Scoliosis: What You Need To Know

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Scoliosis

From the Greek “Skolios” = Cooked, perverse, unfair
Causes

- Nonstructural (Primary)
  - Idiopathic
    - Strong genetic component
      - DNA testing available

- Structural (Secondary)
  - Neuromuscular
  - Tumor
  - Developmental
Standing AP and lateral views
- EOS
  - Provides decreased radiation
How To Measure

• Cobb technique
• Upper body is most highly angulated body above
• Lower body is most highly angulated body below

Goal is to make angle as high as possible
How To Measure

- Measurement is done along superior endplate of most angulated upper body and inferior endplate of most angulated lower body
• Center sacral vertical line
  – Drawn parallel to iliac crests and bisecting sacrum
  – Indicates stable vertebral body as the one which is nearly bisected by CSVL below curve
Primary Vs. Secondary Curves

• Primary curve
  – Structural
  – Develops first
  – Does not straighten to <25 degrees with ipsilateral bending
Primary Vs. Secondary Curves

• Secondary curve
  – Non-structural
  – Develops last
  – Straightens to <25 degrees with ipsilateral bending

• After time a secondary curve can become structural once morphologic osseous change is present
Bending films

- Frontal images with patient bending to right and then left
- Same method as Cobb angle measurement
- During bending curves are assessed for residual angulation for determining structural vs. nonstructural curves
Classifications Systems

- King- Moe
  - obsolete
- Lenke system
3 components
- Curve type
- Lumbar modifier
- Thoracic sagittal modifier
## Curve Type

<table>
<thead>
<tr>
<th>Numeric Designation of Curve Type</th>
<th>Proximal Thoracic</th>
<th>Main Thoracic</th>
<th>Thoracolumbar/Lumbar</th>
<th>Description of Curve Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nonstructural</td>
<td>Structural*</td>
<td>Nonstructural</td>
<td>Main thoracic</td>
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<tr>
<td>2</td>
<td>Structural</td>
<td>Structural*</td>
<td>Nonstructural</td>
<td>Double thoracic</td>
</tr>
<tr>
<td>3</td>
<td>Nonstructural</td>
<td>Structural*</td>
<td>Structural</td>
<td>Double major</td>
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<td>4</td>
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<td>Structural*</td>
<td>Structural*</td>
<td>Triple major</td>
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<tr>
<td>5</td>
<td>Nonstructural</td>
<td>Nonstructural</td>
<td>Structural*</td>
<td>Thoracolumbar/lumbar</td>
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<td>6</td>
<td>Nonstructural</td>
<td>Structural</td>
<td>Structural*</td>
<td>Thoracolumbar/lumbar—main thoracic</td>
</tr>
</tbody>
</table>

*Kim et al.*

Radiographics. 2010 Nov;30(7):1823-42.  
*Scoliosis imaging: what radiologists should know.*
Curve Type

- Using standing and bending films curves are labeled structural or nonstructural and classification is determined
Modifiers

• Lumbar modifier
  – Checks for position of lumbar spine relative to midline

• Thoracic modifier
  – Checks for thoracic curvature i.e. kyphosis
Cobb Technique Caveats

• Greatest source of error is operator error!
• Diurnal variation
  – 5 degrees higher in afternoon
  – Endpoints should remain consistent
    • Same upper and lower bodies used on each measurement
Single Major
Single Major
Single Major Post-op

Post-op immediate

5 months later
Double Major
Double Major
Skeletal Age

- Risser system
  - Convenient since no other films are required
  - Relates growth potential to iliac crest ossification
    - Risser 0-1, patient is growing rapidly
    - Risser 4, patient not growing
- Not very accurate
Treatment Decisions

• Bracing
  – Skeletally immature patient (Risser 0)
  – Curve >25 degrees

• Can reduce curve progression but not reverse it

• Brace must be worn a large part of the day
  – Dose dependent relationship between time in brace and success
Benefits of surgery and curve correction need to be weighed against problems of arthrodesis and cosmetics.

In general:

- Curve > 40-50 degrees skeletally immature
- Curve > 50 skeletally mature
Patient Presenting With Idiopathic Scoliosis

11° to 25°
- Skeletal maturity?
  - Yes: Follow-up every 6 months until skeletal maturity
  - No: Follow-up as needed

25° to 45°
- Skeletal maturity?
  - Yes: Follow-up every 5 years to assess progression
  - No: Consider bracing; follow-up every 4 to 6 months

> 40° to 50°
- Consider surgical intervention
Anterior vs. Posterior Approach

• Anterior approach
  – Less fusion levels
  – Less damage to paraspinal musculature
  – Disc excised allows greater flexibility for curve correction

• Usually used for single TL major or single lumbar
• Posterior approach
  – Greater and more extensive correction possible
    • Ponte osteotomy
    • Requires stripping muscles off spine
  – Ponte osteotomy
    • Facetectomy, spinous process and ligamentous excision
Anterior Vs. Posterior Approach

• Combined approach
  – Anterior discectomy and release
  – Posterior fixation
Methods in the Juvenile

- Correct curve
- Restrict progression
- Retain flexibility
- All while allowing for growth
Growing Rods

- Rods are able to extend
- Require operative lengthening q 6-8 months
MAGEC Rods

- MAGnetic External Control
- Like growing rods can be lengthened
- Using external magnetic controller!
Shilla Rods

- Track and trolley system
- Nuts can slide to allow for growth
VEPTR Rods

- Vertical Expandable Prosthetic Titanium Rod
- For spine with chest wall deformity
- Require surgical lengthening q 6-8 months
Tether Banding

- Anterior approach
- Screw placement
- Screws connected via tether bands
  - High angle
  - Young patient
- Allows for retained flexibility
• Early onset <10YO
• Rapid progression
• Pain
• Thoracic hyperkyphosis
• Short segment curve
• Osseous abnormality
• Leftward curve?
Complications

- Hardware complications
  - Nut problems
Screw Fracture
Rod Fracture