The 3 Studies that Should be Done over the Next Few Years to Help Us Improve the Care of Children with EOS

Michael G. Vitale, MD MPH

Ana Lucia Professor of Orthopedic Surgery
*Columbia University College of Physicians and Surgeons*

Co Director Division of Pediatric Orthopaedic Surgery
Chief of Pediatric Spine and Scoliosis Service
Medical Director, MSCH Initiative to Make Care Better
*New York-Presbyterian Morgan Stanley Children’s Hospital*
Evolving State of EOS

• Expanding array of surgical techniques

• Growing research interest

Variability of Expert Opinion in Treatment of Early-onset Scoliosis

Vitale et al, Clinical Orthopaedics and Related Research 2011

Simultaneously emerging treatment options have led to significant variability in surgeon decision-making.
Variability Study: Case 3 / 10:
18 mo Jehova’s witness with undx “mild mitochondrial disorder”

77 deg bending to 56, progressed 60 deg/yr

Interobserver: 8/13 surgery; 4/13 thoracostomy, 2VEPTR, 1GR, 1Fusion
Intraobserver: 50% changed plan

Unexplained variability reflects suboptimal care

Vitale, Smith, Emans et al, CORR 2010
Infantile Idiopathic Scoliosis Results in Shorter Life

What We Have Learned

Infantile Scoliosis  N = 29

- Observed deaths
- Expected deaths

Pehrsson, Larsson, Oden & Nachemson, Spine, 1992
Standardizing EOS Management: Answering the Call for Higher Level of Evidence Studies

- Two Dedicated EOS Study Groups have emerged:
  - The Chest Wall and Spine Deformity Study Group
  - The Growing Spine Study Group

- Comprehensive research infrastructure via 5 parallel efforts:
  - Endpoints
  - Equipoise
  - Classification
  - Standardizing Complications
  - Clinical Trials
Improving the Evidence Base in EOS

Development of a Research Infrastructure Via Five Parallel Efforts

- **Endpoints**: Development/Validation of a Disease-Specific QoL Measure
- **Equipoise**: Identifying Clinical Equipoise in the Field of EOS
- **Classification-EOS**: Development / Validation of Classification for EOS
- **Standardizing Complications**: Standardize Way We Define and Report Complications
- **Clinical Trials**: Proximal Anchors: Rib Vs Spine – Retrospective (Prospective Underway)
# Top 10 Areas of Equipoise

*Vitale et al, JBJS 2013*

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<tr>
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<th>Question</th>
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<tr>
<td>1</td>
<td>In idiopathic children &lt;9yo, with curves &gt;60 degrees, what should the lengthening intervals be?</td>
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<td>2</td>
<td>In idiopathic 1-3yo children with 30 degree curves, should we observe or cast?</td>
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<td>3</td>
<td>In children &gt;12yo who have finished lengthenings of distraction based treatments, should we observe, remove growing constructs or fuse?</td>
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<td>4</td>
<td>In 3-6yo children with severe kyphosis, should we use rib or spine based distraction?</td>
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<td>5</td>
<td>In idiopathic 2-3yo children with 90 degree curves, should we use spine or rib based distraction?</td>
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<td>6</td>
<td>In high tone neuromuscular children with 90 degree curves who are ambulatory but have pelvic obliquity, should we use pelvic or non-pelvic fixation?</td>
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<td>7</td>
<td>In idiopathic 9yo children with 30-40 degree curves who have progressed 30 degrees (last 6 months), should we treat conservatively, use growth modulation or other?</td>
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<td>8</td>
<td>In an idiopathic 1-2yo child with a 60 degree curve, should we be bracing or casting?</td>
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<td>9</td>
<td>In 9yo children with 90 degree curves, should we distract (rib or spine-based) or fuse?</td>
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<tr>
<td>10</td>
<td>In idiopathic 3-9yo children with 60 degree curves, should we be conservative or employ distraction based techniques?</td>
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Lengthening Interval in Growing Rods
Cast Vs brace in 2-4 year old with IIS
Spine Vs Rib Based Proximal Anchors
Role of Growth Modulation in JIS
Handling the VEPTR Graduate
But what we need to know first is...

*Is any of this better than Natural History?*
Natural History of Untreated Scoliosis

Weinstein et al 1981:
- No increase in mortality in idiopathic scoliosis with onset after age 8

Branthwaite et al 1986:
- Respiratory failure in idiopathic scoliosis with onset before age 5

Branthwaite MA. Br. J.Dis Chest 80:360-369, 1986
Natural History of EOS

We need more studies that investigate the Natural history of EOS

How?
Can we revisit Pehrsson data?

What about early fusion vs delayed fusion with growth strategy?

• Inclusion; Children 7-9 year old with curves >60 degrees

• Height > ?; Weight > ?

• Randomize to Growth Rods vs Fusion
RCT: 30 year f/u of EOS VS NonFusion

Early Fusion (6-9 Year old)
Growth Strategies/ Delayed Fusion

Number of Deaths

Vitale et al, NEJM, 2014

What We Need to Know
Why has it been so difficult to understand pulmonary outcomes and effect of intervention on pulmonary function?

- Do we need a national study of pulmonary norms in the developing child?
- What endpoints would be of value?
Improving the Evidence Base in EOS

Development of a Research Infrastructure Via Five Parallel Efforts

Endpoints: Development/Validation of a Disease-Specific QoL Measure

Equipoise: Identifying Clinical Equipoise in the Field of EOS

Classification-EOS: Development / Validation of Classification for EOS

Standardizing Complications: Standardize Way We Define and Report Complications

Clinical Trials: Proximal Anchors: Rib Vs Spine – Retrospective (Prospective Underway)
Rib vs Spine Anchors

To examine the outcomes of rib vs. spine based proximal anchors in growing instrumentation surgery.
Retrospective Rib vs Spine

Design:

*Retrospective review of CSSG & GSSG databases*

Participants:

- Average Follow up - 5 yrs post op
- Age 2-10, Any Cobb Angle
- Underwent growing instrumentation surgery

Outcomes:

- Cobb correction:
  - Short-term = <1yr, prior to 1st lengthening
  - Long-term = >2yrs, Cobb at last recorded f/u
- Complications

Analysis

- Stratify by C-EOS
Study Limitations

1. Retrospective study design

2. Complications defined differently between study groups

3. Hard to stratify – apples vs apples?

4. Lung function and quality of life?

Impetus for prospective trial of Rib vs. Spine-based proximal anchors
Prospective Rib vs Spine

Design:
Prospective, multi-center study of growing instrumentation surgery

Participants:
• Inclusion:
  • EOS
  • 3.0 – 9.9 years of age
  • Cobb > 40°
  • Undergoing rib or spine based proximal anchor growing instrumentation
  • Able to Complete EOSQ (English or Spanish)
• Exclusion:
  • Prior spine surgery
  • Guided-growth constructs, MCGR

Outcomes:
• Cobb correction (6 mo post-op):
• Complications
• HRQoL (EOSQ-24 6 mo post-op)
Study Limitations

Although Prospective design is superior to retrospective, study design still has limitations:

1. Complications defined differently between study groups

2. The pre-op and post-op evaluations (Cobb, pt characteristics, and EOSQ) are not consistent between the registries, making comparisons difficult

Impetus for Randomized Clinical Trial of Rib vs. Spine-based proximal anchors
Randomized Control Trial comparing Rib vs Spine proximal anchors

Consistent Outcomes measured at consistent intervals are key to determining clear results and conclusions:

- Cobb correction
- Complications
- HRQoL (EOSQ-24)
Conclusions

What Needs to be Done

1. Natural History
2. Early Fusion vs Growth Rods
3. Rib vs Spine Fixation
THANK YOU

Michael G. Vitale, MD MPH

mgv1@columbia.edu