OVERVIEW

- Burden of illness of pain of spinal origin
- Natural History
- Evaluation of patients with pain of spinal origin
- Management of common causes of back pain

Low Back Pain

General Population

- Non specific low back pain:
  - Lumbago, myofascial syndromes, mechanical LBP, muscle spasms, back sprain, back strain
  - 85% of pts

- Weight lifters 17,000N
- Golf swing 6100 – 7000N force across L3-L4 disc
- Rowers 6100N
- Football linemen during a block 8500N
- Rower 6100N
Sprains and Strains

- Strain – disruption of muscle fiber within muscle belly or musculotendinous junction
- Sprain – subcatastrophic stretch of one or more of the spinal ligaments

“I found no data delineating the exact tissue injury involved in low-back sprains in athletes in my review of the literature”


Specific Low Back Pain

- Systemic disease, infection, trauma, structural deformity
  - Adult Scoliosis
  - Spondylolisthesis
  - Herniated disc
  - Compression fracture
  - Tumor
  - others
- 15% of pts

NSLBP

- Lifetime prevalence: 60-85%
- 1 year prevalence: 15-45%
- Incidence
  - Adults 10 - 30%
  - Adolescents 15%
  - Children ? 0%
- Peak incidence: 35-55 yrs
- 80% recover 4-6 wks
- 90% recover 12 wks
- If no recovery by 6 months likelihood of patient returning to normal activities 40-55%
- 10% chronic pain

NSLBP

- Expense of Back Pain:
  - 1% workforce chronically disabled
  - 1% workforce temporarily disabled
  - 2nd most common reason for physician visits
  - 3rd most common reason for surgical procedure
  - 5th most common reason for hospitalization
  - Indirect costs: $25-100 billion / yr
BURDEN OF ILLNESS IN ATHLETES

- Back pain in athletes: 1 - >30%
- Adolescent athletes: 46% vs 18% controls
- Prevalence among former elite athletes 29% vs 44% controls

Risk Factors in the Athlete

- Age
- Type of sport played
- Episodes of previous back pain
  - 3x increase if prior back pain
  - 6x increase of subsequent episodes if player started with back pain

Bony Anatomy

Sports with high incidence of back pain include:
- Wrestling
- Football
- Gymnastics
- Soccer

Degenerative disc disease and spondylolysis most common cause of back pain

References:
Innervation of the Lumbar Spine:
1) Zygoapophyseal Joints: Medial Branch of Dorsal Primary Ramus
2) Structures within Spinal Canal: Sinuvertebral Nerve
3) Lateral Disc, ALL: Branches of Grey Ramii Communicantes and Ventral Primary Ramus
4) Basivertebral nerve- vertebrogenic back pain

Neurogenic Claudication
- Leg pain derived from ischemia to the nerve root
- Spinal stenosis
  - extended posture closes the foramen and cuts off the blood supply
  - Flexed posture opens the foramen

Separating NSLBP from SLBP
- Mechanism of Injury / duration and onset / pain patterns
- Red flags
- Yellow flags
- Physical exam
- Imaging
- F/U

Red Flags
- Age > 50
- Hx of cancer – LR 15
- Unexplained weight loss
- Failure to improve after 6-12 weeks of therapy
- No relief with bedrest
- Night pain
- Combination – LR 2.5
Yellow Flags

- A belief that back pain is harmful or potentially severely disabling
- Fear-avoidance behavior and reduced activity
- Catastrophising – poor coping strategies
- Tendency to low mood and withdrawal from social interaction
- Expectation of passive treatments rather than a belief that active participation will help

Characteristic Pain Patterns

<table>
<thead>
<tr>
<th>Condition</th>
<th>Age Group</th>
<th>Sitting/Standing</th>
<th>Back/Leg</th>
<th>Flexion/Extension</th>
<th>Walking Tolerance</th>
<th>Night Pain/Parasthesia</th>
<th>Peripheral / Sneeze</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervertebral Herniation</td>
<td>20-50</td>
<td>Sitting</td>
<td>Leg</td>
<td>Flex</td>
<td>No limit</td>
<td>No</td>
<td>Pain</td>
</tr>
<tr>
<td>Degenerative Pain Instability</td>
<td>20-50</td>
<td>Sitting</td>
<td>Back</td>
<td>Flex</td>
<td>No limit</td>
<td>No</td>
<td>Pain</td>
</tr>
<tr>
<td>Spondylolisthesis</td>
<td>&gt;50</td>
<td>Stand</td>
<td>Both</td>
<td>Caudal</td>
<td>Limited</td>
<td>No</td>
<td>No Pain</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>&gt;50</td>
<td>Const</td>
<td>Back</td>
<td>Flex</td>
<td>Limited</td>
<td>Yes</td>
<td>Pain</td>
</tr>
<tr>
<td>Infection</td>
<td>&gt;0</td>
<td>Const</td>
<td>Back</td>
<td>Flex</td>
<td>Limited</td>
<td>Yes</td>
<td>Pain</td>
</tr>
</tbody>
</table>

Physical Exam

- Inspection – coronal / sagittal balance / skin
- Palpation – masses / tenderness
- ROM
- Neurological Assessment
  - Motor exam – myotomes / specific muscles
  - Sensory exam – dermatomes / peripheral nerves
  - Reflexes – increased / decreased
  - Nerve Tension Signs – Lesaque / Spurling
- Coordination – rapid flex/ext of hands
- Gait

Inspection
Inspection

Myelopathy vs Radiculopathy

Nerve Tension Tests

OTHER TESTS

- FABER TEST – tests the SI joint
- HIP EXAM
  - TRENDELENBURG TEST
- SHOULDER EXAM – test for rotator cuff deficiency / tears
- SPURLING TEST
- ROMBERG TEST – test for latent hemiparesis
- DIADOCHOKINESIS TEST - coordination
### Imaging Modalities

- **Xray** – alignment / stability / bone
- **CT**
  - Fine cut reconstructions
  - Myelogram
  - Discogram
- **MRI**
  - Gadolinium
- **Nuclear Medicine**
  - Bone scan / gallium scan / SPECT / PET

### Alignment

- **CT (fine cut reconstruction)**
  - Difficult to assess anatomy
  - Bone quality and size of lesions
  - Surgical planning / counseling

### Winking Owl Sign
CT Myelography

- Improves accuracy of stenosis and herniated disc lesions
  - as sensitive and specific as MRI
  - Axial and reconstructed images improve visualization of lateral recess and foramen
- Best for complex deformity
- Used when instrumentation in place

MRI

- New MRI sequences on 3T MRI
  - T1rho – examines the proteoglycan concentration within the disc
- In association with spectroscopy – localize lactate / metabolic changes within disc
- Improved accuracy of prediction of locus of back pain

DISC HERNIATION
MRI + GAD: Discitis

Type I progresses – inflammatory; associated with back pain
Correlation with positive discogram

DISCOGRAM
- ANESTHETIC DISCOGRAM
- POSITIVE CONCORDANCE
- PROVOCATIVE

Acquired Pain of Spinal Origin
- Neck Pain
- Degenerative disc disease / stenosis
- Herniated disc
- Spondylolysis / Spondylolisthesis
- Adult Scoliosis
Degenerative Disc Disease

- Axial back pain / pain with forward flexion / sitting
- Difficult to determine painful level if multiple levels involved

MANAGEMENT

- XRAY – r/o instability / alignment
- MRI
  - r/o infection / tumor
  - Identify other degenerative discs
  - Modic changes – correlation to discogram
  - HIZ
- Anesthetic Discogram
  - Structural changes
  - Concordance following injection of saline
  - Improvement of pain following injection of local anesthetia

Disc Herniation

- 11% of adolescent athletes experience symptomatic disc herniations
- Common at L4-5 and L5-S1
- Far lateral disc herniations
DISC HERNIATION

- Axial loading plus forward flexion
- Radicular leg pain – level identified through history and physical exam
  - Pain is in a dermatomal region
  - Dropped reflex
  - With or without weakness
- With or without back pain

MANAGEMENT

- IMAGING
  - XRAY
  - MRI
    - RECURRENT DISC GET MRI WITH GAD TO DIFFERENTIATE BETWEEN DISC AND SCAR TISSUE
  - NON-OPERATIVE MANAGEMENT
    - PT
    - Trans – foraminal epidural steroid injections
  - OPERATIVE MANAGEMENT – for leg pain
    - Failure of conservative management
    - Progressive pain
    - Progressive neurological deficit

NEUROGENIC CLAUDICATION

- Back pain with symptoms of neurogenic claudication
  - Walking intolerance / standing intolerance
  - Relief with sitting or forward flexion
  - Walks better up hill or with shopping cart or bicycle riding
  - Flexion opens the foramen
MANAGEMENT

- Imaging: MRI
- Non-operative management
  - Core strengthening PT / flexion exercises
  - Trans-foraminal epidural steroid injections based on MRI
- MIS Techniques for decompression
- Decompression and fusion if back pain is significant or instability is present (degenerative spondylolisthesis)

ADULT SCOLIOSIS

- INCIDENCE – UPTO 65%
- EVALUATION
  - PAIN
  - PROGRESSION OF CURVE
  - PROGRESSIVE NEUROLOGIC DEFICIT
  - PULMONARY COMPROMISE
  - CO-MORBIDITIES

MANAGEMENT

- IMAGING:
  - standing AP/LAT xray
  - CT myeolgram or MRI
- Non-operative Therapy
  - PT: stretching / core strengthening / cardiac conditioning
- Operative Options:
  - MIS
  - MAS
Spondylolysis

- Most common etiology for low back pain in athlete (47% of pain in adolescent athlete attributable to spondylolisthesis)
- Very common in gymnasts, weight lifters, football
- Defect in the pars interarticularis

Bony Anatomy
Classification

- Two main categories
  - Primary developmental deficiency resulting in dysplasia
    - Growth alteration in posterior and anterior columns
    - Posterior elements: lamina, pars interarticularis, facets
    - Anterior column: disc, vertebral body of L5 and sacral shelf
    - High dysplastic: adolescent - domed S1 and wedged L5, lumbosacral kyphosis; may or may have pars elongation – at increased risk for cauda equina syndrome
    - Low dysplastic: young adult – translation w/o angulation; low grade may develop into high grade through adaptive changes
  - Acquired: traumatic, iatrogenic, pathological, or degenerative

Pathogenesis – high dysplastic

  - Weakness in the vertebral growth plate as an important mechanism in spondylolisthesis
  - Slippage occurred between the osseous and cartilaginous endplates during the apophyseal stage of lumbar skeletal growth
  - Sacral equivalence of Blount’s disease

Pathogenesis – low dysplastic

  - From biomechanic studies alternate loading is the most likely etiology of the development of spondylolisthesis
  - People involved in repetitive alternate loading activities such as gymnastics, weight lifting, and football have higher incidences of spondylolysis.
- High incidence in athletes are found in:
  - Throwing sports 27%
  - Diving 43%
  - Dance 43%
  - Wrestling 30%
  - Gymnastics 17%
  - Rowing 17%
Incidence

- 500 unselected first-grade children from 1955 through 1957
- The incidence of spondylolysis at the age of six years was 4.4 per cent and increased to 6 per cent in adulthood
- The degree of spondylolisthesis was as much as 28 per cent
- The spondylolytic defect is the result of a defect in the cartilaginous anlage of a vertebra
- Hereditary pre-disposition to the defect and a strong association with spina bifida occulta

Natural History

- Subjects with unilateral defects never experienced slippage over the course of the study
- Progression of spondylolisthesis slowed with each decade
- There was no association of slip progression and low back pain
- There was no statistically significant difference between the study population SF-36 scores and those of the general population the same age

Risk Factors for Slipping

- Female gender
- Pre-pubescence
- Increased slip angle (>55)
- Sagital rotation
- Trapezoidal L5
- Vertical sacrum
- Pelvic Incidence/Sacral Slope:
  - High SS >40 with high PI increases shear vs. low PI and low SS predisposes to increased flex/ext stress and pars fracture: "nutcracker"

Clinic Exam Findings

- Hyperlordosis
- Retroverted pelvis
  - (heart shaped buttock)
- Hamstring tightness
- Nerve tension signs
- Motor and sensory deficits
- Step-off deformity
- Short stepped gait
Radiographic Evaluation

Spondylolisthesis / Scoliosis

MRI

Management

- Acute vs. chronic
- Dependent on back pain
- Close follow up
- Temporary withdrawal from sports
- TLSO
- Physical therapy
- Return to sports

- Observe – stress reaction identified by increased uptake on SPECT, limit sports activities
- Brace: TLSO
  - Spondylolysis: pars fracture undisplaced
  - Spondylolisthesis: low dysplastic
- Surgical Intervention
  - Repair of defect: Buck’s screw
  - Arthrodesis: levels?
  - Decompression
  - Reduction vs. in situ fusion
CERVICAL NECK PAIN

- DEGENERATIVE DISC
- SPODYLOLISTHESIS
- KYPHOSIS
- NEUROGENIC NECK PAIN

CERVICAL PAIN

- NECK PAIN MAY BE CAUSED FROM NEUROGENIC PAIN 2ND TO FORAMINAL STENOSIS
  - C3/4, C4/5 masquerades as neck and shoulder pain
- MRI
  - Depicts foraminal stenosis
- MANAGEMENT
  - Transforaminal epidural steroid injection
  - MIS decompression

CERVICAL FORAMINAL STENOSIS
Summary

- Pain of spinal origin is common
  - Natural Hx
  - Imaging
  - Diagnosis
  - Non-op management

- Back pain and leg pain improve with non-operative management

- Operative management:
  - Progressive neural deficit
  - Progressive deformity
  - Pain unresponsive to non-operative management

Thank you