Non-operative Management of the Adolescent Athlete with Spine Disorders
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Objectives

- Identify differences in clinical presentation of adolescent vs. adult low back pain
- Describe clinical presentation of most common causes of adolescent low back pain
- Discuss conservative treatment approaches for management of adolescent low back pain, particularly spondylolysis

Adolescent vs. Adult

- Pars interarticularis injuries more common
- Disc related problems less common
  - Lower incidence of neurological deficit
  - Most remain contained by the annulus
  - May present with minimal back pain and no sciatica
- Consideration for more sinister causes

(Parcel and Micheli, 2009)

Disclosures

I have no relevant financial disclosures to report.

Back pain

ADULT VS. ADOLESCENT

Adolescent vs. Adult

- Retrospective randomized case comparison study
- Two cohort groups
- Results:

<table>
<thead>
<tr>
<th></th>
<th>Young Athlete</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spondylolysis</td>
<td>47</td>
<td>5</td>
</tr>
<tr>
<td>Discogenic</td>
<td>11</td>
<td>48</td>
</tr>
<tr>
<td>Muscle-tendon strain</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>Stenosis/OA</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

- Conclusion: Significant difference in major causes of LBP in young athletes vs. general adult population
Adolescent vs. Adult

"While the effectiveness of many conservative treatments has been evaluated for adult populations, the spine of a child and adolescent is physiologically different to the adult spine (i.e. ligamentous laxity, bony composition, muscle mass) and, therefore, potentially responds differently to various interventions, movements and loading.”

(Michaleff, Maher, Evans, Broderick, & Henschke, 2014)

LBP in Adolescence

• Prevalence
  – 7-58% in young people (Altaf, et al. 20014)
  – 10% to 15% of young athletes (Purcell and Micheli, 2009)
  – 50% of children by age 15 (Gued, 2011)
• Varies with sport (Purcell and Micheli, 2009)
  – College football players 27%
  – Artistic gymnastics 50%

Risk factors

• Periods of rapid growth
• Training volume and intensity
• Poor technique
• Factors that increase lumbar lordosis

(Purcell and Micheli, 2009)

Etiology

• Spondylolysis
• Spondylolisthesis
• Scheuermann kyphosis
• Lumbar intervertebral disk herniation
• Apophyseal ring fracture
• Scoliosis
• Neoplasms

(Altaf, et al. 2014)

Spondylolysis

• Defect of pars interarticularis
• Most common at L4 and L5
• Overuse injury
  – Repetitive hyperextension
  – Gymnastics, volleyball, football, diving, pole vaulting, swimming
• Worse with activity and improved with rest

http://www.nursing.org/health/library/Article/8931
**Spondylolysis**

- Physical findings
  - Positive Stork test
  - Postural changes
  - Decreased hamstring flexibility with limited forward bend
  - Tender paraspinals/spasm

**Spondylolisthesis**

- Progression of spondylolysis
  - Bilateral pars defect
  - Forward slip of upper vertebrae

**Spondylolisthesis**

- Physical findings
  - Similar to spondylolysis
  - Dramatic limit in forward bend
  - Palpable step off
  - Neurological findings

**Scheuermann Kyphosis**

- Rounding of the thoracic spine
- Anterior wedging of 3 consecutive vertebrae
- Schmorl nodes
- Compensatory lumbar hyperlordosis

**Scheuermann Kyphosis**

- Physical findings
  - Poor posture
  - Pain in mid-thoracic/periscapular region
  - Worse with prolonged sitting and activity

**Apophyseal Ring Fracture**

- Vertebral ring apophysis appears at age and fuses at age 17
- More common with
  - Disk prolapse
  - Weight lifting
- Imaging helpful in diagnosis
- Surgical intervention
LUMBAR SPONDYLOYSIS AND SPONDYLOLYSIS

Treatment Concepts: Stability

- Roof
  - Diaphragm
- Floor
  - Pelvic floor muscles
- Anterior wall
  - Abdominal muscles
- Posterior wall
  - Spine extensor muscles
  - Gluteals

Treatment Concepts: Stability

- Transverse abdominus
  - Increase intra-abdominal pressure
  - Tensions thoracolumbar fascia
  - Critical in stabilization
- Rectus abdominals, internal, and external obliques
  - Activation in direction specific patterns
  - Posture support for limb movements

Treatment Concepts: Co-contraction

- Degree of activation
  - Excessive coactivation can increase spinal compression and decrease mobility
  - Small activation of multifidi and abdominals is needed (5% MVC for ADLs and 10% MVC for rigorous activity)
- Goal
  - Improve transfer of force and energy to extremities during movement
  - Transfer injurious force away from passive spinal structures.

Treatment Concepts: Exercise Prescription

- Exercise selection, sequence, and volume progression dependent on:
  - Previous injury history
  - General fitness level
  - Training goals
  - Future expectations
Clinical Examination (3)

- Psychological factors
- Type of sport
- Amount of training per year (downtime)
- Quality of the pain
- Red flags

Bracing

- Goal is not to heal the defect but to improve symptoms and function

- Potential Benefits
  - Barrier to provocative movements
  - Compliance with rest and activity restrictions

Phase I

- Pain relief
- Relative rest
- Education
- Abdominal bracing
- Avoid end range extension

Phase I

- Foundational coactivation
  - Kinesthetic awareness
  - Endurance during slower velocity movements
  - Clinician-provided cues

Phase I

- Abdominal Bracing
  - Contract TrA, multifidus and draw up pelvic floor
  - Various positions
  - Feedback
Phase I

Phase II
- Frontal/transverse plane and UE/LE integration
  - Multi-planar endurance
  - Strength-power
  - Coordination challenges

Phase II - Bridging
- Quadruped
  - Arm/leg extension
  - Perturbations

Phase II - Trunk Extension

Phase III
- Sport specific movement skill simulations
- Deconstruct composite movement patterns of sport
- Creativity is key
Phase III – Jump/Land
Phase III – Diver/Gymnast
Phase III – Swimmer
Phase III

Phase IV

- Return to Play
  - Pain free
    • Rest
    • Full ROM
    • Performance of sport related skills
  - Normal strength
  - Appropriate aerobic fitness
  - Adequate spinal awareness and mechanics

Effectiveness of Conservative Management

- Retrospective case series, 436 adolescents
- Treatment
  - Custom TLSO and activity cessation (3 months) followed by formal PT
- Results:
  - 95% (415) achieved excellent results at an average of 27.71 months
- Conclusion
  - Symptomatic spondylolysis may be managed effectively in adolescence with conservative care
Effectiveness of Conservative Management

Blanda et al. J Spinal Disorder, 1993
- Retrospective study of 82 patients, 2 year follow up
- Treatment: activity restriction, bracing, and PT
- Excellent results
  - 84% spondylolysis
  - 40% spondylolisthesis
- Conclusions
  - Early aggressive non-op treatment can prevent long term disability

References
