific low back pain.

Maher C¹, Underwood M², Buchbinder R³.

⊕ Author information

Abstract

Non-specific low back pain affects people of all ages and is a lea

Practice

Guidelines

Early management of persistent non-specific low back pain: s

BMJ 2009 ; 338 doi: <https://doi.org/10.1136/bmj.b1805> (Published 04 June 2009)



ELSEVIER

Best Practice & Research Clinical Rheumatology

Volume 21, Issue 1, February 2007, Pages 77

Response

5

Low back pain (non-specific)

M. Krismer MD (Professor of Orthopaedic Surgery), M. van Tulder PhD (Professor of Physiotherapy), M. van der Wal AC (Professor of Pain Assessment) , The Low Back Pain Group of the Bone and Joint Health Stra

Physiotherapy Theory and Practice, 19: 213–237, 2003
Copyright © Taylor & Francis Inc.
ISSN: 0959-3985 print/1521-0510 online
DOI: 10.1080/09593980390246760

Diagnostic classification of non-specific low back pain. A new system integrating patho-anatomic and clinical categories

T. Petersen, M. Laslett, H. Thorsen, C. Manniche,

G. Elstoh and G. Leckeborg

Seminar

Non-specific low back pain

Dr Federico Balagué MD , Anne F Mannion PhD ^b, Ferran Pellisé MD ^c, Christi

⊕ Show more

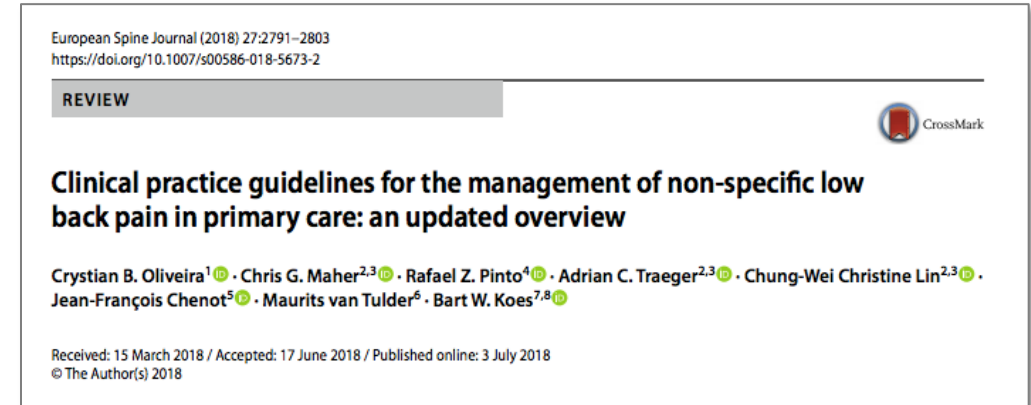
[https://doi.org/10.1016/S0140-6736\(11\)60610-7](https://doi.org/10.1016/S0140-6736(11)60610-7)

Summary

Non-specific low back pain has become a major public health problem. The lifetime prevalence of low back pain is reported to be as high as 80%. The prevalence of chronic low back pain is about 23%, with 11–12% of th

Why you're here!

- “...the clinical practice guidelines recommend **history taking** and **physical examination** to identify red flags, neurological testing to identify radicular syndrome, use of **imaging** if serious pathology is suspected (but discourage routine use), and assessment of **psychosocial factors**.”



- **Non-specific → specific** low back pain?
- Identify structural/mechanical factors
- Recommend specific treatment

#1 – Listen to the history

- Common themes:
 - “I was putting on my pants”
 - “I have to stop and sit down”
 - “Every time I sneeze I think I’m going to die.”
 - “I hate museums.”
- **WHERE?**
 - Back pain?
 - Back and butt pain?
 - Back and leg pain?
 - Butt pain or leg pain only?
- **WHEN?**
 - Sitting, standing, walking, bending, lifting, coughing, sneezing, driving, exercise, going to the bathroom, brushing your teeth, having sex, only on weekends, only on work days...

Key Questions

- Prior history of low back pain
 - Prior treatment, successful?
- Duration
- Frequency
 - Truly constant vs. episodic, positional, waxing/waning
- Exacerbating factors
- Alleviating factors
- Medical history
 - Immunosuppression, cancer, procedures
- Psychosocial history
 - Yellow flags
- Family history

Key Questions: “Red Flags”

- Trauma
 - Intensity, duration, frequency
- Systemic symptoms
 - Fever, chills
 - Unexplained weight loss
 - Fatigue
- Lumbar stiffness
 - Severe, 24/7
- Night pain
- Progressive neurological symptoms
 - Paresthesias, numbness
 - Extremity weakness
 - Gait dysfunction
 - Bladder/bowel dysfunction



#2 - Do a GREAT physical exam

- Not just a straight leg raise!
- Evaluate biomechanical patterns.
- Functional testing
 - Walking into the exam room
 - Getting in and out of a chair
 - Picking something off the floor
- Sport/activity-specific assessment



Physical Examination

“Nobody has ever examined me before!”



- **Inspection**

- Scoliosis, prominence of unilateral paraspinals
- Iliac crests even
- Scars
- Atrophy

- **Palpation**

- TTP of spinous processes, lumbar paraspinals, PSIS, gluteals

- **Range of motion**

- Flexion, extension, rotation, lateral flexion
- Pain vs. limitation

- **Special tests**

- Facet loading maneuver (extension + rotation)
- Straight leg raise
- Seated slump test

- **Hip/pelvis examination**

- ROM (if restricted will shift demand to lumbar spine)
- Provocative hip maneuvers
- SI joint maneuvers

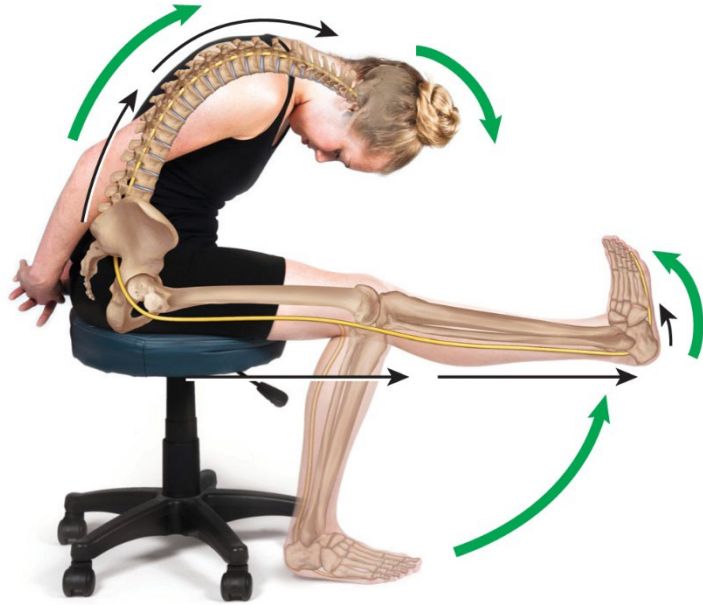
- **Neurologic examination**

- Lower extremity myotomes and dermatomes

- **Functional testing**

- Gluteus medius testing
- **Single-leg squat**
 - Gives lots of good information about hips, knees, feet, balance, strength

Lumbar Provocative Maneuvers

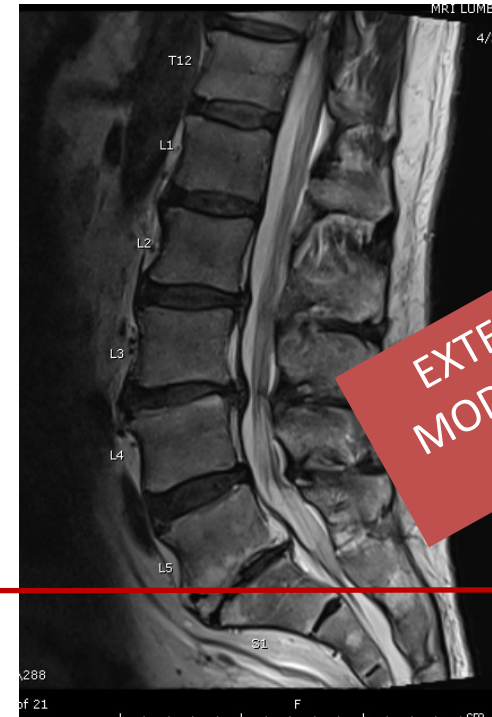


- **Seated slump test**
 - Dural tension with slump and knee extension
 - Alleviated by neck extension
- **Facet loading maneuver**
 - Extension with rotation stresses ipsilateral facet joints
 - May also cause pain from SI joint (adjacent to lower lumbar facets)



#3 – Use imaging appropriately

- Evidence confirming suspicion.
- Exclude zebras (mets, osteomyelitis, etc).
- “Why aren’t you better?”



What is normal?

Brinjikji et al, 2014



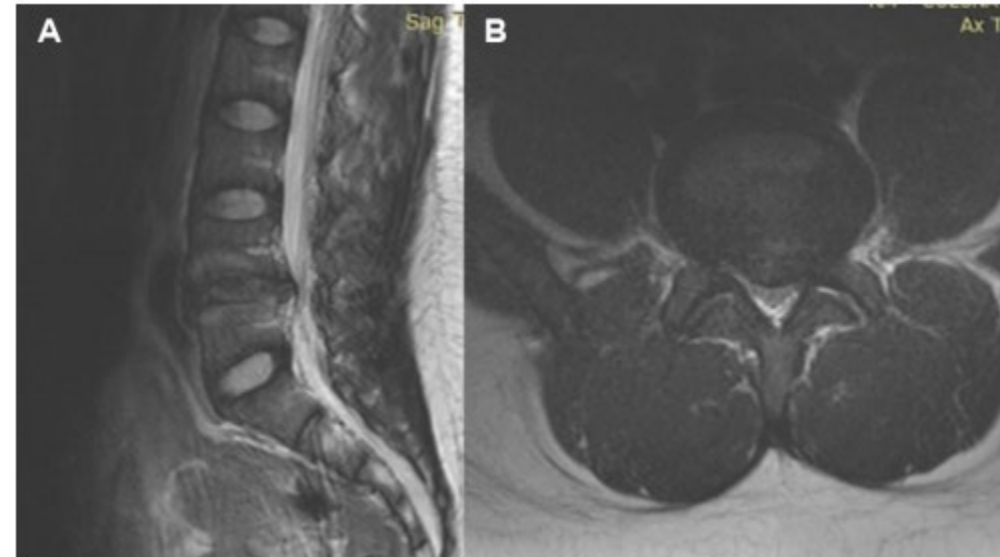
Table 2: Age-specific prevalence estimates of degenerative spine imaging findings in asymptomatic patients^a

Imaging Finding	Age (yr)						
	20	30	40	50	60	70	80
Disk degeneration	37%	52%	68%	80%	88%	93%	96%
Disk signal loss	17%	33%	54%	73%	86%	94%	97%
Disk height loss	24%	34%	45%	56%	67%	76%	84%
Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

- **Degenerative changes** present in
 - 37% of 20 year olds
 - 96% of 80 year olds!
 - Gray hair, wrinkles, etc.

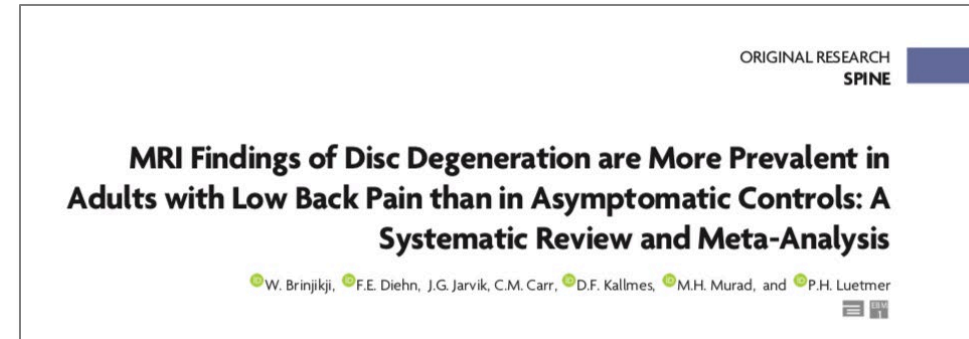
Wasserman Olympic Study

- 100 MRIs (out of 11,274 athletes) done during Rio games
- **52% of those showed moderate to severe spinal disease.**
- Highest incidence:
 - Divers (67%, incidence 3/100).
 - Weightlifters (67%, incidence 1.5/100).
- **“A high number of the world’s premier athletes demonstrated moderate to severe spine disease... including moderate/severe degenerative disc changes with varying degrees of disc bulges and herniations.”**



Not so fast...

- Meta-analysis (2015)
- MR findings of
 - disc bulge
 - disc degeneration
 - extrusion, protrusion
 - Modic 1 changes
 - spondylolysis
- **More prevalent in adults ≤ 50 years old with back pain compared with asymptomatic individuals.**

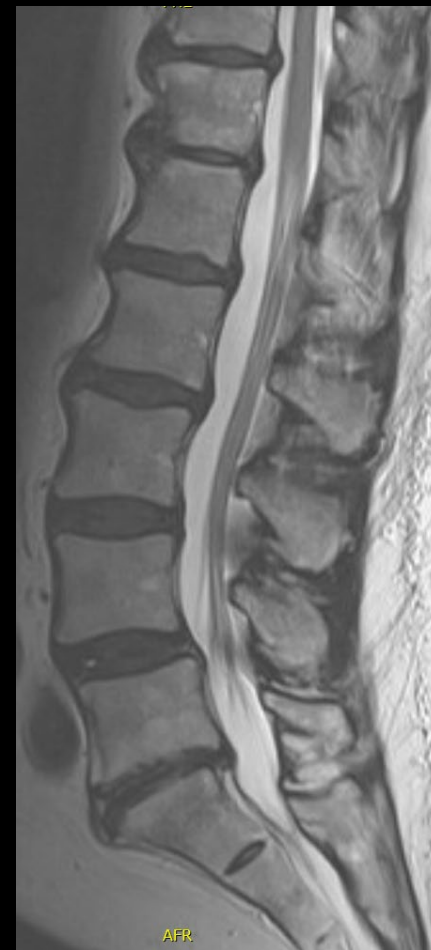


Brinjikji, 2015

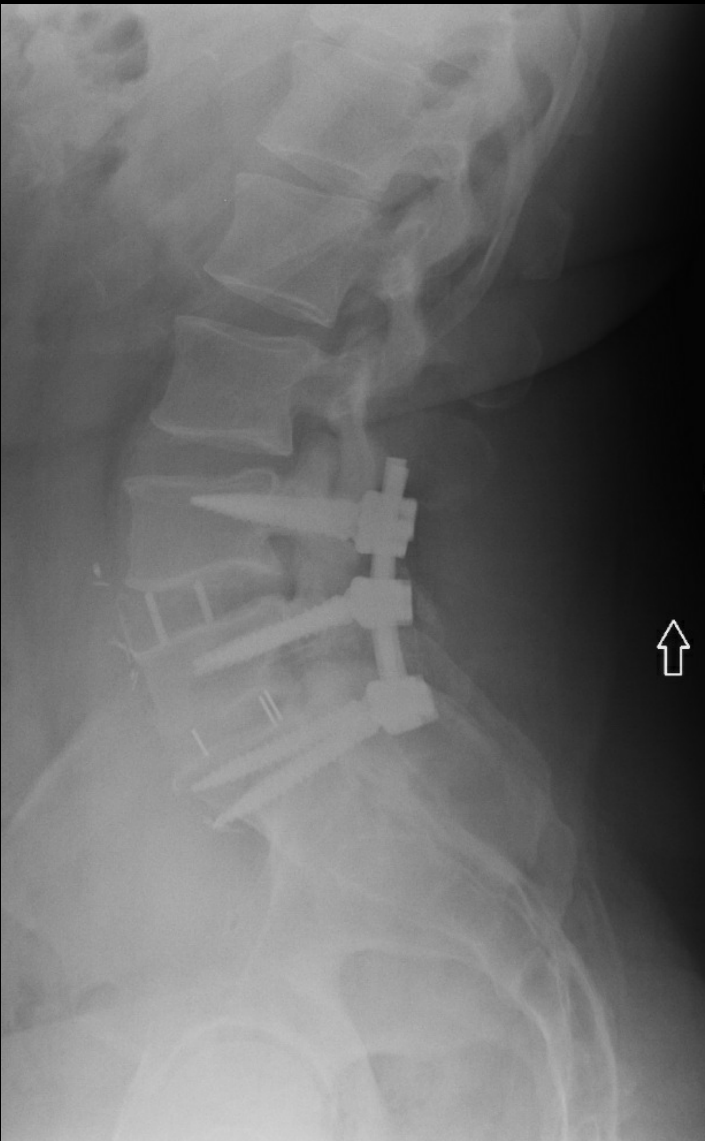
Diagnostic Imaging



- Interpretation of imaging is a subjective assessment

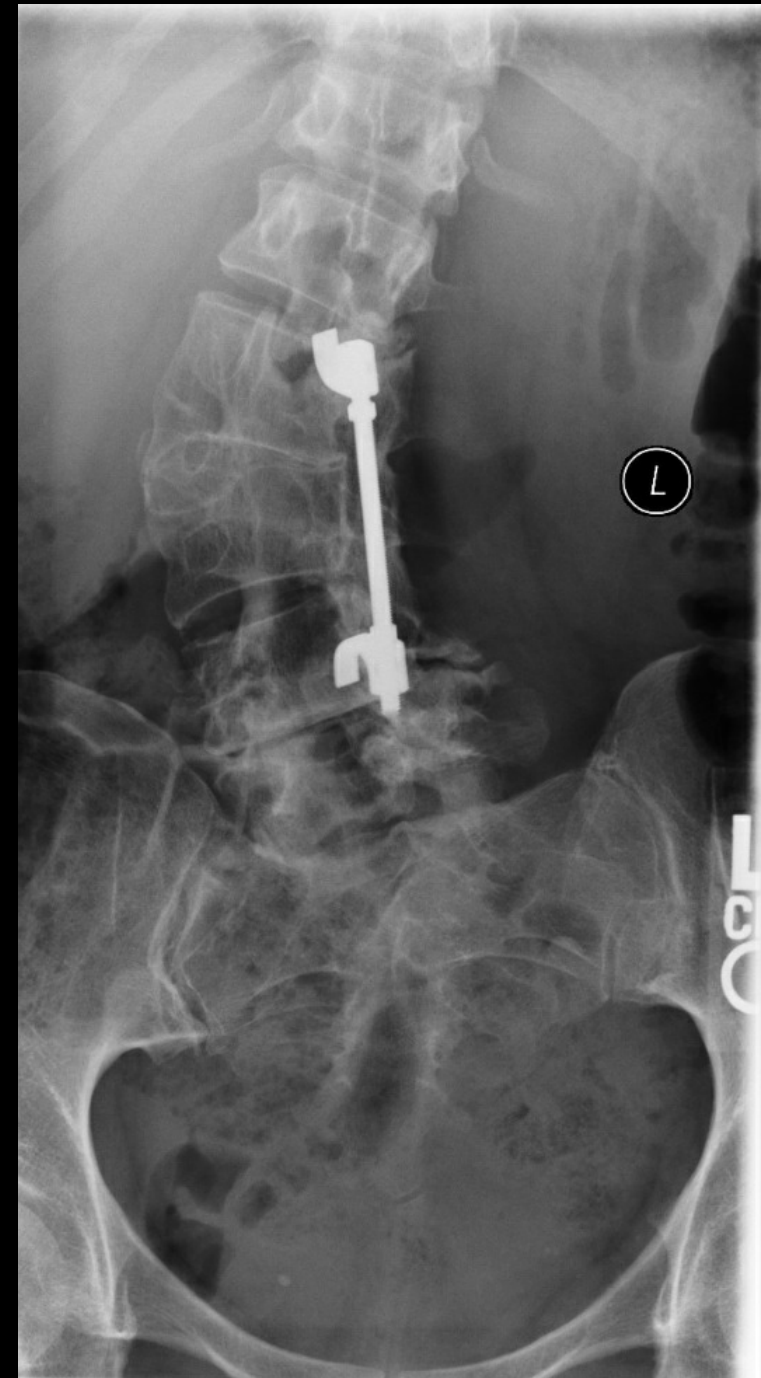


- 4 patients, all very similar complaints
- Very different looking spines



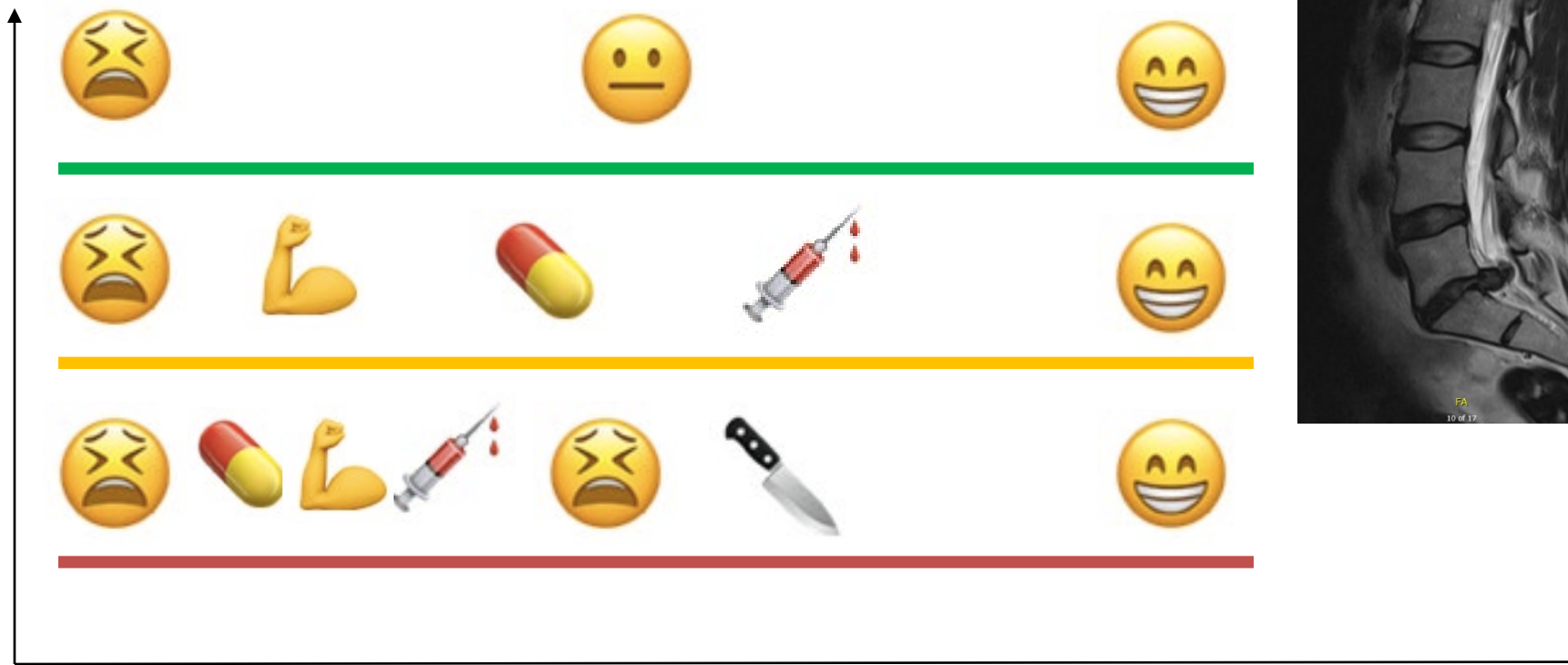
Left: 44 year old man with episodes of severe low back pain

Right: 56 year-old athletic woman with intermittent radiating pain to the right buttock and calf



- You are not defined by pictures of your insides

Natural Progression



Time →

Natural Progression – Imaging

SPINE Volume 31, Number 14, pp 1605–1612
©2006, Lippincott Williams & Wilkins, Inc.

■ Natural Course of Disc Morphology in Patients With Sciatica

An MRI Study Using a Standardized Qualitative Classification System

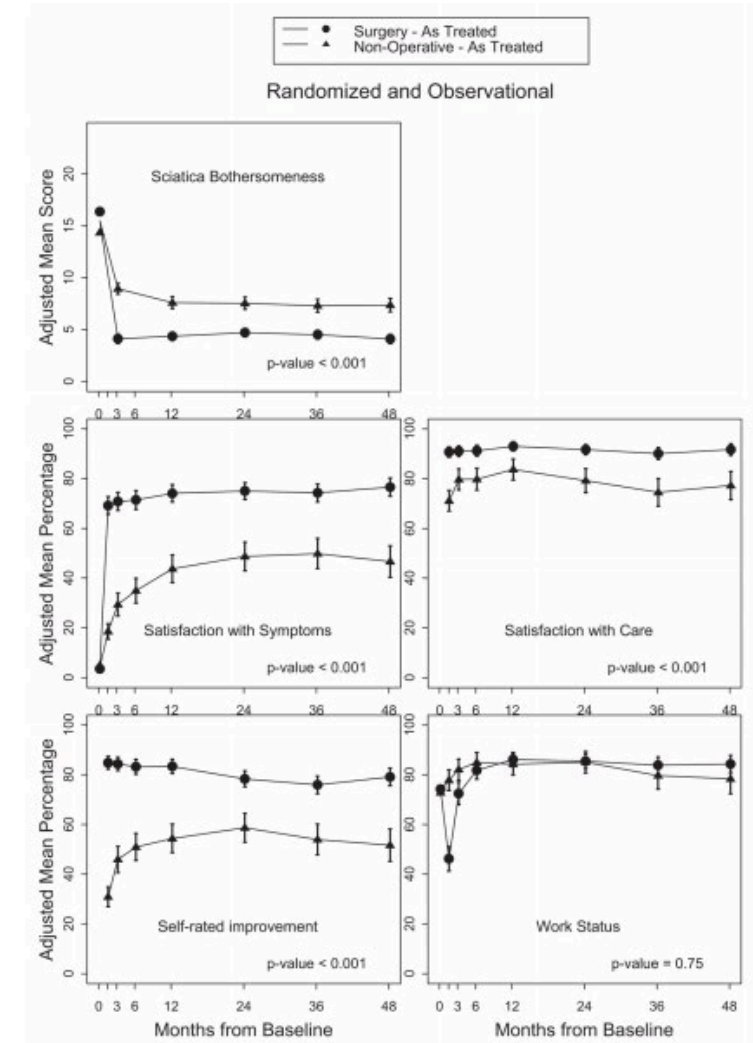
Tue S. Jensen, MHSc (Clin Biomech), Hanne B. Albert, PT, MPH, PhD, Joan S. Soerensen, MD, Claus Manniche, MD, Dr Med Sci, and Charlotte Leboeuf-Yde, DC, MPH, PhD

- Followup MRIs after disc herniation
- 75% to 100% of broad-based protrusions, extrusions, and sequestrations improved
- **Your body is capable of healing disc herniations.**
- The larger the extrusion, the more likely it is to reabsorb.



SPORT Trial

- Spine Patient Outcomes Research Trial (SPORT)
- Herniated disc
 - Confirmed by imaging and leg symptoms persisting for >6 weeks
- Surgery superior to non-operative treatment in relieving symptoms and improving function.
- **“It is notable that the non-operative group improved significantly and this improvement persisted throughout the 4-year period.”**



What's in our toolbox?

Medications

- Anti-inflammatory
- Neuropathic agent
- Muscle relaxer
- Analgesic

Movement

- Physical Therapy
- Home exercise
- Exercise classes

Procedures

- Epidural steroid injection (disc, nerve)
- Facet steroid injection
- Medial branch block, radiofrequency lesioning
- Sacroiliac injection

Surgery

- Too tight? → Decompress
- Too mobile? → Fuse

Lifestyle

- Education
- Reassurance
- Smoking
- Nutrition
- Weight management
- Mood
- Sleep
- Stress

Manual/Passive

- Chiropractic
- Massage
- ART, Graston
- Craniosacral
- Acupuncture



Low Back Pain: Analgesics and Anti-inflammatory

- **Acetaminophen**
 - Probable weak inhibitor of prostaglandin synthesis
- **Topical Lidocaine**
 - Potential benefit
 - Lack of prospective, controlled trials
- **Tramadol**
 - Mild opioid agonist
 - Inhibits reuptake of serotonin and norepinephrine
 - ? Abuse potential, schedule IV (8/14)
- **NSAIDs**
 - Mildly better than placebo in acute and chronic low back pain for short term symptomatic relief
 - Significant risks/side effects
- **Oral steroids**
 - Modest benefit
- **Alternative anti-inflammatories**
 - Omega-3 Fatty Acids: Fish Oil, Flaxseed Oil
 - > 2.7g of EPA/DHA daily
 - Turmeric 500 mg TID
 - Side effects
 - Increased bleeding risk (mild), dyspepsia

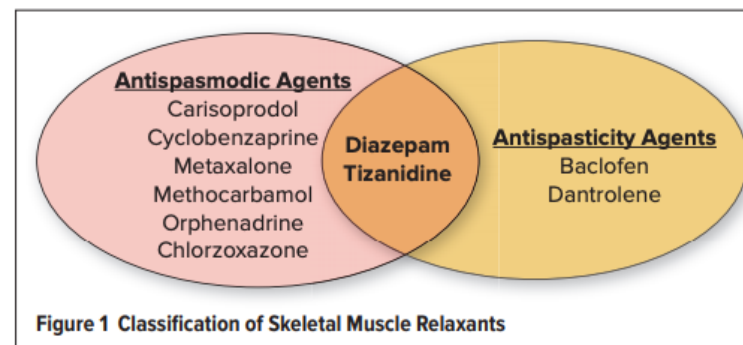
Low Back Pain: Muscle relaxants and Neuropathic pain agents

- **Muscle relaxants**

- **Tizanidine** – alpha-2 agonist, 2-4 mg up to TID
- **Cyclobenzaprine** – related to TCA, 5 mg probably as effective as 10 mg with less side effects
 - Most evidence
- **Methocarbamol**
 - Mechanism unknown
- **Carisoprodol**
 - Meprobamate – anxiolytic, schedule IV
 - CNS depressant
- **Benzodiazepines**
 - Short or intermediate acting
 - Schedule IV, potentially addictive

- **Neuropathic pain agents**

- **Gabapentin**
 - Inhibits voltage gated calcium channels (not actually GABA)
- **Pregabalin**
 - Structurally related to gabapentin, but greater potency in pain and seizure disorders.
- **Tricyclic antidepressants**
 - Amitriptyline, nortriptyline
- **Duloxetine**



GET MOVING

- Understand the progression, reassure
- Manage symptoms
 - Passive: Medications, Injections
 - Active: Movement (positions, stretches, exercises)
- Return to functional activity
 - Movement is our only tool to change the structure/mechanics of the body
 - Correct imbalances/faults
 - Improve quality of movement
 - Prevent recurrence



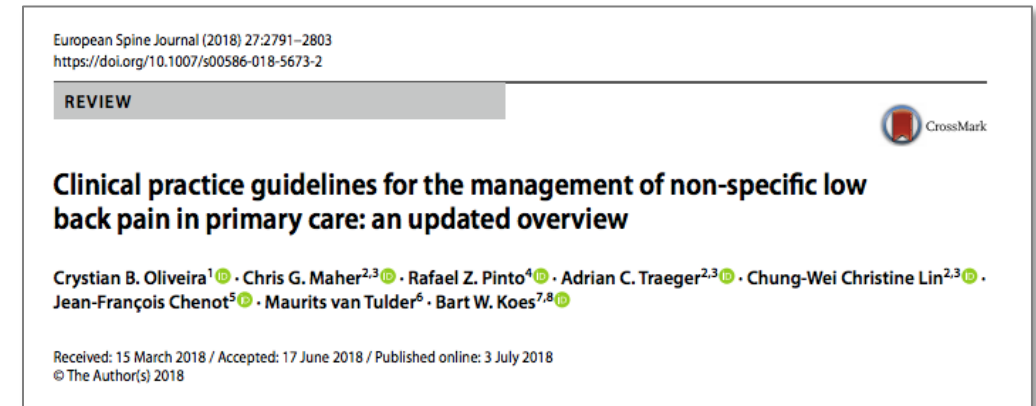
We seem to agree on avoiding bed rest

- Understand limitations
 - Surgical referral when indicated

Exercise

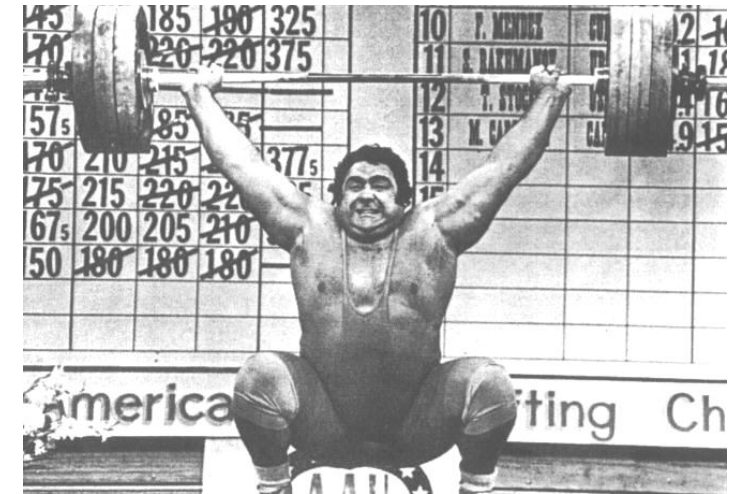


- Most clinical practice guidelines (10 out of 14; 71%) recommend **exercise therapy** for patients with chronic LBP.
- “Noteworthy, we identified great discrepancy in the type of exercise program (e.g., aquatic exercises, stretching, back schools, McKenzie exercise approach, yoga, and tai-chi) and mode of delivery (e.g., individually designed programs, supervised home exercise, and group exercise). Guidelines provided inconsistent recommendations on exercise therapy for acute LBP.”



Physical Therapy for Low Back Pain

- Patient Education
- Spinal manipulation, superficial heat
 - Small-moderate evidence¹
- Treatment exercises
 - Evidence is conflicting²
- Post-treatment exercise program
 - Moderate quality evidence of back pain prevention²
 - Strengthening
 - Flexibility
 - Low impact aerobic exercises
 - Postural exercises



¹Chou R, Huffman LH; Nonpharmacologic therapies for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. Ann Intern Med. 2007 Oct 2;147(7):492-504. Review.

²Choi BK, Verbeek JH, Tam WW, Jiang JY. Exercises for prevention of recurrences of low-back pain. Cochrane Database Syst Rev. 2010 Jan 20;(1):CD006555.

Exercise

- Cuenca-Martinez, 2018
 - “chronic non-specific low back pain”
 - 6 studies reviewed, 5 moderate quality and 1 low quality.
 - Back School – ineffective
 - McKenzie – ineffective
 - OMT (3 studies) – effective short term
 - Massages – effective short term
 - Stretching/GPR – some effect but lowest quality study



- Nonspecific back pain
- Nonspecific research
- Nonspecific results

Significance vs. Relevance

- **Statistically significant vs. clinically relevant improvement.**
- 42 RCTs encompassing 81 intervention comparisons.
- 60% (25 RCTs) were statistically significant
- Only 36% (15 RCTs) were both statistically and clinically significant.
- Most trials (38%) did not discuss the clinical relevance of treatment effects when results did not reach statistical significance.
- Among trials with non-statistically significant findings, 60% did not reach the planned sample size

Gianola et al. *Health and Quality of Life Outcomes* (2019) 17:127
<https://doi.org/10.1186/s12955-019-1196-8>

Health and Quality
of Life Outcomes

RESEARCH

Open Access

Rehabilitation interventions in randomized controlled trials for low back pain: proof of statistical significance often is not relevant



Silvia Gianola^{1*}, Greta Castellini^{1,2}, Davide Corbetta^{3,4} and Lorenzo Moja^{1,2}

Clinical Classification

- Identifying **relevant subgroups** of nonspecific low back pain patients may improve research efficiency and clinical outcomes.
 - **Promising CDRs for: disc, SI joint, nerve root, stenosis, spondylolisthesis**
- Lack of consistency in description and diagnosis
- Few reliability/validity studies
- Few classification systems for back pain only

Physiotherapy Theory and Practice, 19: 213–237, 2003.
Copyright © Taylor & Francis Inc.
ISSN: 0959-3985 print/1521-0510 online
DOI: 10.1080/09593980390246760

Diagnostic classification of non-specific low back pain. A new system integrating patho-anatomic and clinical categories

T. Petersen, M. Laslett, H. Thorsen, C. Manniche,
C. Ekdahl, and S. Jacobsen

Petersen et al. *BMC Musculoskeletal Disorders* (2017) 18:188
DOI 10.1186/s12891-017-1549-6

BMC Musculoskeletal
Disorders

RESEARCH ARTICLE

Open Access

Clinical classification in low back pain: best- evidence diagnostic rules based on systematic reviews

Tom Petersen^{1*}, Mark Laslett^{2,3} and Carsten Juhl^{4,5}

[RESEARCH REPORT]

ROBIN HASKINS, BPhy (Hons) • PETER G. OSMOTHERLY, PhD • DARREN A. RIVETT, PhD

Diagnostic Clinical Prediction Rules for Specific Subtypes of Low Back Pain: A Systematic Review

2017 meta-analysis:
Clusters > single tests

Petersen T, Laslett M, Thorsen H, Manniche C, Ekdahl C, Jacobsen S. Diagnostic classification of non-specific low back pain. A new system integrating patho-anatomic and clinical categories. *Physiotherapy Theory and Practice*. 2003 Jan 1;19(4):213-37.

Petersen T, Laslett M, Juhl C. Clinical classification in low back pain: best-evidence diagnostic rules based on systematic reviews. *BMC musculoskeletal disorders*. 2017 Dec;18(1):188.

Stynes S, Konstantinou K, Dunn KM. Classification of patients with low back-related leg pain: a systematic review. *BMC musculoskeletal disorders*. 2016 Dec;17(1):226.

Haskins R, Osmotherly PG, Rivett DA. Diagnostic clinical prediction rules for specific subtypes of low back pain: a systematic review. *journal of orthopaedic & sports physical therapy*. 2015 Feb;45(2):61-76.

McKenzie

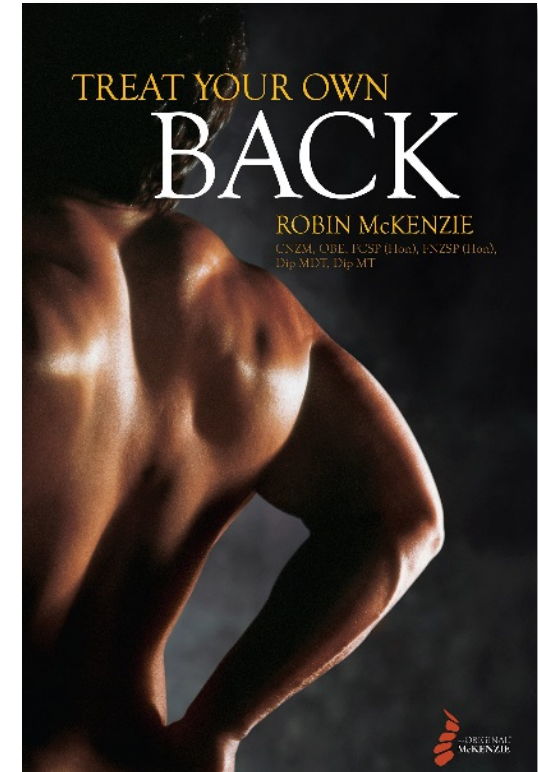
- **Mechanical Diagnosis and Treatment (MDT)**

SPINE Volume 31, Number 9, pp E254–E262
©2006, Lippincott Williams & Wilkins, Inc.

■ **The McKenzie Method for Low Back Pain**
A Systematic Review of the Literature With a Meta-Analysis Approach

Luciana Andrade Carneiro Machado, BScPT (Honours),*†
Marcelo von Sperling de Souza, BScPT (Honours),* Paulo Henrique Ferreira, PhD,*
and Manuela Loureiro Ferreira, PhD‡

- *Directional preference*
- Classification based on patterns of pain response noted during the assessment
- Centralization phenomenon
- “Generic McKenzie” vs. “Classification-based McKenzie.”
- “It is important to note that our results cannot be generalized to a classification-based McKenzie because trials reporting on generic McKenzie were included in the main analysis.”



Treat Your Own Back Paperback – January 1, 2011

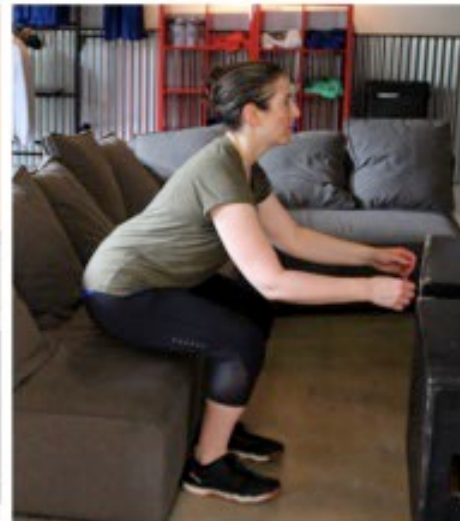
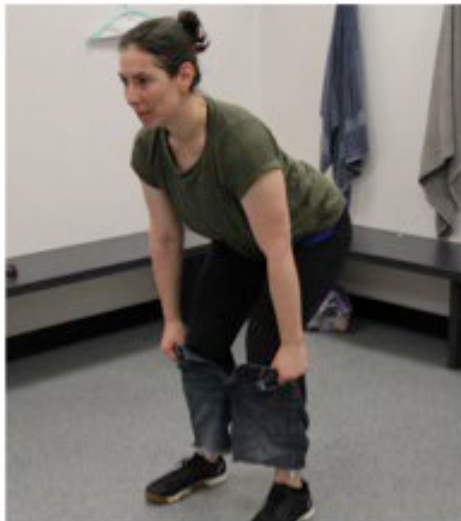
by Robin A McKenzie (Author)

★★★★★ 1,181 customer reviews

#1 Best Seller in Back Pain

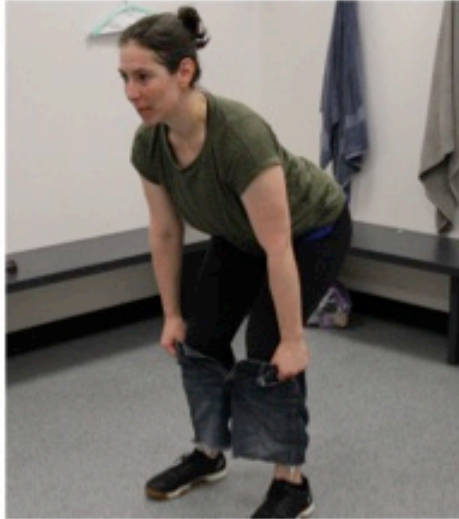
Rehab

- Correct imbalances
- Start with basic movements
- Make them harder
- **Apply to functional activity**



Functional Movements

- Movements which existed before gyms were invented
- Movements people need to do every day to accomplish a task



Functional Movements



- May be adapted or “scaled” for different levels of ability.
- Every movement has progressions.
- **Functional:** Push-up is part of getting up off the floor if you fall!

CASES



Case #1: Acute Low Back Pain

- 45-year-old software engineer
 - Acute midline low back pain
 - Two week duration
 - Started after 3-hour car ride
-
- *“It’s really hard to put my pants on in the morning.”*



“Going and Coming” by Norman Rockwell, 1947

Case #1: History

- Axial, no radiation
- Pain increases with:
 - **Sitting/forward bending**
 - **Coughing/sneezing**, road bumps, bowel movements
 - **Mornings** are particularly bad
- PMH of similar self-limiting episodes, increasing in frequency, duration and intensity; otherwise healthy
- No neuro symptoms, bowel/bladder dysfunction
- No red or yellow flags

Case #1: Physical Exam

- Inspection: May have **side shift** (lumbar listing)
- ROM: Very **restricted, painful forward flexion**, full nonpainful extension
- Minimal tenderness to palpation of lumbosacral spinous processes or lumbar paraspinals
- **Seated slump test (+)**
- Facet loading (-)
- Normal hip mobility and negative provocative maneuvers
- Normal neuro exam (strength, sensation, reflexes)
- Single leg squat with contralateral pelvic tilt and medial knee deviation bilaterally

Case #1: Acute Low Back Pain

- How do we describe this?
 - Acute, flexion-based, axial low back pain

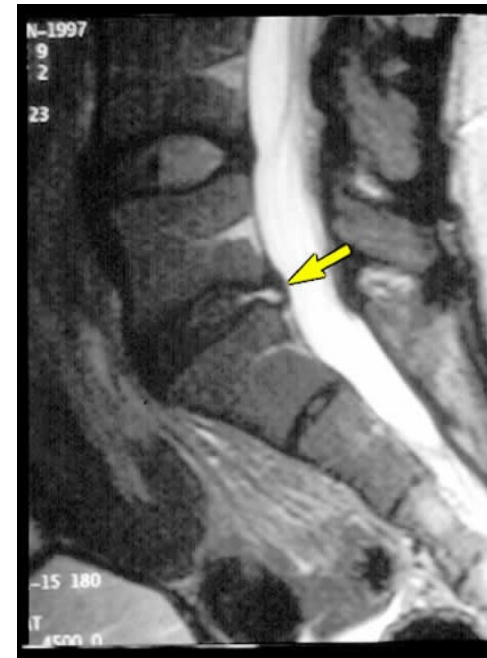
TABLE 1. DIFFERENTIAL DIAGNOSIS OF LOW BACK PAIN.*

MECHANICAL LOW BACK OR LEG PAIN (97%)†	NONMECHANICAL SPINAL CONDITIONS (ABOUT 1%)‡	VISCERAL DISEASE (2%)
Lumbar strain, sprain (70%)§ Degenerative processes of disks and facets, usually age-related (10%) <i>Herniated disk</i> (4%) <i>Spinal stenosis</i> (3%) Osteoporotic compression fracture (4%) Spondylolisthesis (2%) Traumatic fracture (<1%) Congenital disease (<1%) Severe kyphosis Severe scoliosis Transitional vertebrae Spondylolysis¶ Internal disk disruption or diskogenic low back pain Presumed instability**	Neoplasia (0.7%) Multiple myeloma Metastatic carcinoma Lymphoma and leukemia Spinal cord tumors Retroperitoneal tumors Primary vertebral tumors Infection (0.01%) Osteomyelitis Septic diskitis Paraspinal abscess Epidural abscess <i>Shingles</i> Inflammatory arthritis (often associated with HLA-B27) (0.3%) Ankylosing spondylitis Psoriatic spondylitis Reiter's syndrome Inflammatory bowel disease Scheuermann's disease (osteochondrosis) Paget's disease of bone	Disease of pelvic organs Prostatitis Endometriosis Chronic pelvic inflammatory disease Renal disease Nephrolithiasis Pyelonephritis Perinephric abscess Aortic aneurysm Gastrointestinal disease Pancreatitis Cholecystitis Penetrating ulcer

What is the most likely diagnosis?

- Acute, flexion-based, low back pain in a 40-year old.

1. Muscle strain
2. Discogenic pain
3. Lumbar compression fracture
4. Sacroiliac joint pain
- ~~5. I don't know, it's "nonspecific!"~~



- Severe flexion-based acute low back pain with associated “lumbar shift” is often **disc** related
 - Annular tear
 - Bulge/protrusion
 - Discitis

Disc pressures in different positions

- Measurement of intradiscal pressures in various positions (ouch!)

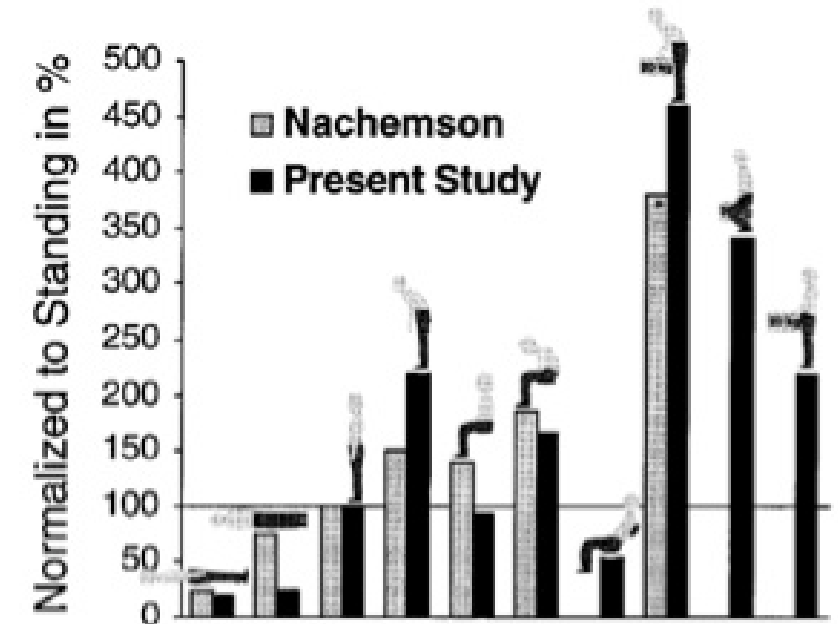
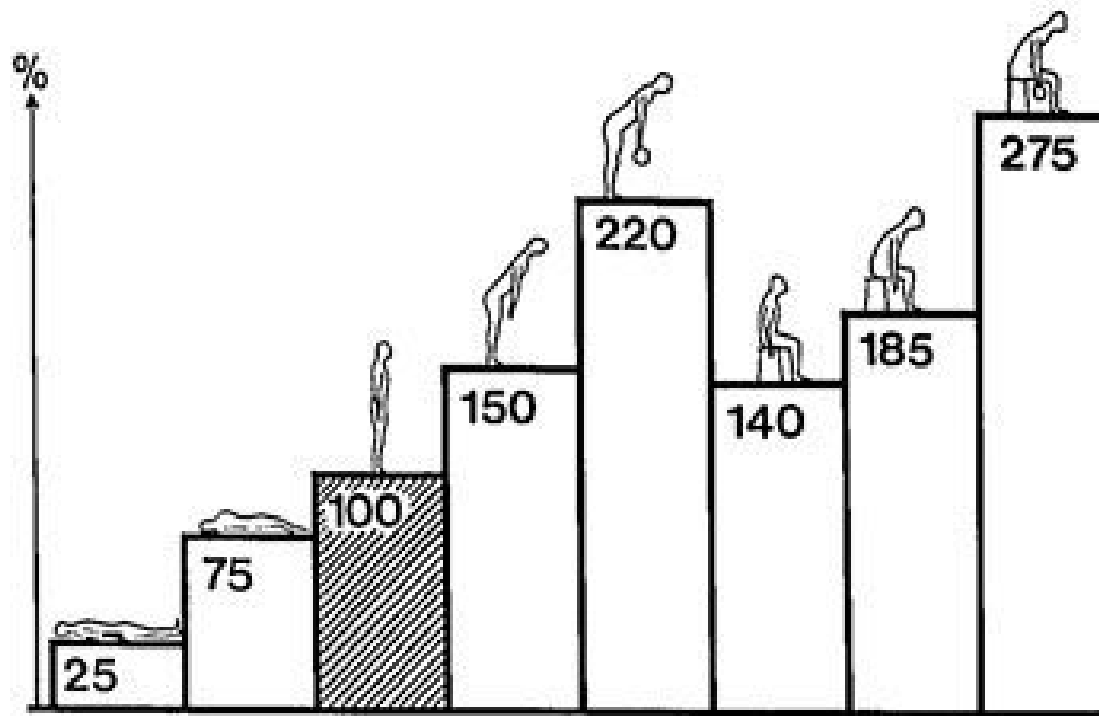
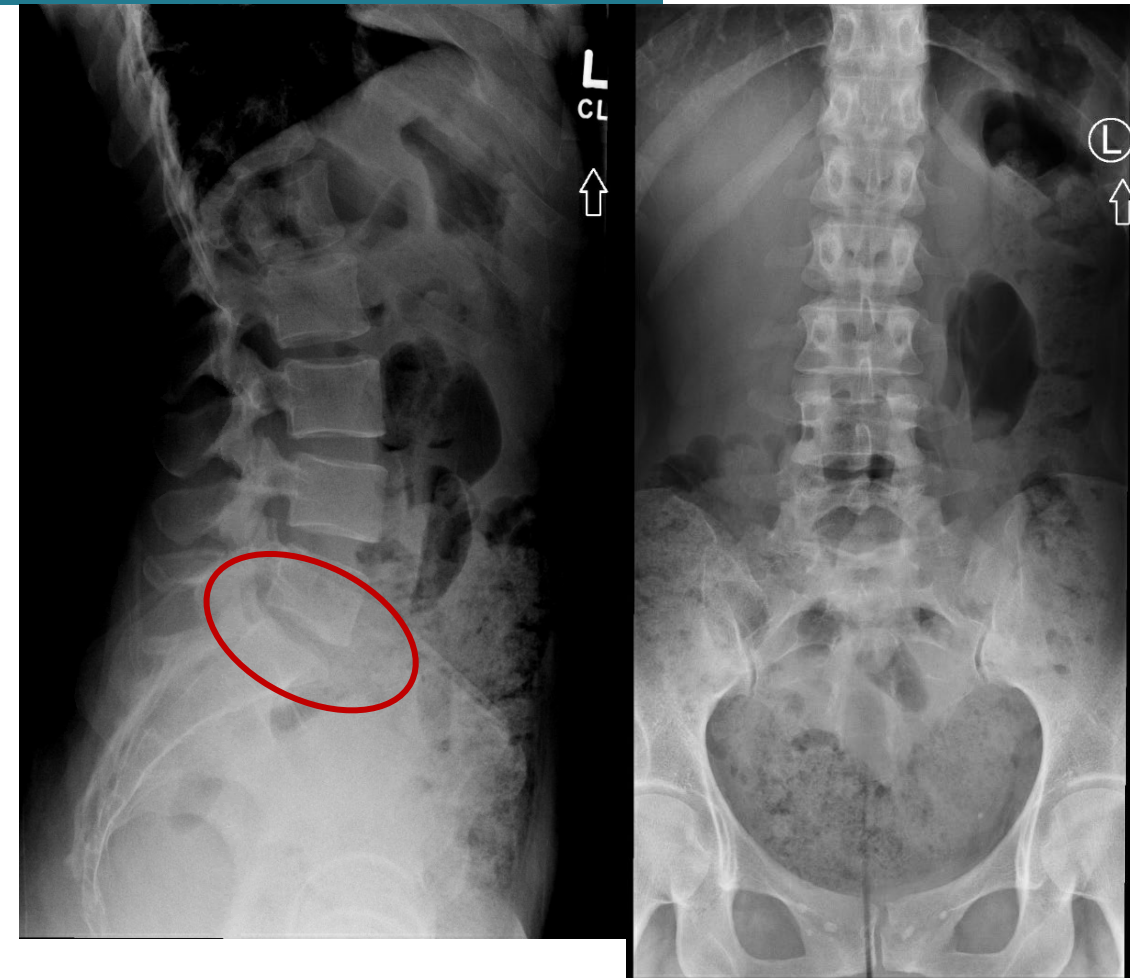


Figure 11. A comparison between data of Nachemson^{17,18} and those of the current study (both for 70-kg individuals) regarding intradiscal pressure in common postures and activities, normalized to standing. Lifting weight = 20 kg in the current study; *lifting weight = 10 kg in Nachemson study.

Case #1: Acute Low Back Pain

- Workup:
 - X-rays
 - Fractures
 - Disc space narrowing or normal
 - Transitional anatomy
 - MRI
 - Neuro findings (weakness, reflex change)
 - Red flags
 - If not improving or if anatomic pathology suspected
 - Discograms out of favor
 - Labs
 - If underlying inflammatory etiology suspected
 - ESR, CRP, CBC with diff



Case #1: Management



- **Education**

- Set appropriate expectations
- Avoid continuous sitting
 - Stand up every 20-30 minutes
- Standing desk or lumbar support
- Avoid excessive bending/lifting and improve mechanics
- Evaluate for directional preference

- **Exercise**

- Encourage activity as tolerated
- Avoid flexion stretching
- Running? If tolerating.

- **Medications**

- Anti-inflammatory of choice (short burst)
- Optimize sleep

- **Physical Therapy**

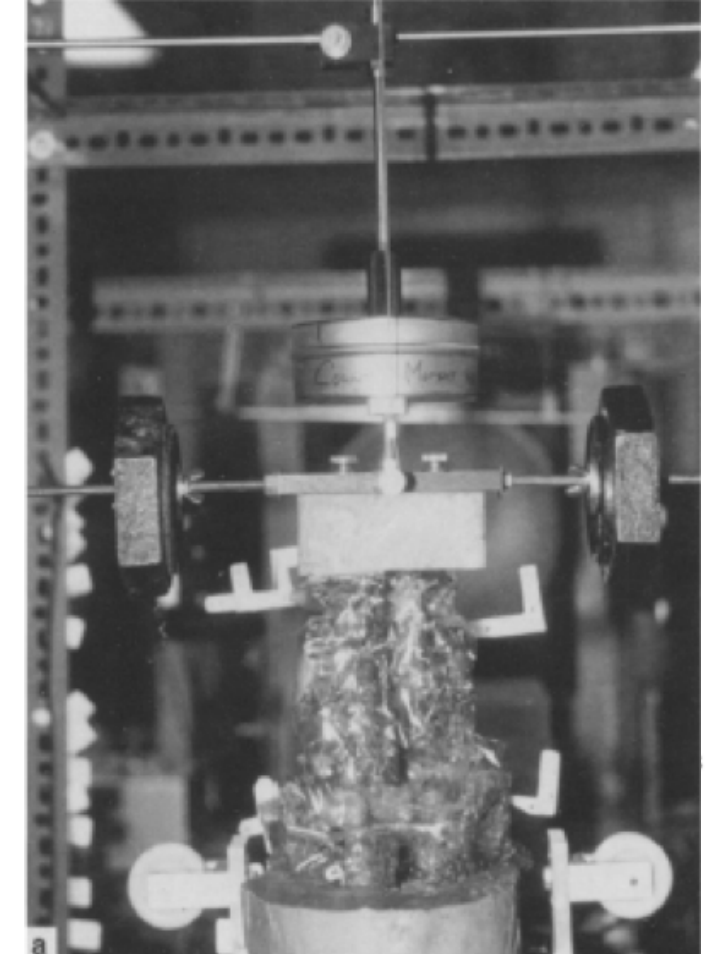
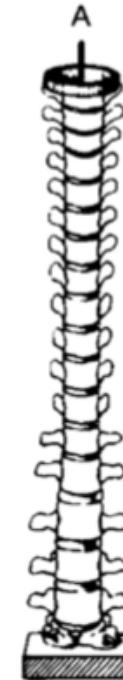
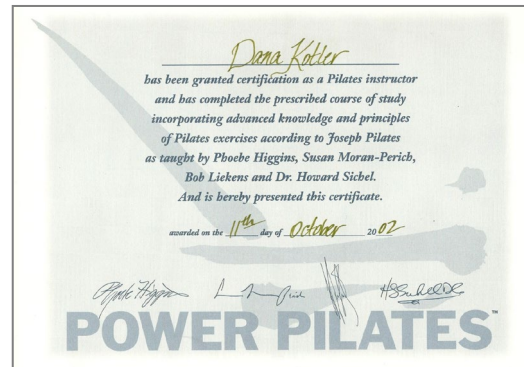
- MDT/McKenzie
- Stabilization program
- Functional training

- **Procedures**

- To reach discs/nerves → Epidural steroid
- No quality evidence for intradiscal procedures
 - Steroids, radiofrequency ablation, prolotherapy, platelet rich plasma, stem cells

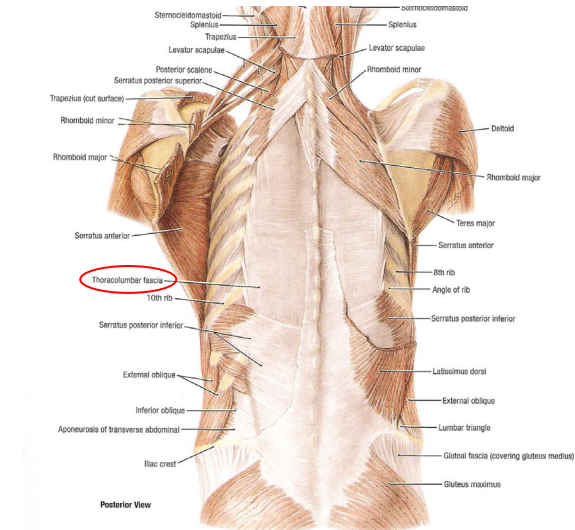
Spine does not stand alone

- Without muscular support, bony structures buckle with very low axial load (20 N or 4.5 lbs)¹
- Requires stabilizing muscles of the trunk and hip girdle



Strength and Control

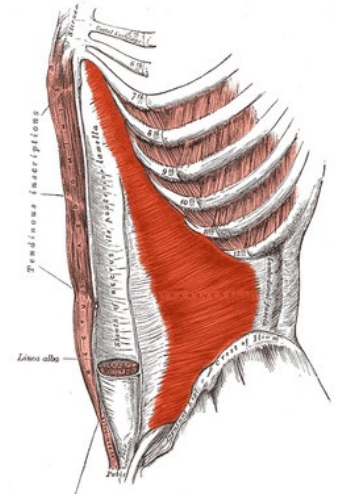
- Musculature of trunk and pelvis provide support and control of motion.¹
- Engage both before and in response to perturbations



“The Core” and Functional Movement

- **Perturbation**

- **Trunk loading, limb movement**
- TrA, OI, multifidi have been studied
 - “Abdominal hollowing” and abdominal bracing
- Increase intra-abdominal pressure, tension in thoracolumbar fascia, stiffening and stabilization
- **TrA activates first**
 - In unexpected and expected trunk loading.¹
 - Before the prime mover of the limb (in all directions).²
 - Preprogrammed response by the CNS, in preparation for perturbation.^{2,3}
- Dysfunction³ and reduced size⁴ in LBP patients³, improves with motor control exercise.⁴



¹Cresswell et al, 1994

³Hodges & Richardson, 1996

²Hodges & Richardson, 1997

⁴Ferreira & Hodges, 2010

Control of Movement

- **Proprioception**
 - Specialized nerves in Z-joints & multifidi^{1,2}
- **Postural control** altered in patients with chronic low back pain.³
 - Single leg balance⁴, trunk perturbation⁵
 - Difficulty finding neutral spine posture.⁶
 - Delay/failure of stabilizing muscles to activate⁷



Case #1b: Followup

- Patient gets through this acute flareup and does well for the next several months.
- They come back to you 6 months later with a flare which occurred after travel.
- Pain continues to be flexion-based
- Now there is associated posterior thigh and leg pain, numbness, tingling, and some difficulty going up stairs.



The Law Student, Norman Rockwell, 1927

Case #1b: Physical Exam

- Inspection: **Side-shift** away from the painful side
- ROM: Very restricted forward flexion with reproduction of **left posterolateral leg pain**
- TTP of bilateral lumbar paraspinals
- **Seated slump test (+)**
- Facet loading (-)
- Normal hip mobility and negative provocative maneuvers
- **Reduced sensation in first web space and lateral foot**
- **Weakness of EHL on manual muscle testing**
- **Single-leg heel raises impaired on the left**

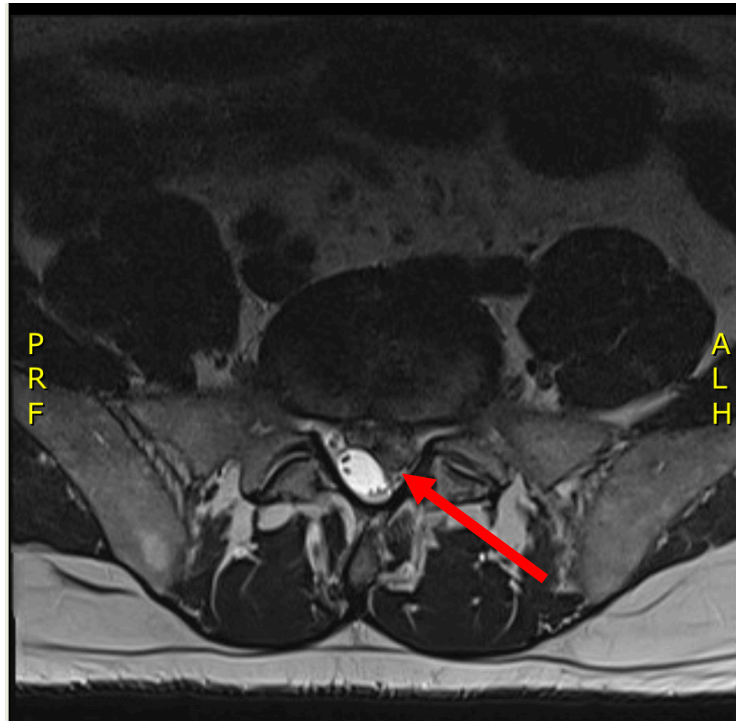


Case #1b: New diagnosis

- How do we describe this?
 - Acute, flexion-based, _____
- 1. Lumbar spondylosis
- 2. Piriformis syndrome
- 3. Lumbar radiculopathy
- 4. Sacroiliac joint pain
- 5. ~~I don't know, it's "nonspecific!"~~
- At this point imaging may prove more helpful to find the anatomic basis for the radiculopathy
- Disc, osteophyte, other.

Imaging: Radiculopathy

- Xray:
 - Negative or degenerative changes
- MRI:
 - Disc extrusion at L5-S1 with compression of the S1 nerve root
 - There is no spinal cord in the lumbar spine!
 - Sciatic nerve is not in the lumbar spine!
 - May not always be this impressive!



Electrodiagnostic testing

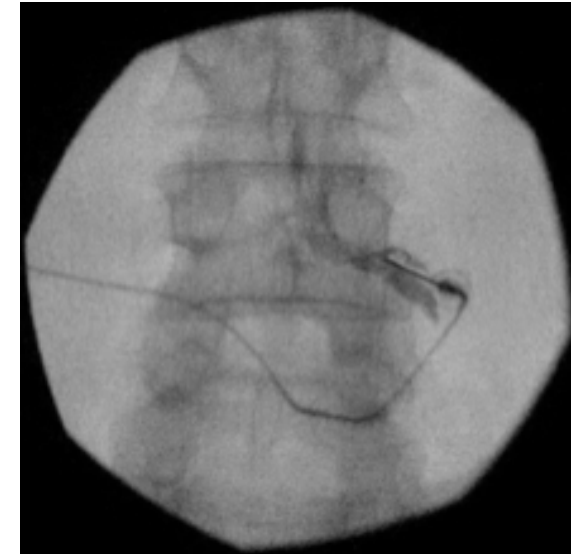
- When to do EMG/NCS? To discern:
 - **Mono vs. polyneuropathy** (nerve pattern)
 - i.e. leg pain and foot drop due to peroneal neuropathy
 - **Radiculopathy:** Myotomal (nerve root pattern)
 - i.e. leg pain and foot drop due to L4 radiculopathy
 - **Acute denervation changes vs. chronic reinnervation changes**
 - Prognostic value

Radiculopathy: Management

- Ergonomics
- Exercise as tolerated
 - Avoid excessive flexion if painful
 - Standing exercise often OK
- **Medications**
 - Anti-inflammatory of choice (short burst)
 - Optimize sleep
- **Physical Therapy**
 - MDT (often flexion-based)

- **Injections**

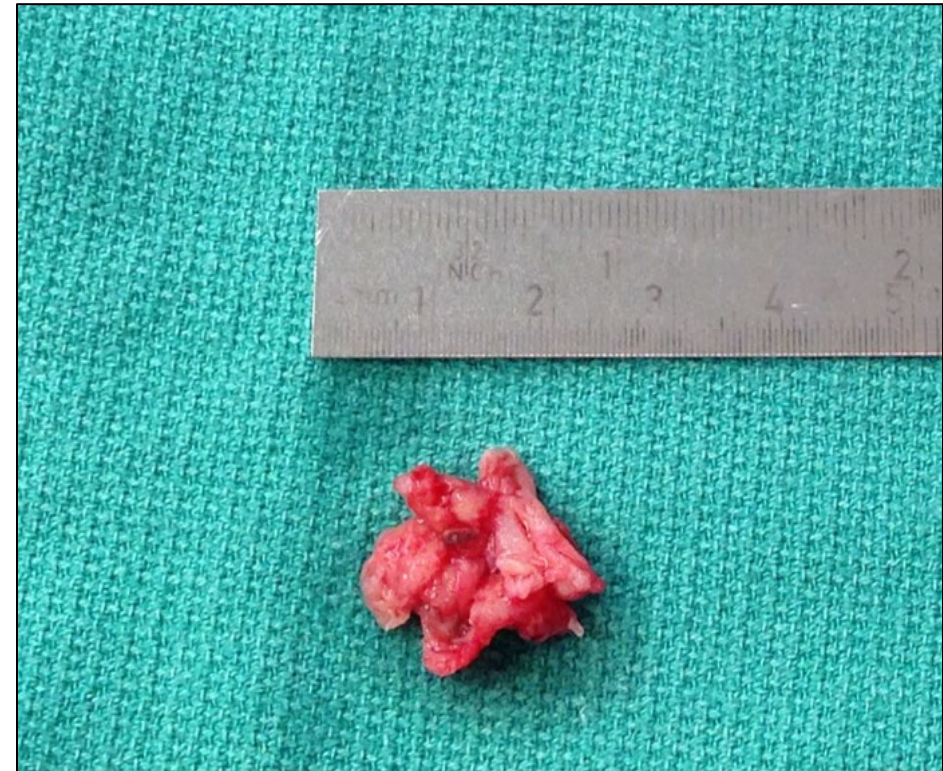
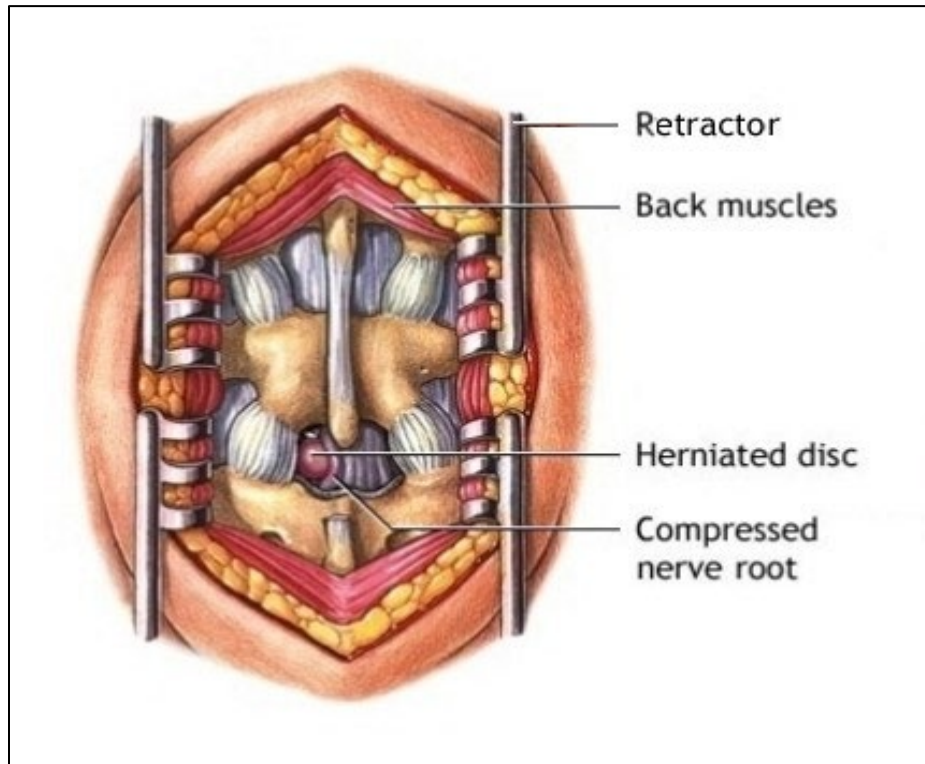
- To reach discs/nerves – epidural



- **Surgical**

- Discectomy
 - Decompression

Microdiscectomy for Disc Herniation



Case #1c: Followup

- Patient gets through this flareup, strength returns, and does well for the next several years, using occasional medication and ongoing home PT exercise.
- They come back to you 5 years later after chronic, frequent exacerbations, and a flare which occurred after travel.
- Pain continues to be flexion-based
- Never fully remits
- Forward bending, brushing teeth, washing face have become more difficult.
- Continues to be active, but basic functional activity i.e. dressing becoming more difficult due to pain.

Case #1c: Physical Exam

- Inspection: Neutral posture
- ROM: Painful but intact forward flexion
- Tender, taut bilateral lumbar paraspinals
- Seated slump test (+)
- Normal hip mobility and negative provocative maneuvers, but tight hip flexors
- Normal neuro exam (strength, sensation, reflexes)

Case #1b: New diagnosis

- How do we describe this?
 - Chronic, flexion-based, axial back pain → _____
 - 1. Myofascial pain
 - 2. Coccydynia
 - 3. Sacroiliac joint pain
 - 4. Degenerative disc disease
 - 5. ~~I don't know, it's "nonspecific!"~~
- At this point the problem is no longer pure disc pain, but now a **degenerative disc with alteration in spinal mechanics.**

Imaging: DDD



- Xray shows narrowing of disc space, endplate spurring



- MRI shows a desiccated, degenerative disc at L5-S1, may have endplate reactive marrow edema
- L4-5 also degenerative

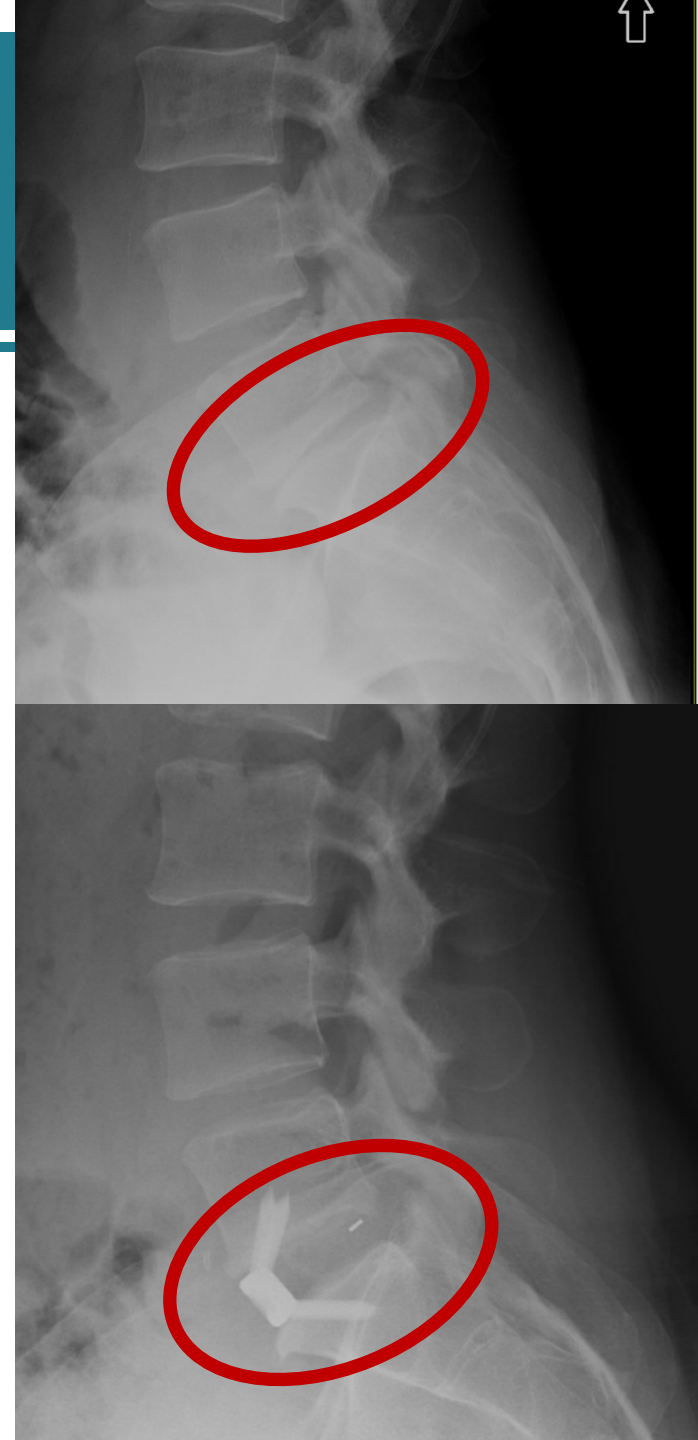
Case #1c: Management

- Medications
 - Anti-inflammatory of choice (short burst)
 - Optimize sleep
- Physical Therapy
- Injections
 - To reach discs/nerves – epidural
- **Surgical interventions**
 - **Lumbar fusion**
 - Anterior, transforaminal, posterior
- Ergonomics
 - Avoid continuous sitting
 - Frequent breaks
 - Standing desk
 - Use good body mechanics
- Exercise
 - As tolerated
 - Avoid flexion stretching
 - Encourage strength/stability exercise

Chronic Low Back Pain

Role of Surgical Intervention

- Systematic review by Phillips et al, Spine, 2013
 - Clinically meaningful improvement in pain and function after lumbar fusion in selected patients with degenerative disc disease
- Lumbar fusion indications for axial lumbar pain (NASS)
 - Progressive deformity, pain with functional limitation unresponsive to 1 year of conservative management
 - Single level advanced disc degeneration, symptoms longer than 1 year and unresponsive to multi-disciplinary treatment, absence of significant active psychiatric disorder, no smoking for at least 3 months



Case #2

- 60-year-old financial advisor
- ~6 months of progressive bilateral lower back pain
- Worst with static standing
- *“I hate museums.”*

Case #2: History

- Axial, radiates laterally and into buttocks
 - No radiation beyond buttocks
- Pain increases with:
 - Static standing
 - Transitional movements
 - Carrying objects
- Remits with:
 - Sitting
 - +/- Walking
- No neuro symptoms, bowel/bladder dysfunction
- No red or yellow flags

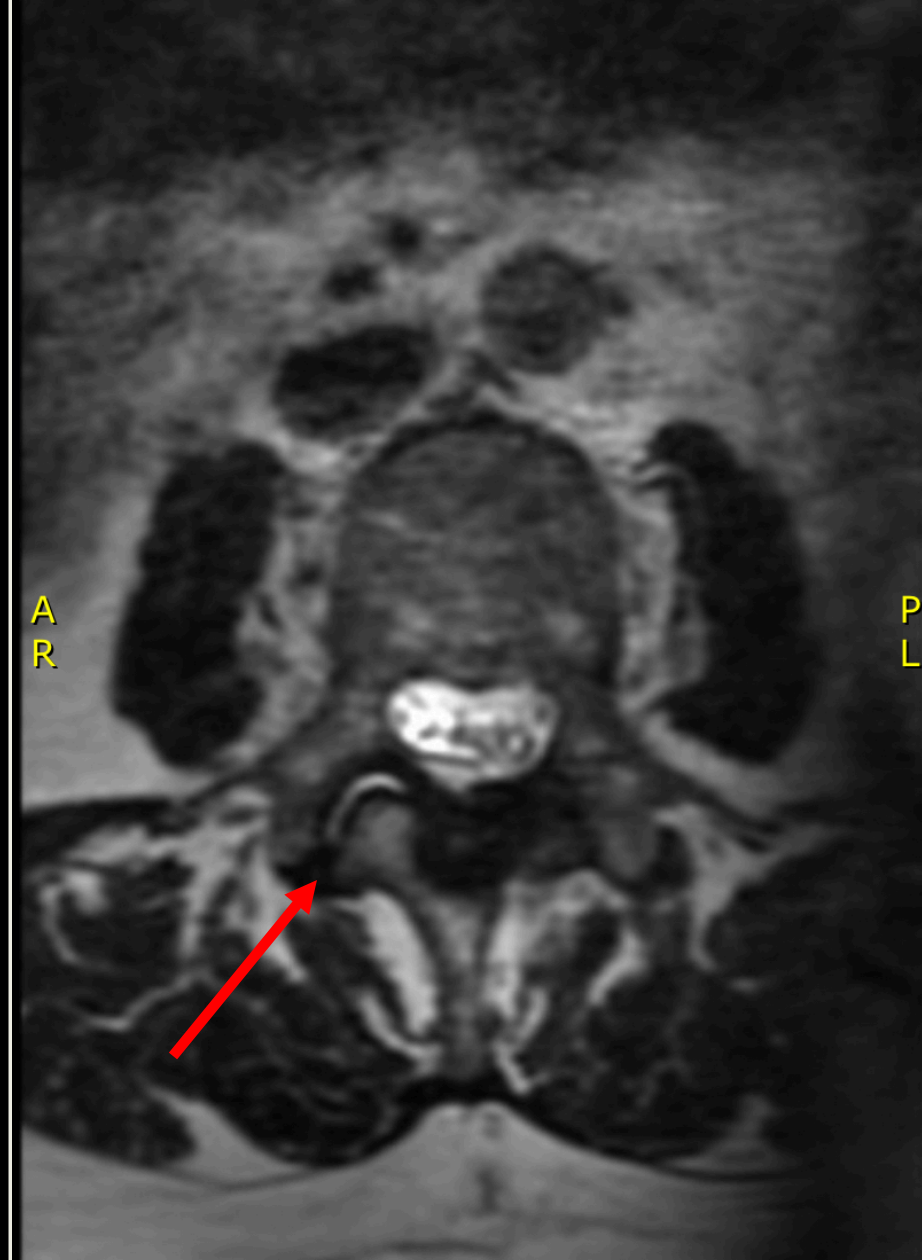
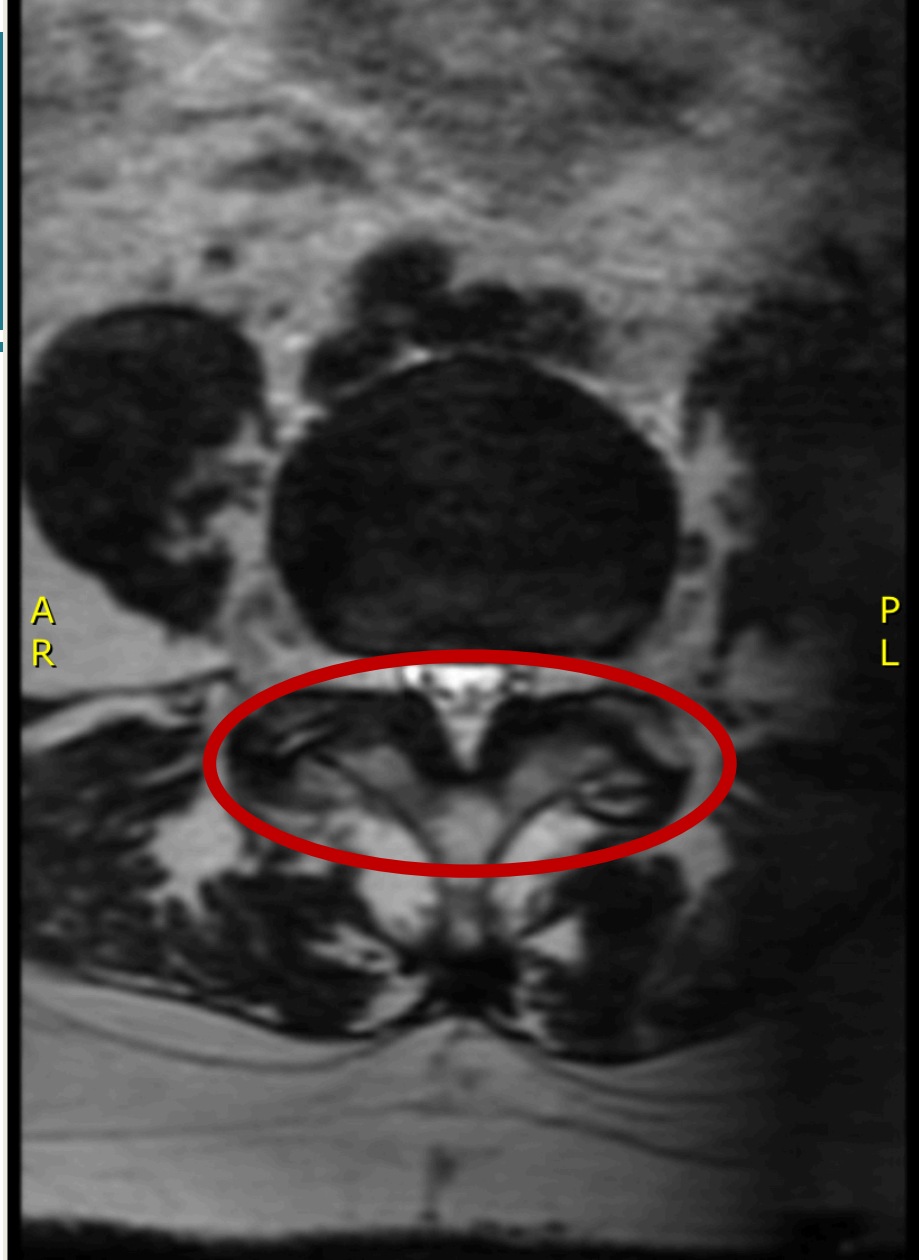
Case #2: Physical Exam

- Inspection: neutral posture, may have loss of lumbar lordosis
- ROM: Intact and nonpainful forward flexion, **restricted and painful extension**
- Minimal tenderness to palpation of lumbosacral spinous processes or lumbar paraspinals
- **Facet loading (+)**
- Seated slump test (-)
- Normal hip mobility and negative provocative maneuvers, negative SI exam
- Normal neuro exam (strength, sensation, reflexes)
- Single leg squat with contralateral pelvic tilt and medial knee deviation bilaterally



Case #2: Impression

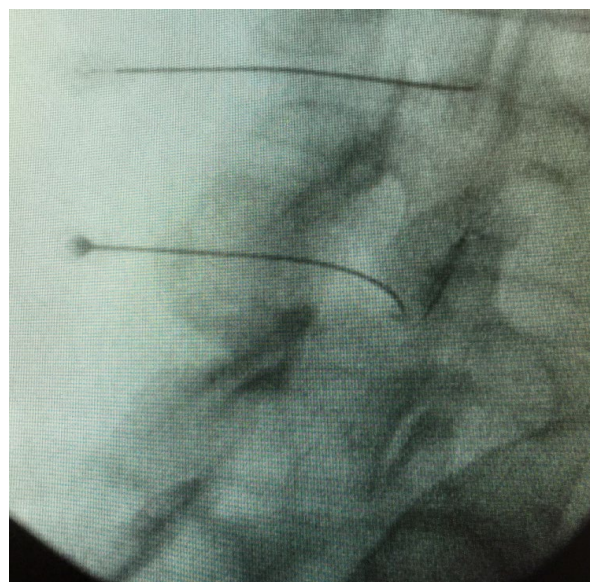
- How do we describe this?
 - Chronic, extension-based, axial low back pain
- 1. Muscle strain
- 2. Discogenic pain
- 3. Degenerative disc disease
- 4. Facet-mediated pain
- 5. ~~I don't know, it's "nonspecific!"~~
- People with facet pain often have pain with static positions, particularly standing.
 - Cocktail parties
 - Museums
 - Shopping



- MRI shows facet joint arthritis, moderate L4/5 stenosis

Facet-mediated pain: Management

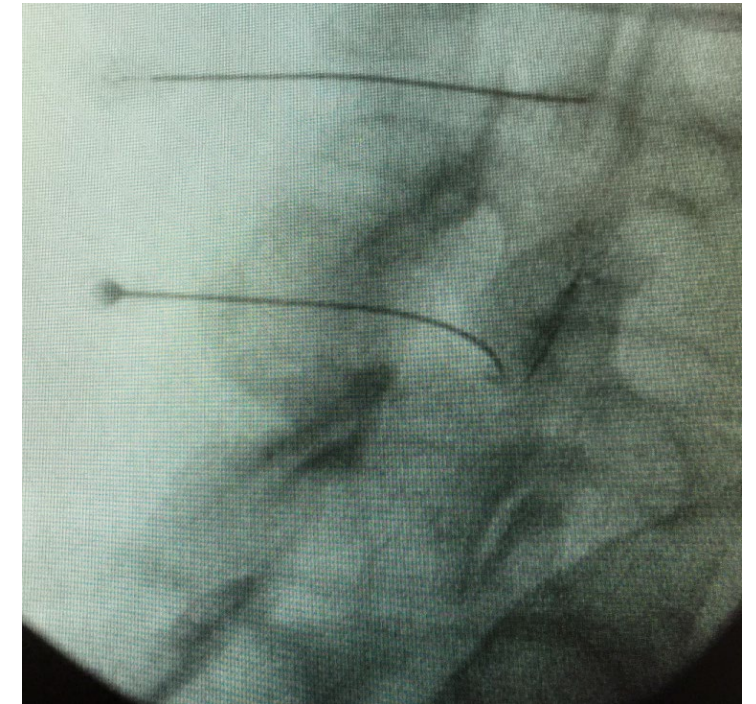
- Medications
 - Anti-inflammatory, analgesic
 - Optimize sleep
- Physical Therapy
- **Injections**
 - **Facet joint injections**
 - **Medial branch blocks**
 - **Radiofrequency lesioning of medial branch**



- Ergonomics
 - Avoid continuous standing
- Exercise
 - As tolerated
 - Avoid extension/rotation stretching

Facet Joint Procedures

- Facetogenic (zygapophyseal joint) pain
 - Limited evidence on intra-articular injections²
 - Low to moderate quality evidence for radiofrequency ablation^{1,2}
 - Short term pain relief
 - Functional improvement



¹Poetscher AW, Gentil AF, Lenza M, Ferretti M. Radiofrequency denervation for facet joint low back pain: a systematic review. Spine (Phila Pa 1976). 2014 Jun 15;39(14):E842-9.

²Falco FJ et al. An update of the effectiveness of therapeutic lumbar facet joint interventions. Pain Physician. 2012 Nov-Dec;15(6):E909-53. Review.

Case #3

- 75 year old woman with chronic and progressive bilateral buttock, thigh, and leg pain, exacerbated by standing and walking.
- *“I have to sit down and rest.”*

Case #3: History

- Bilateral buttock, thigh, and leg pain
- Pain increases with:
 - Walking
- Remits with:
 - Sitting
- No neuro symptoms, bowel/bladder dysfunction
- No red or yellow flags
 - Incontinence, profound or progressive weakness

Case #3: Physical Exam

- Inspection: stooped posture, loss of lumbar lordosis
- ROM: **Restricted in extension with reproduction of leg pain**
- Minimal tenderness to palpation of lumbosacral spinous processes or lumbar paraspinals
- Normal hip mobility and negative provocative maneuvers, negative SI exam
- Neuro exam: may be normal or subtle myotomal weakness unilaterally or bilaterally
- Gait: **Forward flexed**

Case #3: Impression

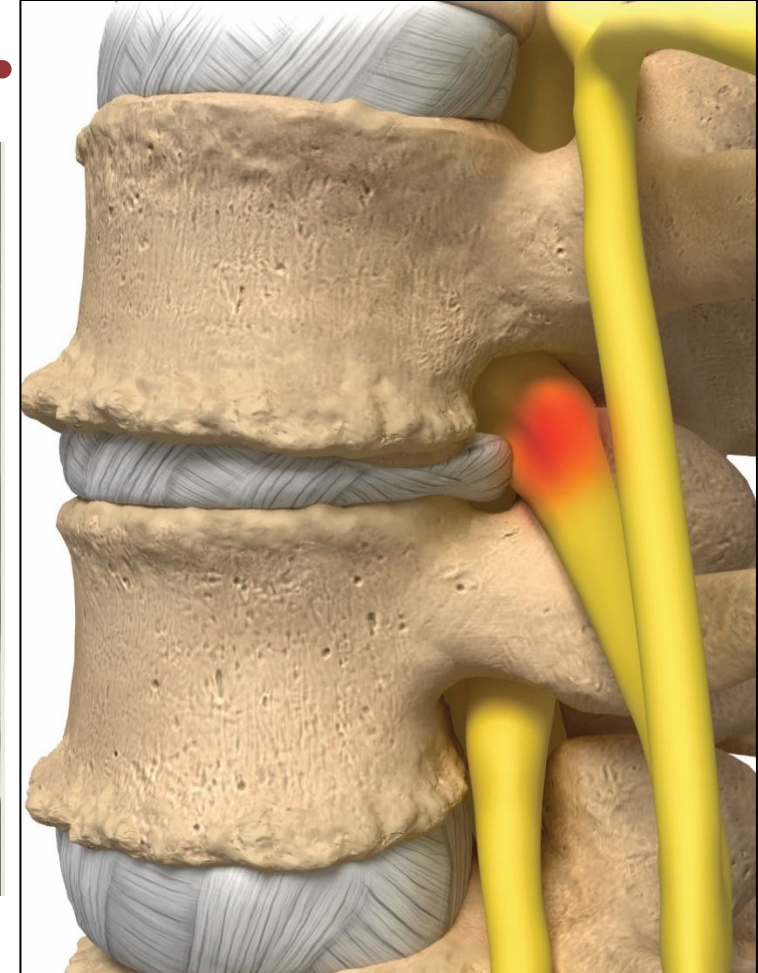
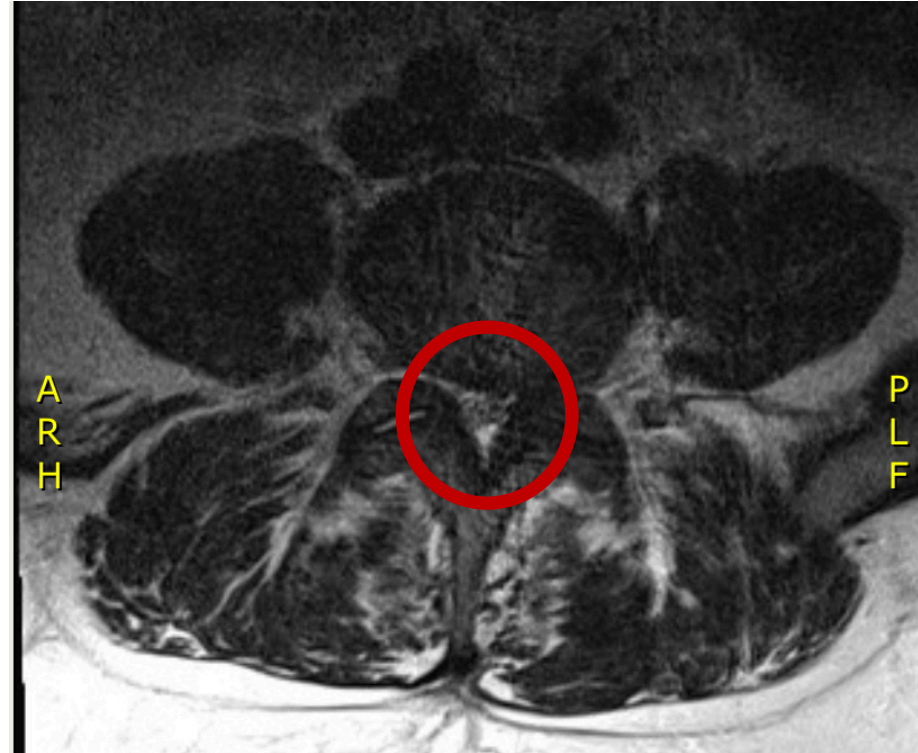
- How do we describe this?
 - Chronic, extension-based, **radicular pain/claudeication**
- 1. Lumbar spinal stenosis
- 2. Discogenic pain
- 3. Degenerative disc disease
- 4. Facet-mediated pain
- 5. ~~I don't know, it's "nonspecific!"~~
- What is causing the stenosis and where is it?
- Central canal vs. foraminal stenosis
- Neurodegenerative and vascular disease also in differential

Spinal Stenosis

- Symptoms
 - Back, buttock, leg, or foot pain
 - Numbness/tingling in leg/foot
 - Weakness of the leg or foot
 - Can be one-sided or both legs

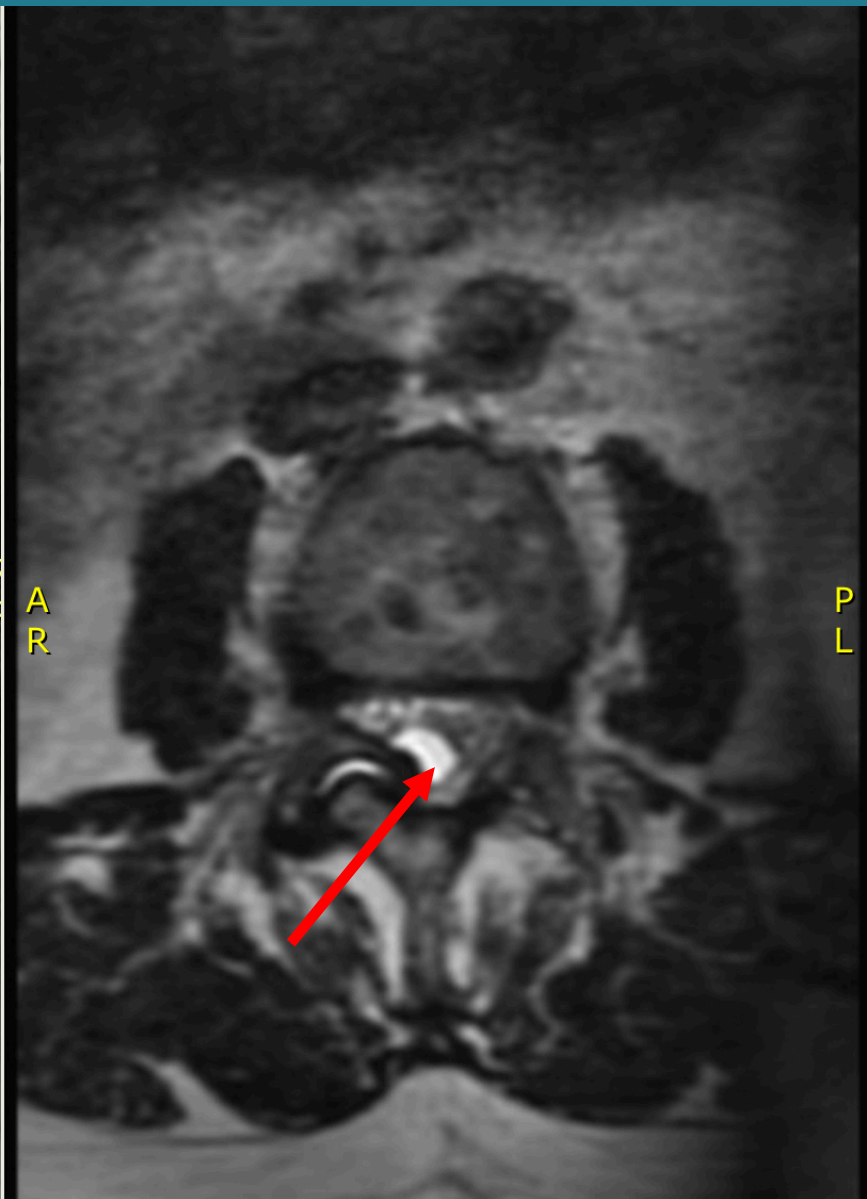
Spinal Stenosis: Imaging

- Many anatomic sources of stenosis





Stenosis secondary to a **facet synovial cyst**



Stenosis secondary to a **nerve sheath tumor**



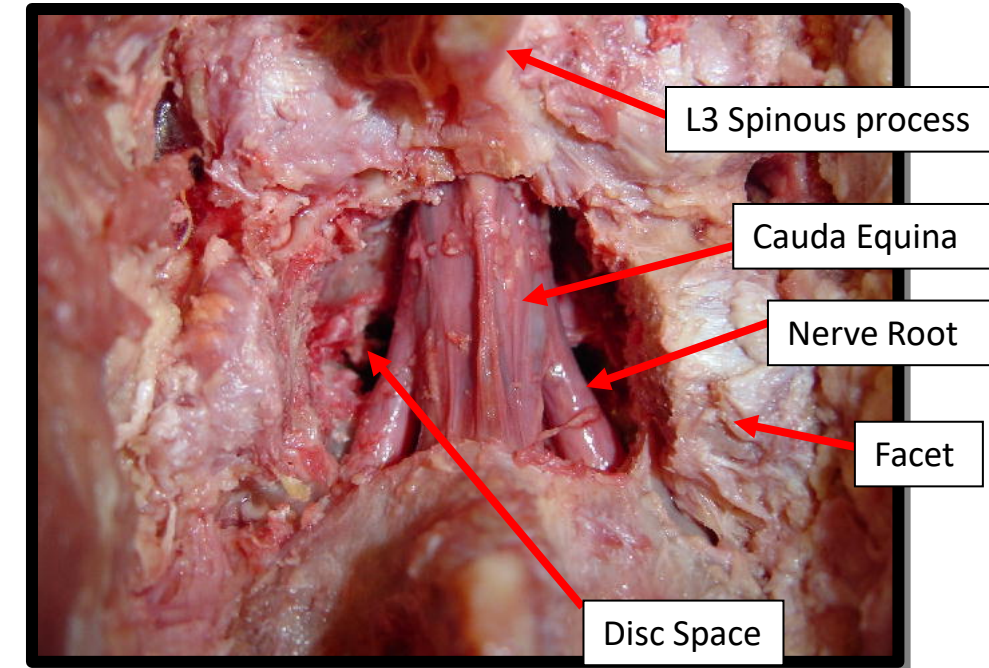
- Stenosis related to **spondylolisthesis** and **facet arthropathy**

Lumbar Stenosis: Spinal Injections

- Lumbar Spinal Stenosis
 - Epidural Steroid Injections
 - Limited high quality evidence for short term relief
 - Friedly et al.
 - Lidocaine (L) vs. lidocaine + steroid (LS)
 - Both groups showed association with function and pain improvement at 3 and 6 weeks; steroid > lidocaine at 3 weeks (clin sig)
 - Only interlaminar injection approach showed significant improvement in function and pain at 3 weeks over lidocaine only group
 - 50% improvement in leg pain at 6 weeks in 38% in each L and LS groups; no subgroup analysis between transforaminal and interlaminar approaches reported

Lumbar Stenosis: Surgery

- Laminectomy: traditional gold standard for central stenosis
- *Advantage: complete wide decompression of neural structures with excellent visualization
- RISK: iatrogenic instability
- Most case series report > 85% good to excellent results after lumbar decompression



Verbiest HE. Results of surgical treatment of idiopathic developmental stenosis of the lumbar vertebral canal. A review of twenty-seven years' experience. The Journal of bone and joint surgery. British volume. 1977 May;59(2):181-8.

Athiviraham A, Yen D. Is spinal stenosis better treated surgically or nonsurgically?. Clinical Orthopaedics and Related Research®. 2007 May 1;458:90-3.

Malmivaara A, Slätis P, Heliövaara M, Sainio P, Kinnunen H, Kankare J, Dalin-Hirvonen N, Seitsalo S, Hernö A, Kortekangas P, Niinimäki T. Surgical or nonoperative treatment for lumbar spinal stenosis?: a randomized controlled trial. Spine. 2007 Jan 1;32(1):1-8.

Key Points

- Evaluation of back pain involves a detailed history, physical examination, and appropriate use of imaging.
- Diagnosis should be based on pattern of symptoms and then confirmed with appropriate imaging.
- Management of lumbar spine disorders is multifactorial, including medications, exercise, physical therapy, interventional injections, and sometimes surgery.
- Patient education on managing symptoms and preventing recurrence is essential.

Next Best Steps

LOW BACK PAIN



- Specific diagnosis
- Symptom management and rehabilitation



- Improving strength and movement quality for a lifetime
- Maintenance of a healthy lifestyle

References

1. Bernstein IA, Malik Q, Carville S, Ward S. Low back pain and sciatica: summary of NICE guidance. *BMJ*. 2017 Jan 6;356:i6748.
2. Bogduk N: *Clinical Anatomy of the Lumbar Spine and Sacrum*. Edinburgh, Churchill Livingstone, 1997
3. Brinjikji W, Luetmer PH, Comstock B, Bresnahan BW, Chen LE, Deyo RA, Halabi S, Turner JA, Avins AL, James K, Wald JT. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *American Journal of Neuroradiology*. 2014 Nov 27.
4. Brinjikji W, Diehn FE, Jarvik JG, et al. MRI Findings of disc degeneration are more prevalent in adults with low back pain than in asymptomatic controls: a systematic review and meta-analysis. *Am J Neuroradio* 2015; 36: 2394–99.
5. Choi BK, Verbeek JH, Tam WW, Jiang JY. Exercises for prevention of recurrences of low-back pain. *Cochrane Database Syst Rev*. 2010 Jan 20;(1):CD006555.
6. Chou R, Huffman LH; Nonpharmacologic therapies for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med*. 2007 Oct 2;147(7):492-504. Review.
7. Cresswell AG, Oddsson L, Thorstensson A. The influence of sudden perturbations on trunk muscle activity and intra-abdominal pressure while standing. *Experimental Brain Research*. 1994;98(2):336-41.
8. CUENCA-MARTÍNEZ F, CORTÉS-AMADOR S, ESPÍ-LÓPEZ GV. Effectiveness of classic physical therapy proposals for chronic non-specific low back pain: a literature review. *Physical Therapy Research*. 2018:E9937.
9. Deyo RA, Weinstein JN. Low back pain. *N Engl J Med*. 2001 Feb 1;344(5):363-70. Review.
10. Ebenbichler GR, Oddsson LI, Kollmitzer J, et al: Sensorymotor control of the lower back: Implications for rehabilitation. *Med Sci Sports Exerc* 2001;33:1889–98.
11. Enthoven WT, Roelofs PD, Deyo RA, van Tulder MW, Koes BW. Non-steroidal anti-inflammatory drugs for chronic low back pain. *Cochrane Database of Systematic Reviews*. 2016(2).
12. Falco FJ et al. An update of the effectiveness of therapeutic lumbar facet joint interventions. *Pain Physician*. 2012 Nov-Dec;15(6):E909-53. Review.
13. Ferreira PH, Ferreira ML, Maher CG, Refshauge K, Herbert RD, Hodges PW. Changes in recruitment of transversus abdominis correlate with disability in people with chronic low back pain. *Br J Sports Med*. 2010 Dec;44(16):1166-72.
14. Friedly JL et al. A randomized trial of epidural glucocorticoid injections for spinal stenosis. *N Engl J Med*. 2014 Jul 3;371(1):11-21.
15. Gianola S, Castellini G, Corbetta D, Moja L. Rehabilitation interventions in randomized controlled trials for low back pain: proof of statistical significance often is not relevant. *Health and quality of life outcomes*. 2019 Dec;17(1):127. Published online 2019 Jul 22.

References

1. Gimbel J, Linn R, Hale M, Nicholson B. Lidocaine patch treatment in patients with low back pain: results of an open-label, nonrandomized pilot study. *Am J Ther.* 2005 Jul-Aug;12(4):311-9.
2. Goldberg H, et al. Oral steroids for acute radiculopathy due to a herniated lumbar disk: a randomized clinical trial. *JAMA.* 2015 May 19;313(19):1915-23.
3. Goldberg RJ, Katz J. A meta-analysis of the analgesic effects of omega-3 polyunsaturated fatty acid supplementation for inflammatory joint pain. *Pain.* 2007 May;129(1-2):210-23. Epub 2007 Mar 1.
4. Haskins R, Osmotherly PG, Rivett DA. Diagnostic clinical prediction rules for specific subtypes of low back pain: a systematic review. *Journal of orthopaedic & sports physical therapy.* 2015 Feb;45(2):61-76.
5. Hides J: Paraspinal mechanism and support of the lumbar spine, in: Richardson C (ed): *Therapeutic Exercise for Lumbopelvic Stabilization*, ed 2. Edinburgh, Churchill Livingstone, 2004, pp 59–74.
6. Hodges PW, Richardson CA. Contraction of the abdominal muscles associated with movement of the lower limb. *Physical Therapy.* 1997 Feb;77(2):132-42; discussion 142-4.
7. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain. A motor control evaluation of transversus abdominis. *Spine.* 1996 Nov 15;21(22):2640-50.
8. Jensen TS, Albert HB, Soerensen JS, et al. Natural course of disc morphology in patients with sciatica: an MRI study using a standardized qualitative classification system. *Spine (Phila Pa 1976)* 2006;31(14): 1605–12.
9. Kuptniratsaikul V et al. Efficacy and safety of Curcuma domestica extracts compared with ibuprofen in patients with knee osteoarthritis: a multicenter study. *Clin Interv Aging.* 2014 Mar 20;9:451-8. doi: 10.2147/CIA.S58535. eCollection 2014.
10. Lee YH, Bae SC, Song GG. Omega-3 Polyunsaturated Fatty Acids and the Treatment of Rheumatoid Arthritis: A Meta-analysis. *Arch Med Res.* 2012 Jul;43(5):356-62. doi: 10.1016/j.arcmed.2012.06.011. Epub 2012 Jul 24.
11. Machado LA, De Souza MV, Ferreira PH, Ferreira ML. The McKenzie method for low back pain: a systematic review of the literature with a meta-analysis approach. *Spine.* 2006 Apr 20;31(9):E254-62.
12. Mok NW, Brauer SG, Hodges PW: Hip strategy for balance control in quiet standing is reduced in people with low back pain. *Spine* 2004;29:E107–12.
13. Morris JM, Lucas DB, Bresler B. Role of the Trunk in Stability of the Spine. *J Bone Joint Surg Am,* 1961 Apr;43(3):327-351.
14. Nachemson AL, Morris JM. In vivo measurements of intradiscal pressure: discometry, a method for the determination of pressure in the lower lumbar discs. *JBJS.* 1964 Jul 1;46(5):1077-92.
15. Nachemson AL. Towards a better understanding of low-back pain: a review of the mechanics of the lumbar disc. *Rheumatology.* 1975 Aug 1;14(3):129-43.

References

1. Oliveira CB, Maher CG, Pinto RZ, Traeger AC, Lin CW, Chenot JF, van Tulder M, Koes BW. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *European Spine Journal*. 2018 Jul 3;1-3.
2. O'Sullivan PB, Burnett A, Floyd AN, et al: Lumbar repositioning deficit in a specific low back pain population. *Spine* 2003;28:1074–9 -
3. Petersen T, Laslett M, Thorsen H, Manniche C, Ekdahl C, Jacobsen S. Diagnostic classification of non-specific low back pain. A new system integrating patho-anatomic and clinical categories. *Physiotherapy Theory and Practice*. 2003 Jan 1;19(4):213-37.
4. Petersen T, Laslett M, Juhl C. Clinical classification in low back pain: best-evidence diagnostic rules based on systematic reviews. *BMC musculoskeletal disorders*. 2017 Dec;18(1):188.
5. Phillips FM, Slosar PJ, Youssef JA, Andersson G, Papatheofanis F. Lumbar spine fusion for chronic low back pain due to degenerative disc disease: a systematic review. *Spine (Phila Pa 1976)*. 2013 Apr 1;38(7):E409-22.
6. Poetscher AW, Gentil AF, Lenza M, Ferretti M. Radiofrequency denervation for facet joint low back pain: a systematic review. *Spine (Phila Pa 1976)*. 2014 Jun 15;39(14):E842-9.
7. Rasmussen-Barr E, Held U, Grooten WJ, Roelofs PD, Koes BW, van Tulder MW, Wertli MM. Non-steroidal anti-inflammatory drugs for sciatica. *Cochrane Database of Systematic Reviews*. 2016(10).
8. Richardson, C et al. Therapeutic exercise for spinal segmental stabilization in low back pain. Churchill Livingstone, 1999.
9. Roelofs PD, Deyo RA, Koes BW, Scholten RJ, van Tulder MW. Non-steroidal anti-inflammatory drugs for low back pain. *Cochrane database of systematic reviews*. 2008(1).
10. Stynes S, Konstantinou K, Dunn KM. Classification of patients with low back-related leg pain: a systematic review. *BMC musculoskeletal disorders*. 2016 Dec;17(1):226.
11. Wasserman MS, Guermazi A, Jarraya M, Engbretsen L, Abdalkader M, Roemer FW, Hayashi D, Crema MD, Mian AZ. Evaluation of spine MRIs in athletes participating in the Rio de Janeiro 2016 Summer Olympic Games. *BMJ open sport & exercise medicine*. 2018 Feb 1;4(1):e000335.
12. Weinstein JN, Lurie JD, Tosteson TD, Tosteson AN, Blood E, Abdu WA, Herkowitz H, Hilibrand A, Albert T, Fischgrund J. Surgical versus non-operative treatment for lumbar disc herniation: four-year results for the Spine Patient Outcomes Research Trial (SPORT). *Spine*. 2008 Dec 1;33(25):2789.
13. Wilder DG, Aleksiev AR, Magnusson ML, et al: Muscular response to sudden load: A tool to evaluate fatigue and rehabilitation. *Spine* 1996;21:2628–39.
14. Wilke HJ, Neef P, Caimi M, Hoogland T, Claes LE. New in vivo measurements of pressures in the intervertebral disc in daily life. *Spine*. 1999 Apr 15;24(8):755-62.

Thank you!

dkotler@partners.org

