The Young Athlete With Back Pain

Natalie Voskanian, MD
UCSD Sports Medicine
Associate Clinical Professor
Dept of Orthopaedic Surgery
Objectives

• Learn the common causes of back pain in the young athlete
• Understand how to evaluate and treat back pain the young athlete
• Understand the biomechanics of how various back problems develop and how to reduce risk of progression
Background

- Ddx of back pain in skeletally immature athletes differs from adults
- LBP occurs in 10-15% of young athletes, in some sports
- Period of rapid growth (11-14yo), growth cartilage and secondary ossification centers are vulnerable to injury
- Posterior column ossifies from anterior to posterior
- Pars interarticularis does not reach bony maturity until approx 25yo
- Spondylolysis is much more common in adolescents than adults
- Young adolescents w/ back pain: 47% spondylolysis
Ddx of back pain in the young athlete

- Spondylolysis
- Spondylolisthesis
- Posterior element overuse syndrome
- SI joint dysfunction
- Adolescent Idiopathic Scoliosis
- Atypical (lumbar) Scheurman’s
- Vertebral body apophyseal avulsion fracture
- Degenerative disc disease
- Disc herniation
Spondylolysis

- Pars interarticularis = small isthmus of bone b/t superior and inferior articular facets of vertebra
- Spondylolysis is a defect in the pars interarticularis of a vertebra
Spondylolysis background

- Most commonly occurs in the lumbar spine:
  - L5 (85-95%)
  - L4 (5-15%)
- Mechanism of injury = repetitive hyperextension of the lumbar spine, or hyperextension w/ rotation
- Pain focal lumbar spine w/ hyperextension
- Get photo of hyperextending athletes
Spondy Sports

- Football
- Gymnastics (17%)
- Swimmers
- Divers (43%)
- Rowers (17%)
- Weight-lifters (23%)
- Track and field
- Soccer
- Volleyball
- Throwing athletes (27%)
- Figure skating
- Dancers
Incidence

- 5-6% of adults
- 47% of adolescents with low back pain
- Male: Female = 2-3:1
- Can be an incidental finding (asymptomatic), but in young athletes much more likely to be symptomatic
Classifications: 3 general categories

- Developmental: genetic predisposition to pars interarticularis failure (ex: posterior bony arch development is incomplete)

- Acute trauma: severe collision, fall

- Overuse, stress injury (aka repetitive trauma)
  - stress reaction, stress fracture, fracture, chronic nonunion
Spondylolisthesis

• 25-48% of athletes w/ symptomatic spondy may get spondylolisthesis -> displacement anterior vertebral body translation over the other
• D/t either pars elongation or bilateral pars defects
• Affects females more than males

• Grading system according to degree of slip:
  - Grade 1 = 0-25%: <5% of progression
  - Grade 2 = 25-50%
  - Grade 3 = 50-75%: increased risk of progression
  - Grade 4 = >75%
  -If the slip progresses beyond 50% or if neuro sx or persits pain, then surgical stabilization
Risk Factors for Spondylolysis

- Repetitive hyperextension activities
- Elongated pars
- Spina bifida occulta (lack of posterior arch development)
- Scoliosis
- Scheuermann’s disease
- Cerebral palsy
- Excessive lumbar lordosis
- Abdominal muscle weakness
- Tight hip flexors, hamstrings, thoracolumbar fascia
- Genu recurvatum, increased femoral anteversion, increased thoracic kyphosis
Excessive lumbar lordosis increases stress on the lumbar spine.
Symptoms of Spondy

• Focal low back pain that worsens with extension activities, improves w/ rest
• Pain is typically focal and axial, can be unilateral or bilateral
• +/- referred pain to buttock or thigh
• Dull ache, or sharp pain
Common PEX Findings in Spondy

- Focally TTP at affected level (87-100% spec, 60-88% sens)
- Palpating for step deformity (moderate-high sens & high spec for spondylolisthesis)
- Limited lumbar ROM, espec in extension +/- rotation
- Muscle spasm unilateral or bilateral
- Hamstring tightness, hip flexor tightness
- Hyperlordosis seen in spondylolisthesis
- +Stork sign -> one legged extension; often done but 50-73% sens, 0-87% spec
- SLR usually negative (could sometimes be + d/t hamstring tightness or nerve root tension)
Diagnostic testing: Xrays

- Xrays Lumbar spine: AP, lateral, oblique views
  - *lateral* views: flexion/extension to look for spondylolysis
  - Look for “scotty dog’s collar” on *oblique* view
- Low sensitivity, particularly <3wks
- Identifies pars defects in only 1/3 of cases, misses stress reactions
Diagnostic testing: SPECT scan

- SPECT scan (bone scan w/ CT localization) = single proton emission computerized tomography
- Most sensitive test for identifying spondy
- +Radiation, but less than CT scan
- Helps identify hot vs cold lesion -> new/acute (higher healing potential) vs old/chronic (less likely to heal)
- Cold lesion may be old healed (fibrous) or nonunion
- Low specificity (any dx with high bone turnover)
Diagnostic testing: CT scan

- CT scan: evaluates bones in more detail
- Helpful in evaluating the degree of fracture and stage of healing
- Sclerotic in later healing stages, clean/sharp edges are more early stages
- Negatives:
  - significant radiation
  - no soft tissue visualization
  - can miss stress reaction (early stages)
- Consider CT when not improving
Diagnostic testing: MRI Imaging in Spondy

- Evaluates soft tissues real well (incl discs, nerves, connective tissue)
- Can identify stress reactions (early stages), but less detail of bony anatomy
- Most expensive, but radiation-free
- Not as sensitive as SPECT and CT scan but can catch other diagnoses, evaluate nerves & discs
Treatment

• Rest, brace, PT, gradual transition to sport without or without brace
  -> Rest is the most important, key to successful tx
• Need to be pain free and have muscle imbalances addressed before resuming sport
• Best outcome if rest at least 3 mos
• Rest 3-6 mos, brace 3-6mos
• Treatment should be individualized to the athlete
Brace

- For lumbosacral immobilization to allow bone healing
- Typically worn 3-6 mos, depending on degree of bone healing seen
- Boston brace often used
- Evidence is equivocal
Physical therapy

- Start when athlete is pain-free
- Spondy athletes often have the following that need to be addressed:
  - Hip flexor tightness
  - Hamstring tightness
  - Abdominal muscle weakness
  - Glut weakness
- Spine neutral exercises, and avoiding end ranges of motion (particularly avoid extension and rotation)
- Strengthen core: internal/external obliques & transverse abdominals (to stabilize spine) > rectus abdominis
- Strengthen spine extensors when pain-free
- Sport specific conditioning to transition to RTP
Followup Imaging

• Follow spondylolisthesis athletes q4-6mos w/ Xrays (wb lateral XR) until skeletal maturity to eval for progression

• Can take 12mos of conservative tx to return to play

• 70-90% will achieve good to excellent results without surgical intervention
Consideration for Surgery

- If slip >50%
- If continue to have pain >6mos despite rest, brace, etc
- Persistent neuro symptoms
- Can include: screw fixation, bone grafting, fusion
Other Causes of Back Pain in the Young Athlete
Posterior Element Overuse Syndrome

- From repetitive extension and rotation of spine
- Involves muscle-tendon units, ligaments, facet joints, and joint capsules
- Aka Hyperlordotic syndrome
- Mimics spondylolysis
- Negative imaging

- Tx: PT, nsaids, avoid extension of spine, pain-free activity, consider bracing
SI Joint Pain

- Common source of LBP in athletes of all ages
- Pain is off the midline
- +FABER
- Normal imaging in SI joint dysfunction
- Could be stress reaction or stress fracture of sacrum in avid athlete
- Sacroiliitis lights up on MRI, labs +
  - Inflammatory (Reiters, seronegative spondyloarthropathy like Crohn’s or psoriasis)
  - Infection
- Tx for SI joint dysfunction: PT, symptom management
Vertebral body apophyseal ring fractures

• Vertebral bodies have epiphyseal growth plates at either end, with overlying cartilaginous end plates and ring apophyses (secondary ossification centers) which are attached to the outer anulus fibrosus.
• Injury to vertebral apophyseal ring can result from excessive flexion-extension... and lead to avulsion fracture.
• Lumbar spine pain with flexion: L4/5, L5/S1 most common.
Vertebral body apophyseal ring fractures

- 15-20% seen on lateral XR, often need CT scan

- In some cases the intervertebral disc may herniate through the apophysis with repetitive flexion

- Rest, heat, NSAIDS

- Need surgery if + neuro symptoms from displaced fragment
Disc disease and herniation

- Uncommon in young athletes, more common cause of back pain in adults
- 7-11% of young athletes w/ back pain (vs 48% in adults)
- Flexion related pain
- Start with XR
- MRI shows degree of herniation, & any nerve root impingement
- 90% improve w/ conservative tx
Adolescent Idiopathic Scoliosis

- Tx based on Cobb angle
- 0-25°: serial observation
- 25-30°: if 5-10° progression then brace
- 30-40°: brace
- >40°: surgery
- Use Risser for skeletal age
- Less chance of progression when skeletally mature

### Risk of Progression of AIS

<table>
<thead>
<tr>
<th>Degree of curve (Cobb angle)</th>
<th>Age 10 – 12</th>
<th>Age 13– 15</th>
<th>Age over 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20°</td>
<td>25%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>20 – 30°</td>
<td>60%</td>
<td>40%</td>
<td>10%</td>
</tr>
<tr>
<td>30 – 60°</td>
<td>90%</td>
<td>70%</td>
<td>30%</td>
</tr>
<tr>
<td>&gt;60°</td>
<td>100%</td>
<td>90%</td>
<td>70%</td>
</tr>
</tbody>
</table>
Scheuermann’s disease...

- Common adolescent condition of thoracic spine, painful dorsal kyphosis
- Dx’d by loss of anterior vertebral body height, wedging >3 vertebral bodies
- Anterior longitudinal ligament connecting the vertebral bodies typically thickens, adding to forward pull and more wedging
- Schmorl’s nodes and irregular vertebral end plates also found
- Tx = PT, possible bracing
Atypical Scheuermann’s dz (aka Lumbar)

- A type of Scheuermann’s dz affecting the proximal lumbar spine
- Results d/t repetitive flexion of thoracolumbar spine
- Ex: gymnastics, rowing, diving
- Flat back syndrome (decr’d thoracic kyphosis and lumbar lordosis and tight thoracolumbar fascia)
- TX: PT, possible bracing in 15deg lordosis
A simplified diagram
Examining the Athlete With Back Pain
Back PEX should include:

- Inspection: look for scoliosis (bend forward/down), café au lait spots, hairy patches/skin dimples
- Evaluate Back ROM
- Lower extremity strength
- Lower extremity flexibility
- Neuro exam: sensation, reflexes
- Focal tenderness of lumbar spine, SI joints
- Palpable step-offs
- Gait and stance
- Reflexes, Sensation
Back PEX continued

- Stork test (single leg hyperextension): + if elicits unilateral pain
- Straight leg raise (SLR)
- FABER
- Gaenslens
- Trendelenburg
- Heel walk, toe walk
- Hip exam: axial load, FADIR, passive IR/ER
- Abdominal exam
- Using ROM to elicit pain: if flexion reproduces pain then suggest anterior element or disc herniation
Red flag symptoms

• Consider infection, inflammatory, or malignancy
  - Fever, malaise, weight loss
  - Night pain
• Significant focal bony tenderness
• Neurologic abnormalities
• Family history
• Any recent illness
• Discitis, osteomyelitis
• Osteoid osteoma, osteoblastoma, aneurysmal bone cyst, chondroblastoma, osteosarcoma
• Need advanced imaging, consider labwork
Conclusion

• Back pain in the young athlete is not normal
• Needs further investigation
• Start with XR, consider appropriate advanced imaging depending on clinical suspicion and differential diagnosis
• Tx entails rest until pain-free
• PT is done to treat muscle imbalances and restore normal function, ROM, strength
References

Acknowledgements

Thank you to my colleague, Dr. Ken Vitale, for his assistance & contribution to this talk