Growing Rod “Graduates” - Spine Length and Pulmonary Outcome

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Warsaw
Graduates

- Patients who have undergone “final” fusion
- Patients no longer being actively lengthened and simply followed for progression
What do we know about outcome?

Flynn JBJS 2013 - GSSG database

- 93% fused age 11-13
- Reason often obscure
- Extended prox & distal 2°/2 balance issues
  - coronal & sagittal
- 81% autofused / stiff
- Final correction minimal or worse in 37%
- Final fusion may not be final Poe-Kochert/Thompson SRS

Know a lot about the fusion......
But how did they really do?

Lengthening worth it?
PFT’s?
QOL?
TSRH GR “Graduates” (n=7)

- 4 idiopathic/-like, 1 cong, 1 amb n-m, 1 syndromic (Marfan)
- 77 mo (69-97/ ~6½ yo) @1st surgery
- Last f/u age 156 mo (13 yr - range 11-15)
- 44 mo delay tactics in 4 pts prior to 1st
- Mean 8.0 procedures (5-13, incl. initial), 1 unplanned, 6 lengthenings
- 5 definitive fusion f/u 1-2.5 yr, 2 observed after last lengthen 3-4 yrs
**“Graduates” -> Bigger, Curves Better**

<table>
<thead>
<tr>
<th></th>
<th>T1-12 cm</th>
<th>MT deg</th>
<th>Th width cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>14.2 (9.9-17.7)</td>
<td>94 (73-123)</td>
<td>16.2 (14.7-18.9)</td>
</tr>
<tr>
<td>Last surg</td>
<td>22.6 (18.6-29.5)</td>
<td>50 (36-63)</td>
<td>19.8 (16.3-23.6)</td>
</tr>
<tr>
<td>Last f/u</td>
<td>23.6 (20.3-29.6)</td>
<td>46 (26-69)</td>
<td>20.3 (17.1-23)</td>
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</tbody>
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<th>preop</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Kyphosis</td>
<td>67 (35-99)</td>
<td>49 (34-71)</td>
<td>44 (26-57)</td>
</tr>
<tr>
<td>BMI</td>
<td>13.5 (11.6-18)</td>
<td>11.9 (10.1-14.3)</td>
<td>17 (11.9-26)</td>
</tr>
<tr>
<td>Pelv width</td>
<td>8.5 (6.7-9.8)</td>
<td>11.9 (10.1-14.3)</td>
<td>13.3 (10.6-15.2)</td>
</tr>
</tbody>
</table>

Complication (rod/anchor): 7 in 4 patients

No re-operations to date
T1-12 Length

[Graph showing the relationship between Thoracic Spine Height and Pelvic Width with mean value and 95% confidence limits.]
Th width

![Graph showing relationship between maximum chest width and pelvic width.](image)
Pulmonary/Volume

**PFT 1**

- **FEV₁ (L.)**: 0.66
- **FEV₁ (%)**: 57.4
- **FVC (L.)**: 0.70
- **FVC (%)**: 58.4

**CT vol**
- **900 (670-1268)**
- **1328 (915-2026)**

@ age
- **56 m 4+8**
- **88 m 7+4**
Observations (n=only 7)

- Pulmonary outcome **diminished** (% pred criteria)
  
  ...in spite of apparent satisfactory thoracic length gain and curve correction over 7 year of surgical management with acceptable complication rate

  [Consistent with Dede et al Veptr pulmonary outcomes]

- Th width increase **not keeping up** with normal growth (significance ?)
Observations - Th width ? significance
Good News, Bad News

- T1-12 length effectively increases (Glotzbecker et al Spine Deformity '14)
- Th width - increased but not keeping up with growth - ? Significance
- PFT data worrisome (consistent with Dede et al JBJS Veptr outcomes) - the increase in absolute volume not keeping up with growth
• Age 15 mo
• MRI: Negative
• Weight: 5.2 kg (<5\textsuperscript{th}%)

Early intervention ?? Try delay ?
ES - HGT x 3+ yr

Age 4+10
Cobb: 50°
T1-12: 153.8 mm

Age 11
broken rod #3 + 9
scheduled lengthen
ASF (vats)/PSF with extensive posterior facet ankylosis

T1-12 = 21.0 cm
T1-S1 = 32.3 cm
T4-L1 48°
3 ¾ yr delay
5 yr surgical rx
PFT's: FVC 46%
FEV1 50%

4/11 - final fusion
5 yr surgical rx
Clinical - final fusion
F/u QOL data missing.... Challenge for the next “graduate” reports
Thanks
5+6 yoM s/p neuroblastoma

HGT x 3mo then GRI

Too much kyphosis?
Last lengthening 10/10  age 12

Last f/u 10/13  age 15

43° 27.0 cm
5+6

14
Final Outcome - what do we know?
Flynn JBJS 2013 - GSSG database

- Most patients get fused formally between 11-13
- Indication for fusion obscure (often 2° to recent complication)
- Final fusion extended proximally for pjk or pullout; distally for coronal balance
- 81% with operative info reported to have stiff or autofused spine
- Final “correction” minimal or actually worse in 37% [correction could not be determined in 30% of cohort]
- Final fusion may not be final 2° more complications (Poe-Kochert/Thompson SRS '14)