The Young Athlete With Back Pain

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Objectives

• Identify potential different causes of low back pain in the young athlete
• Make the diagnosis of spondylolysis and initiate treatment
• Know when to refer a patient with spondylolysis or spondylolisthesis for surgery
Back Pain in Children

- No cause is identifiable in 90% of adult back pain
- Diagnosis of pain generator is more common in children’s back pain
# Causes of Back Pain


<table>
<thead>
<tr>
<th>Lesion</th>
<th>Youth</th>
<th>Adult</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discogenic</td>
<td>11</td>
<td>48</td>
<td>0.05</td>
</tr>
<tr>
<td>Spondylolytic lesion</td>
<td>47</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>Lumbosacral strain</td>
<td>6</td>
<td>27</td>
<td>0.05</td>
</tr>
<tr>
<td>Hyperlordotic mechanical back pain</td>
<td>26</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>0</td>
<td>4</td>
<td></td>
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</table>
Differential Diagnosis

• Spondylolysis / Spondylolisthesis (33%)
• Scheuermann’s (33%)
  – Kyphosis
  – Atypical Scheuermann’s
• Tumor / Infection (18%)
• Idiopathic (15%)

(Statistics from Hensinger RN, Instr Course Lect, 32: 132-143, 1983)
Unique Characteristics of the Pediatric Cervical Spine

Under 8:
1. Increased laxity
2. Incomplete ossification
3. Horizontal facet orientation

SCIWORA
• Under the age of 11, acute injuries will affect the occiput to C3
Adolescent Idiopathic Scoliosis

Often detected on the Adams forward bending test
Best in girls 11-13 and boys 13-14
Adolescent Idiopathic Scoliosis

Treatment guidelines based on Cobb Angle

- 0-25° = Serial observation
- 25°-30° = if 5-10° progression then brace
- 30°-40° = Brace
- >40° = Surgery
Adolescent Idiopathic Scoliosis Progression Risk

<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>
Spondylolysis

- Stress fracture at the pars interarticularis
- 90% occur at the L5-S1 region
Types of Spondylolysis

Wiltse Classification

1. Dysplastic - True developmental deficiency of lumbar facet or posterior element architecture, permitting facilitated displacement
2. Isthmic (pars defect, acquired) MOST COMMON
3. Traumatic
4. Degenerative
5. Pathologic
Mechanism of Spondylolysis

- Repetitive stress injury to bone
- Stress over pars with extension
- Pars represents a weaker area of bone due to growth
“Stress” Fracture

- Microtrauma from repetitive hyperextension
- Pars stress reaction → Lytic lesion of the pars “Spondy” → Spondylolisthesis
Risk Factors

- Genetic
- Males > Females
- Increased lumbar lordosis
- Disc degeneration
- Lumbar Spina Bifida occulta
- Transitional Vertebra
Prevalence of Spondylolysis in Athletes

*Soler and Calderon, AJSM, 2000.*

- 3152 elite Spanish athletes, all got PA and lateral spine films (+/- Bone Scan, MRI)
- 253 spondylolytic lesions found, 8% prevalence
- 30% listhesis, significantly higher in women
- Pain not a good criterion for screening
High Risk Sports

- Gymnastics (artistic 11-33% > rhythmic 10%)
- Diving
- Figure skating
- Dancers (15 – 20%)
More High Risk Sports

- Football (linemen - 15 - 24%)
- Wrestling (12 - 33%)
- Judo (12%)
- Rowing (17%)
- Throwing (baseball pitchers - 27%)
- Volleyball
- Speed skaters
- Track (pole-vault, hurdlers, javelin)
Spondylololisthesis

- Progression of bilateral spondylolysis
- Anterior displacement of the superior vertebra on the vertebra below
- Graded I-IV by percent slip
Spondylolisthesis in Athletes


- N=86 competitive athletes with spondy or listhesis (24 F, 62 M)
- Prospective observational study, Average f/u 4.8 yrs
- Out of 86, 78 had L5 lesions
- 69 were bilateral spondylolysis and unilateral in 9
- 64 initially had spondylolisthesis with 10.1% slippage on average
- 33 had slip increase > 5%; average increase was 10.5 ± 4.7%
- 36 No progression, 7 decreased, 10 no f/u
Long term effects?

• Natural history uncertain
• Fibrous union
• 2/3 of patients with symptomatic spondylolisthesis had associated pathologies (Elster, 1985)
• Pseudohernation
• Disk herniation
• Nerve root canal stenosis
• Central Spinal stenosis
History

- Repetitive hyperextension
- Low back pain worse with extension
- Pain with running or jumping
- May radiate to buttock or thigh
- 40% of athletes remember an injury
Physical Exam - Posture

- Hyperlordotic posture with anterior tilt of the pelvis
- Tight thoracolumbar fascia, hip flexors and hamstrings
- Genu Recurvatum
Physical Examination

- Tenderness over vertebrae
- May have palpable step
- Pain on provocative hyperextension/rotation
- One-legged hyperextension test (Stork Test)
  - Not sensitive or specific vs imaging
X-rays

- Examine pedicles
- Scoliosis
- Spina Bifida occulta
- Transitional vertebra
- Risser Sign to assess maturity

AP Lumbar Spine
X-ray Lateral

- Assess for spondylolisthesis
- Assess lumbosacral slip angle
Lumbosacral Slip Angle

- Angle between L5 superior endplate and the posterior wall of the sacrum
- Normal 90-110°; If less than 90° → vertical sacrum → likely to progress
- High correlation between degree of displacement and slip angle
Oblique X-ray

- “Scotty Dog of LaChapelle”, visible in 1/3 of known spondylolysis
X-rays are Unreliable

- X-rays have low sensitivity for detecting spondylolysis
- False negative rate 59% compared with SPECT
- If strongly positive history and physical exam need another imaging modality
Bone Scan with SPECT

(Single Photon Emission Computed Tomography)

- Almost doubles the sensitivity of detecting lesions over plain bone scan
- 39/71 had positive SPECT but negative Bone Scan
- Bone Scan false negative rate 20%
- May remain positive for 6 to 9 months
Bone Scan with SPECT images
Bone Scan with SPECT

- Intensity of SPECT scan increased with early lesions; predictive of symptom resolution
- Non-specific
- Helps identify level of lesion
CT Scan

- Use thin cut CT for pars if level of lesion is known
- Can demonstrate the fracture
- Useful for prognosis
Staging Lesions by CT

- Early – focal bony absorption or a hairline defect
- Progressive – wide defect with small fragments
- Terminal – sclerotic change
Healing Potential

Morita et al. JBJS, 1995; 77B:620-625.
• 185 patients < 19 years, 346 pars defects
Healing rates
• 73% of “Early” lesions
• 38.5% of “Progressive” lesions
• 0% of “Terminal” lesions

• 42 patients, 32 athletes
• Healing rates 81% with unilateral Spondy (34/42)
MRI

- Not generally a 1st line imaging modality
- Useful for ruling out other pathology
- Can identify early lesions with “edema”; no edema if chronic lesions
- MRI has difficulty identifying incomplete fractures
MRI Edema

- High signal changes at the pedicle were associated with healing (15 of 19 defects - 79%)
- Only 50% of progressive lesions healed
- Zero Terminal lesions healed
Treatment of Spondylolysis

- Activity modification
- Physical therapy
- Bracing? Compliance?
- Bone stimulator?
- Consider vitamin D level in chronic pain, multiple stress fracture patients
Activity Modification

- Discontinue athletic activities, variable time, little consensus, begin with 4-6 weeks
- Watch out for heavy backpacks!
Physical Therapy


- N=44
- Patients randomized to specific exercise program or control group
- Focus on lumbar multifidus, transversus abdominis and internal obliques
- Stretch the hamstrings
- 10 week program showed positive effects on pain and function at over 30 months F/U
Physical Therapy

Phase 1 – Pain control
- Modalities
- Postural exercises (anterolpelvic tilts)

Phase 2 – Mobilization
- Restore joint restrictions at thoracolumbar junction, SI joints and hips

Phase 3 – Sport specific
- Core stabilization program
- No manipulation

- Incorporate stabilization training into athletic routines
- Limit excess practice of injury provoking routines
Theory of Bracing

- Rigid braces restrict gross motions of the trunk (twice as well as lumbar corsets)
- Radiographic studies show that rigid bracing decreases motion at L1 to L4, but increases motion at L5-S1
- Decreased gross motions reduces amount of stress and shear at the pars
Lumbar Corset and Healing

Morita et al. JBJS, 1995; 77B:620-625.

- 185 patients < 19 years, 346 pars defects
- Patients treated with lumbar corset for 3 to 6 months, physical therapy, d/c athletics

Healing rates

- 73% of “Early” lesions
- 38.5% of “Progressive” lesions
- 0% of “Terminal” lesions
Lumbar Corset with Rigid Insert
Lumbar Corset
Rigid Bracing


• N=67 with spondylolysis (44) or Gr. 1 spondylolisthesis (23)
• Treated with Boston brace at 15 degrees of lumbar flexion
• 78% had excellent/good results with pain free return to full activities, 9% (6) required in-situ fusion
• 12 lesions showed radiographic healing
Bracing and Symptoms

*Blanda et al, J Spinal Disorders 1993.*

- N= 82 (62 with spondylolysis and 20 with spondylolisthesis gr 1 to 3)
- Retrospective study
- Patients treated with bracing, activity modification and physical therapy
- 84% of patients with spondylolysis had excellent results
Electrical Stimulation

- Limited evidence
- 2 case reports of 3 patients with documented healing of previously unhealed fractures
- Has been used in Spinal fusion surgery to promote healing as well as non-union tibia fractures
- Use daily ~ 30 minutes
- Rarely covered by insurance
Treatment Algorithm

1. History & Physical Exam
2. X-ray (AP, Lateral, Obliques)
3. MRI if neurologic signs
4. Consider Bone Scan with SPECT if negative x rays
5. Consider Thin Cut CT at affected levels
6. Treat with activity modification, bracing and physical therapy until asymptomatic; consider following healing with CT scan at 4 +/- 6 months
7. If no improvement even after rigid bracing or unstable lesion, e-stimulation or surgery
Treatment of Symptomatic Spondylolisthesis

Conservative

- Antilordotic brace 100% effective for pain with grades 1 and 2
- Conservative treatment effective in 67% with < 50% slip, 8% with > 50% slip
Surgical Fixation for Unilateral Spondylolysis

• If pain after 6 months of conservative treatment and no healing on CT scan
• Screw or wire fixation

Return to Play

- Controversial
- Athlete can return to sports when painful hyperextension has resolved
- May play in any form of brace as allowed even as early as 4-6 weeks
- More conservative with skeletally immature athletes
- 2 studies: 63% (20/32) and 87.5% (35/40) returned to sports after non-operative care within 6 months
- 82% post surgery returned to sports (average 7 months)
  Debnath et al., JBJS-Br, 2003.
Summary

- Suspect Spondylolytic lesions in young patients with hyperextension back pain
- Spondylolytic lesions can heal
- Order Bone Scan with SPECT for spondylolysis to detect early lesions if x-ray is negative
- Begin conservative care immediately
References