Scoliosis: Diagnosis, Evaluation, & Treatment

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Disclosures
I have no disclosures related to this presentation
Training Background

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Objectives

congenital, infantile, neuromuscular, juvenile, and idiopathic scoliosis
Learn Associated Pathology
Basic Treatment Algorithms
Scoliosis Definition

- **Scoliosis**
  - 10 degrees or greater of curvature

- <10 degrees = Spinal Asymmetry
  - If skeletally immature, requires follow up to monitor for progression to possible scoliosis

3 DIMENSIONAL DEFORMITY
Scoliosis Subtypes:
Diagnosed <10 years of age

High Incidence of Neural Axis Abnormalities

- Syrinx
- Arnold-Chiari syndrome
- Tethered cord
- Dysraphism
- Spinal cord tumor
Neural Axis Abnormalities

NEED FOR A MRI

Infantile Birth - 3 years of age
Infantile Example

Epidemiology

Incidence
- 5% of idiopathic scoliosis cases

Demographics
- males > females

Anatomic location
- usually left thoracic curve

Risk factors/Genetics
- Family history
  - Autosomal Dominant with variable Penetrance
Associated Conditions

- Associated conditions:
  - Plagiocephaly
  - Congenital Defects

- Neural-Axis Abnormalities: 20-40% of patients

Congenital Abnormally Shaped Vertebrate

- Healthy
- Congenital Scoliosis
  - Hemivertebrae
  - Fused vertebrae
**Associated Conditions**

Systemic Anomalies (38-58%)

- Cardiac defects - 10%
- Genitourinary defects - 25%
- Spinal cord malformations - 20-40%

Can be part of an underlying syndrome or associated with a chromosomal abnormality

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**VACTERL Association**

- Vertebral malformations
- Anal atresia
- Cardiac malformations
- Tracheo-Esophageal fistula
- Renal & radial anomalies
- Limb defects
Juvenile Scoliosis
3-10 years of age

Epidemiology

Incidence
• 10% of all idiopathic scoliosis cases

Demographics
• Females > males

Anatomic location
• Most commonly right main thoracic curve
Other Types of Scoliosis....

Neuromuscular Scoliosis
Caused by disorders of the brain, spinal cord, and muscular system
Neuromuscular Scoliosis Example

GMFCS Classification

GMFCS Level I
GMFCS Level II
GMFCS Level III

GMFCS Level IV
GMFCS Level V
Adolescent Idiopathic Scoliosis

Age 10-18 years
Most Common

Demographics

- Children 10 to 18 yrs
- 10:1 female to male ratio for curves > 30°
- Right thoracic curve most common
- Left thoracic curves are rare (investigate with a MRI)
Reaching a Diagnosis of Scoliosis

History

- When Was the Scoliosis Identified?
- Is Patient Experiencing Pain?
- Neurologic Symptoms?
- Family History?
- Growth Remaining?

- With increased growth remaining comes increase risk of curve progression
Red Flags

- Painful Scoliosis
- Scoliosis rarely causes pain
- Differential Diagnosis:
  - Infection
  - Benign neoplasm
  - Malignant neoplasm
  - Spinal cord abnormality
  - Spondylolysis or Spondylothesis

Physical Exam Pearls

- Shoulder asymmetry
- Unequal scapular prominence
- Elevated or prominent “hip”
  - Abdominal/flank asymmetry
- Head not centered over pelvis
Adams Forward Bend Test

The patient bends forward at the waist until the back comes in the horizontal plane
- Feet together
- Knees extended
- Arms hanging

Atypical Physical Exam Findings

- Café Au Lait Spots
- Axillary or Inguinal Freckling
- Hairy Patch
- Sacral Dimple
Neurologic Examination

- Gait Exam
- Strength
- Sensation
- Deep Tendon Reflexes
- Babinski Sign
- Clonus
- Abdominal Reflexes

Abdominal Reflexes

[Images of Abdominal Reflexes]
Abdominal Reflexes
Radiographs
- Full-Length & Standing
  - P-A
  - Lateral

Cobb Angle Measurement

Northern Light Health.
Skeletal Maturity Assessment

- Calendar age & Height over time
- Sexual maturity
  - Tanner staging
  - Menarche
- Skeletal age
  - Risser sign
  - Elbow apophysis
  - Proximal Humerus
  - Left Hand Xray
    - Sanders Classification
Treatment of Scoliosis

Why do we treat?

- Curves < 30° cause no problem
- Curves > 50° consistently cause problems
- Curves > 90° shorten life expectancy

Significant Pulmonary Complications
### Treatment Options

<table>
<thead>
<tr>
<th>Observation</th>
<th>Curves &lt;20°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracing</td>
<td>Curves between 25-45°</td>
</tr>
<tr>
<td>Casting</td>
<td></td>
</tr>
<tr>
<td>Halo/Traction</td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>Curves &gt;50°</td>
</tr>
</tbody>
</table>

#### Halo Traction

- Images showing different stages of Halo Traction treatment.
Bracing

Brace treatment can alter the natural history of Idiopathic Scoliosis

Successful brace treatment defined:
- Lack of curve progression
- Preventing surgery

Who gets a brace?

- Skeletally Immature Patient
- Curves 20 - 45 degrees
- Halt Progression 70 - 80%
- Risser 2 or less
- When worn >16hrs/day!
Surgery that allows continued growth...
Traditional Growing Rods

- Correction of scoliosis while allowing for continued growth in early onset scoliosis

- Fear of fusing too early and concern of pulmonary hypoplasia and resulting pulmonary disability

- Require lengthening in the operating room every 4-6 months

MAGEC Rods
Definitive Treatment

Gold Standard for Fusion...
Posterior Spinal Instrumentation and Fusion

- Reliable and powerful fusion technique with excellent track record
- Definitive Treatment for curves over 50 degrees
- Complication rate in idiopathic cases is 0.6-0.8%

New and Emerging Technologies
Vertebral Body Tethering

Non-fusion technique
- Theoretical Maintenance of spinal motion

Initially designed for flexible scoliosis
- Benefit likely for lumbar curves

High complication rate ~20%
- Failure of tether a concern

No Long-term Data (>5 year)
Apifix Device

In Summary...
**DIAGNOSIS SUMMARY**

**History**
- Age of occurrence
- *Painful Scoliosis or neurological symptoms are RED FLAGS*

**Physical Exam**
- Look for asymmetry
- *Adams Forward Bend Test*
- Neurologic exam

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**Indications For MRI**

- Progressive Infantile or Juvenile Scoliosis
  - *Scoliosis before 10 years of age*
- Abnormal Physical Exam
- Abnormal Neurologic Exam
Scoliosis Subtypes Summary

**Early Onset Scoliosis**
- Infantile, Congenital, Juvenile
- Require MRI evaluation
- Congenital Scoliosis
- VACTERL Association
- DON’T FORGET TO CHECK THE KIDNEYS!

**Adolescent Scoliosis**
- Most Common
- Left sided curves rare
- Evaluate with MRI

Treatment Summary for Idiopathic Scoliosis ONLY

**Non-Operative Options**
- Observation q3-4 months at first

**Brace Curves**
- 20° – 45°
- Skeletally Immature Patients
  - <Risser 2 or Sander <5

**Curves over 50° = FUSION**
When to Refer?

- Curves over 10 degrees and patient under 10 years of age
- Curves over 15 degrees in skeletally immature patients
  - Risser 2 or less
- Scoliosis with any Red Flag
  - Abnormal neurological exam
  - Night time pain
- Syndromic, Infantile, Juvenile, Congenital or Neuromuscular Curves
Thank You!

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Northern Light Pediatric Orthopedics
Welcomes
William Bassett, MD

Dr. Bassett is the only fellowship trained surgeon in the state performing complex pediatric orthopedic procedures. He provides subspecialized surgical care to patients throughout Maine. His goal is to help children retain and regain their childhood by enabling families to take part in activities they enjoy, while improving patients’ overall quality of life.

Dr. Bassett specializes in treating:
- Bone tumors
- Club foot
- Foot reconstruction
- Fracture care
- Hip dysplasia
- Leg length discrepancy
- Lower extremity deformity
- Scoliosis
- Slipped capital femoral epiphysis

For more information or to schedule a referral:
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