# "Back" to basics

Managing low back pain in the orthopedic patient



#### Disclosures



• I have no personal, financial or commercial relationships or messages to disclose. All relevant financial relationships have been mitigated.

# Objectives

- Name 2-3 causes of low back pain
- Differentiate between Lumbar radiculopathy and Neurogenic Claudication
- Name 1 pharmacological and 1 procedural treatment for compression fractures.
- Describe 2-3 major symptoms of cauda equina syndrome

# Dr. Zack Lerner, DNP-APRN

- Functional Dry Needling
- Suboxone certified through the ASAM
- Husband to Krista
- DNP University of Kansas 2021
- Father (Max 7, Mia 4, Avi 2)
- Pets Murphy (Musky) 10, Millie (Great Dane) 9
- Orthopedics:
  - 7 years 1<sup>st</sup> assist with total joints, trauma, sports injury.
- Pain Management "chronic non-operative orthopedics":
  - 6 years pharmacological and interventional



# Statistics

Common presentation to primary care or emergency departments

~\$200 billion annually—much attributed to work lost

90% mechanical

Up to 30% of presenting back pain is SI joint

Main determinant of years lived with disability

Up to 84% of adults at some point in life.

Facet Joints Joint capsule Joint cavity Body of vertebra Intervertebral disk -Facet joint Facet joint Spinous process

#### TERMS

- *Spondylosis* = arthritis of spine
  - Radiographically = arthritic changes at face joint
- *Spondylolisthesis* = vertebral displacement
- Antero/Retro –listhesis = anterior/posterior displacement of vertebral body relative to one below respectively
- *Spondylolysis* = fracture of pars interarticularis where vertebral body and posterior elements protecting nerves are joined (most common at L5)
- Spinal Stenosis = Local, segmental, or generalized narrowing of vertebral canal by bone or soft tissue elements via bony hypertrophic changes in facet joints and thickening ligamentum flavum
- Radiculopathy = impairment of nerve root causing radiating pain, numbness, tingling or ms weakness corresponding to specific nerve root

*Neurogenic claudication* = pain, weakness, or both occurring with compression of the nerves in the Lumbar spine.

#### Highsmith, J. (2020).

# Risk factors

- Age—body changes, osteoporosis, core strength loss, disc degeneration
- Fitness level—Active vs. sedentary
- Weight gain—obesity or quick weight gain
- Genetics—predisposed to OA or disc disease
- Work—heavy lifting, pushing, pulling, ergonomics
- Mental health—depression, anxiety, mood psychological well-being
- Smoking—accelerates disc degeneration
- Backpacks in children—leading to muscle fatigue and eventual injury

#### Causes

- **Mechanical**: Due to injury to the spine, intervertebral discs, or soft tissues. Spondylolisthesis can be both an acute or chronic process. Pain or a strain to either the quadratus lumborum muscle or the paraspinal muscles. Disc herniation
- **Degenerative**: Osteoarthritis of the spine includes facet joint osteoarthritis, sacroiliac joint osteoarthritis, spinal stenosis, and degenerative disc disease. Furthermore, osteoporotic compressive fractures are also a degenerative process.
- **Inflammatory**: This is caused primarily due to inflammatory (seronegative) spondyloarthropathies such as ankylosing spondylitis.
- **Oncologic**: This is caused by lytic lesions to the spine, cancers of the marrow, or compressive nerve phenomena from adjacent space-occupying lesions. Often presenting as a pathological fracture.
- **Infectious**: Infections of the spine, discs, epidural abscesses, or muscular/soft tissue abscesses

# Categories

Non-Specific—No **OBVIOUS** physiologic/pathologic cause

• Up to 85% of back pain presenting to urgent care or ED

#### Serious—Requires quick action to address the problem (~1%)

- Cauda Equina
- Metastasis
- Spinal Epidural Hematoma
- Vertebral Osteomyelitis

#### Less Serious—Urgent but not emergent (~10%)

- Compression fracture
- Radiculopathy
- Stenosis

#### Chronic and Other

- Arthritis: OA, Degenerative disc disease, Spondyloarthritis
- Scoliosis/Hyperkyphosis
- Psychologic Distress: anxiety, depression, PTSD
- Pyriformis Syndrome
- SI joint dysfunction

#### DDX

#### Differential diagnosis of low back pain

Mechanical low back pain	Nonmechanical spine disease	Visceral disease
Lumbar strain	Neoplasia	Pelvic organs
Degenerative disease <ul> <li>Discs (spondylosis)</li> <li>Facet joints (osteoarthritis)</li> </ul>	<ul> <li>Multiple myeloma</li> <li>Metastatic carcinoma</li> <li>Lymphoma and leukemia</li> <li>Spinal cord tumors</li> <li>Retroperitoneal tumors</li> </ul>	<ul> <li>Prostatitis</li> <li>Endometriosis</li> <li>Chronic pelvic inflammatory disease</li> <li>Renal disease</li> <li>Nephrolithiasis</li> <li>Pyelonephritis</li> <li>Perinephric abscess</li> </ul>
Spondylolisthesis		
Herniated disc	Infection  Osteomyelitis Septic discitis Paraspinous abscess Epidural abscess Inflammatory arthritis (often HLA-B27-associated) Ankylosing spondylitis Psoriatic spondylitis Reactive arthritis Inflammatory bowel disease Scheuermann disease (osteochondrosis)	
Spinal stenosis		
Osteoporosis		Aortic aneurysm
Fractures		Gastrointestinal disease Pancreatitis Cholecystitis Penetrating ulcer Fat herniation of lumbar space
Congenital disease <ul> <li>Severe kyphosis</li> <li>Severe scoliosis</li> <li>Possible type II or type IV transitional vertebra*</li> </ul> Possible spondylolysis		
Possible facet joint asymmetry		

Paget disease





# Observation

- Edema
- Erythema
- Ecchymosis
- Symmetry/Deformity
  - Scoliosis/Kyphosis/Lordosis

Physical Exam

# Physical Exam Cont.

- Palpation
  - Pain
  - Effusion
  - Crepitus
    - Fracture, OA
  - Anatomical Abnormalities
    - Scoliosis/Hyperkyphosis





#### Physical Exam Cont.

- Range of Motion (Active and Passive)
  - Lumbar Spine
    - Flexion=60-90 deg
    - Extension=25-40 deg
    - Lateral bend=25-40 deg
    - Rotation=45-75 deg
  - *HIP* (ROM & Strength testing)
    - Flexion=110-145 deg
    - Extension=25-40 deg
    - Abduction=40-50 deg
    - Adduction=20-30 deg
    - Internal Rotation=30-45 deg
    - External Rotation=45-75 deg

# Strength Testing

Muscle	Level	Disk
Psoas	L-2	L1-2
Quads	L-3	L2-3
Tibialis Anterior	L-4	L3-4
Extensor Hallucis Longus	L-5	L4-5
Gastrocnemius	S-1	L5-S1
Bladder Sphincter	S-2	
Anal Sphincter	S-3	(Sacral Sparring & Cauda Equina)

# Special Testing

#### SLR (Straight Leg Raise)

# FABER (Flexion, Abduction, External Rotation)

FADIR (Flexion, Adduction, Internal Rotation)

Gaenslen (Extension of the leg with Flexion of the Contralateral side)







Straight Leg Raise (2022)

#### DEGENERATIVE DISORDERS

#### Age related wear and tear



Degenerative Disc: Gradual wear of the intervertebral disc

#### Spondylosis: gradually degenerate with age

Osteophytes compress adjacent nerve roots

Radiculopathy & Lumbar spinal stenosis

#### Spondylolisthesis: Chronic or Congenital

OA of facet joints = slips	Degenerative disc dx =	Radiculopathy &
forward	slips dorsally	Lumbar spinal stenosis

#### Examples of Disc Problems



## Degenerative disorders cont.

- Degenerative Disc Disease
  - Disc loses hydration/mass/height over time
  - Intervertebral space decreases until "bone on bone"
    - Oteophytes
    - Cystic changes
    - Documented loss of height
    - Axial Pain
  - Treatment
    - NSAIDS
      - Celecoxib 200mg 1 PO QD-BID (long term)
      - Meloxicam 7.5-15mg 1 PO QD (long term)
      - Ibuprofen 600mg 1 PO TID (short term)
      - Naproxen 500mg 1 PO BID (short term)
      - Diclofenac Gel 1-2 in QID
    - Surgery
      - Disc Replacement
    - Exercise/Physical therapy

# Degenerative disorders cont.

- Spondylolisthesis
  - Anterior/posterior shift of vertebrae compared to its adjacent vertebrae.
  - Instability leading to:
    - Pain
    - Radiculopathy
    - Neurogenic Claudication



#### Degenerative disorders cont.



- Spondylolithesis treatment
  - PT/Exercise
    - Core Strengthening
  - Pharmacologic--treating symptoms
    - NSAIDS
      - Celecoxib 200mg 1 PO QD-BID (long term)
      - Meloxicam 7.5-15mg 1 PO QD (long term)
      - Ibuprofen 600mg 1 PO TID (short term)
      - Naproxen 500mg 1 PO BID (short term)
    - Neurologic agents
      - Gabapentin 300mg 1 PO QD x 3-5 days, 1 PO BID x 3-5 days, 1 PO TID
      - Pregabalin 50-100mg 1 PO QD x 3-5 days, 1 PO BID x 3-5 days, 1 PO TID
      - Duloxetine 30mg 1 PO QD x 1 week then 1 PO BID or 2 PO QD
    - Injections/Surgery
      - Lumbar Epidural Spinal Injections
      - Lumbar Fusion

# Degenerative disorders cont.

- Spondylosis
  - Osteoarthritis that can encompass the facet joints and disc space
    - Axial pain with rotation/extension/flexion
  - Causes
    - Overuse
    - Aging
    - Trauma
  - X-ray or MRI confirmation
  - Treatment
    - Pharmacological
      - Celecoxib 200mg 1 PO QD-BID (long term)
      - Meloxicam 7.5-15mg 1 PO QD (long term)
      - Ibuprofen 600mg 1 PO TID (short term)
      - Naproxen 500mg 1 PO BID (short term)
      - Diclofenac Gel 1-2 in QID
    - Surgical/Procedural
      - Facet joint injection
      - Nerve ablation
      - Laminectomy
      - Fusion
    - Exercise/PT

# MECHANICAL DISORDERS

#### **Disc Herniation**

Spondylosis -> at risk for disc herniation

Mechanical: compresses nerve roots

Inflammatory: irritates nerves

Both lead to Sciatica: unilateral sx's

Compresses nerve root below

L3-4: Diminished Quadriceps or Knee Jerk reflex

L4-5: Weakness in Dorsiflexion

L5-S1: Weakness in Plantarflexion & Diminished achilles reflex (most common radiculopathy)



# Magnetic Resonance Imaging



#### MECHANICAL DISORDERS

#### Lumbar spinal stenosis

- Causes: Spondylosis, Spondylolisthesis, Trauma, Paget Dx of Bone, Achondroplasia
- Osteophytes & thickened ligamentum flavum, facet OA, Disc bulging -> Edema & Swelling
- Bilateral sensory loss or weakness: central canal narrowing

Neurogenic Claudication: pain induced by positions that extend the spine

Relieved by positions that flex and decompress the spine



# MECHANICAL DISORDERS

- Lumbar spinal stenosis/Claudication
  - Diagnosis = MRI
  - Treatment: PT & NSAIDs
    - Corticosteroid injections
    - Surgical Laminectomy
    - Surgical Fusion

#### Scoliosis

- Characteristics
  - Uneven shoulders
    - One shoulder blade that appears more prominent than the other
  - Uneven waist
    - One hip higher than the other
  - · One side of the rib cage jutting forward
  - A prominence on one side of the back when bending forward



#### Scoliosis Cont.

#### Degenerative

- Disc degeneration
- Spondylosis
- Spondylolisthesis

#### Congenital

- Certain neuromuscular conditions: cerebral palsy or muscular dystrophy
- Neural or structural birth defects
- Previous surgery on the chest wall
- Injuries to or infections of the spine
- Spinal cord abnormalities

#### Scoliosis Cont.

- Severity
  - Maturity—Growing bone is at greatest risk
  - Greater curve = greater risk of poor outcomes
  - Sex—young females at greater risk
- Treatment
  - Braces
  - Extensive, intensive PT
  - Surgery



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#### Vertebral (compression) Factures

#### Osteoporosis

- Decreases bone density which increases risk of fractures
- Vertebral compression fractures
- Etiology:
  - relatively mild trauma (fall, car accident)
  - Stepping down hard
- Risk factors:
  - elderly
  - postmenopausal females
  - chronic steroid users
- Imaging:
  - X-ray
  - MRI
  - CT

# Compression Fractures

#### Acute

- Pain localized to midline
- Minimized neurologic symptoms

Chronic

- Vertebral Column loss
- Kyphosis, Lordosis, Scoliosis

#### **Compression Fracture Treatment**

- Pharmacological
  - Biphosphonates: Inhibit Osteoclast activity, reducing bone resorption and turnover.
    - Ibandronate (Boniva)= 2x/year
  - Parathyroid Hormone Analog: Regulates bone metabolism, intestinal calcium absorption, and renal tubular calcium and phosphate reabsorption.
    - Teriparatide (Forteo)= Daily injections.
- Procedural
  - Kyphoplasty: Image guidance to place a balloon and then inject bone cement into the balloon inside the vertebral body.
  - Vertebroplasty: Imaging guidance to inject bone cement into the vertebral body.
- Low impact exercise focusing on core strengthening.

#### ANKYLOSING SPONDYLITIS

Population: young males

Presentation: Pain in spine, SI joints

Gradual onset: morning stiffness, improves with exercise, does NOT improve with rest Extra-articular manifestation: uveitis, psoriasis, aortic root dilation (dissection)

Workup:

CBC: microcytic hypochromic anemia

ESR/CRP: mainly regulating tx response

HLA-B27: only small percentage w/this HLA develop ankylosing spondylitis

XRAY/MRI: erosions, sclerosis, narrowing of joint space, bamboo spine (syndesmophytes)

Treatment: anti-inflammatories (sulfasalazine) and TNF- $\alpha$  inhibitors (infliximab)



# \* HEMATOGENOUS ROUTE

**\* TRAUMA or SURGERY** 

**\* NEARBY SOFT TISSUE** 

INFECTION

**Major Risk Factors** 

- Current immunosuppression
- Current hemodialysis
- Current or recent injection drug use
- Current or recent invasive epidural/spinal procedure
- Current or recent endocarditis or bacteremia

#### INFECTIONS

- Vertebral Osteomyelitis
- Spinal Epidural Abscess

#### INFECTION

#### Vertebral Osteomyelitis

- Back pain increases weeks to months
- Commonly associated with discitis
- Presentation
  - Positional discomfort
  - Pain to palpation (pin-point)
  - Neurologic signs and sx's
- Biopsy
- Antibiotics 6wks: Beta-lactam & Vanco
  - Septic and/or rapidly progressing
- Vertebral: RIPE (rifampin, isoniazid, pyrazinamide, and ethambutol) therapy with surgical debridement.

- Spinal Epidural Abscess
  - (10%) Generalized becomes localized pain over time followed by:
    - Radicular pain
    - Neurologic deficits
  - Neurological deficits:
    - Antibiotics 6wks: Vanco & Ceftazidime
    - Surgical decompression & drainage
  - NO neurological deficits
    - Sample of abscess via CT guided aspiration + subsequent antibiotic therapy

#### SPINAL EPIDURAL HEMATOMA

- Etiologies: Disc herniation, trauma, recent surgery, bleeding disorder/anticoagulation therapy
- Presentation: Back pain is severe and localized
- Workup:
  - CBC: thrombocytopenia, PT, PTT
  - MRI
    - Sac of blood in epidural space = extend across multiple spinal levels
  - Surgical decompression ASAP!!!
- If underlying coagulopathy present: give fresh, frozen plasma

#### Metastatic Disease

#### Spinal metastases

- Origin: bladder, breast, kidney, lung
- Presentation:
  - constant pain worse at night
  - Focal neuro symptoms
  - Fever, night sweats, unexplained weight loss
- Imaging: XRAY/MRI/CT
- Tx: based on type of primary cancer (refer to above)
  - Surgical decompression
  - Localized spine radiation

#### CAUDA EQUINA SYNDROME

• Presentation:

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- Unilateral or bilateral, asymmetric sensory loss
- Pain or weakness in extremities
- Loss of reflexes, Saddle anesthesia
- Bowel, Bladder, or Sexual Dysfunction



# CONUS MEDULLARIS SYNDROME

#### • Difference from cauda equina:

• Lower and upper motor neuron involvement whereas Cauda Equina is usually only lower.

#### • **EMERGENT** MRI for both

- Treatment:
  - surgical decompression
  - If cancer is cause = IV corticosteroids and spinal radiation as well.
- Both rare: 1:30,000-100,000

#### The Great Mystery

#### Nonorganic signs in low back pain (originally described by Waddell)

Overreaction during physical examination

Superficial or widespread tenderness

Inconsistent supine and seated (distracted) straight leg raise test

Unexplainable neurologic deficits

Pain on simulated axial load (top of head pressure)

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Waddell Signs = 2 or more present suggests psychiatric component

#### REVIEW



#### SUMMARY



## Case Study

- 84-year-old female
  - Presentation
    - Low back pain
      - She fell on her back during exercise class and reports severe pain to the point where she called her PCP and was prescribed oxycodone for pain. She denies neurological deficits. Her pain is severe and persistent 3 days post injury. She has a friend's walker she is using at today's visit for ambulation assistance.
  - Hx
    - Basal Cell Carcinoma
    - Breast cancer
    - CAD
    - HTN
    - Hypothyroidism
    - Knee OA
    - Hypercholesterolemia
    - SLE

#### Case Study cont.

- Medications of consequence
  - Alendronate (Fosamax), Oxycodone, Sertraline (Zoloft), Trazadone, Bupropion XL (Wellbutrin).
    - Alendronate (bisphosphonate)—Inhibits osteoclast activity, reducing bone resorption and turnover. Treatment for people with osteoporosis.
    - Osteoporosis is a very common finding in people with vertebral fractures.
  - Lumbar spine exam
    - Lumbothoracic scoliosis
    - No S&S of infection, neurovascular intact
    - Pain with palpation of the lumbar spine mostly around L1-3
    - Reduction in flexion, extension, lateral rotation and bending (mostly due to pain)
    - 4-5/5 strength with strength testing of the lower extremities bilaterally (mostly due to pain)

# Case study cont.

- Radiographs
  - Age indeterminate L1 compression fx with moderate height loss
  - Mild right convexivity curvature. Likely degenerative with mild retrolisthesis of L2 on L3.
  - Severe multilevel disc disease with multilevel marked disc space narrowing and anterior osteophyte formation greatest as L2-3 and L3-4
  - Marked multilevel facet arthrosis



# Case Study cont.

- Assessment and plan
  - Review all available, applicable records and discussed all pertinent treatment options.
  - MRI based on the radiographs and patient symptoms.
  - Ibuprofen 600mg 1 PO TID
  - Try to avoid continued use of oxycodone
  - Continue with activity as tolerated
  - Follow up with spine within 1 week of MRI results
- Also consider
  - Steroid taper
  - Muscle relaxer
  - Back brace
  - Core strengthening exercises
  - NO manual therapy at this time.



#### Case study cont.

- MRI
- 1. Severe multilevel disc disease at multiple levels of malalignment. Slight anterolisthesis at L1-2 and L5-S1, trace retrolisthesis at L2-3 and L3-4. Right lumbar curvature with mild right lateral listhesis of L3 on L4.
- 2. Subacute moderate compression of L1
- At T12-L1 there is severe central stenosis and moderate mass effect on the conus due to the L1 compression fracture and degenerative change of the facets. No cord edema. There is also likely marked central stenosis at T11-12 due to a large posterior disc protrusion which is calcified on prior CT. This could be further evaluated with dedicated MRI of the thoracic spine if desired.
- 4. Multilevel disc disease with additional levels of central and foraminal stenosis, moderate to severe at L1-2 and L2-3. Diffuse high-grade foraminal stenosis in the lumbar spine.

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