Management of the Complex: Too Much Kyphosis

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Disclosures

- K2M/Stryker – Consultant, Royalties, Speaker Bureau
- Depuy Synthes - Consultant, Speaker Bureau
- Nuvasive - Consultant, Royalties, Speaker Bureau
- Biogen – Consultant
- Orthopediatrics – Royalties
- Globus - Royalties
Why is Kyphosis Important

• Increased risk of PJK
  1. El-Hawary et al. - Hyperkyphosis \(\rightarrow\) risk ratio 2.8 for PJK
  2. Watanabe et al. - PJK risk \(\rightarrow\) thoracic kyphosis > 60°, shorter instrumentation, large scoliosis

Kyphosis and Complications

- **Increased risk of rod fracture and implant pullout**
  - Chen et al. - Compared NL to Hyperkyphosis (> 50°) \(\rightarrow\) Greater rod fracture and PJK
  - Schroerlucke et al. - Hyperkyphosis (> 40°) \(\rightarrow\) increased implant complication
    - Complications increased linearly with increasing kyphosis
    - Rod breakage most common


What are the options?

1. Increase anchor density

2. Preoperative traction +/- staged anchor implantation

3. Implant $\rightarrow$ smaller or more contourable

4. Change Growth Friendly method
Anchor Density

- Pull out typically requires revision
- Harris, Andras et al. “Proximal Anchor Constructs in EOS Treated with GF Implants” – EPOSNA 2017
  - > 5 anchors → less pull out
Anchor Density

Hyperkyphosis and sagittal balance

Consider anchor supplementation
Traction + Staged Implantation

- **Scheflaut et al.** - 15 pts – mean f/u 49.5 mo
  - Hyperkyphosis (11/15) – 71° to 46°
  - No anchor migration or pull out

- **Gomez et al.** - 8 pts – mean f/u 4.9 yrs
  - Indications - poor bone and neurologic changes
  - Halo-gravity traction between stages
  - No instrumentation-bone failure

- Scheflaut et al. “Staged insertion of growing rods in severe scoliosis” Eur Spine J 2018 27(9):2203-2212
6 yo with unknown CTD
Stage 1 – Anchors/Halo
8 week traction
Staged Anchors + Traction
A Case for TGR

• Varley, Yaszay et al. “The role of traditional growing rods in the ERA of MCGR for the treatment of EOS” SRS 2018

  – 25 TGR vs MCGR – kyphosis indication in 11
  – Avg kyphosis – TGR 71° vs MCGR 55°
5 yo with chromosomal abnl
Alternative Growth
Friendly Methods

• **Attempt to control or correct kyphosis**
  – Shilla technique
  – Fusion
  – Osteotomies - VCR
8 yo with CMD
Shilla Technique
5 yo with spina bifida
Kyphectomy + Shilla
Revision x 1 for broken rods
4 yo with Conradi Hunermann Syndrome

Courtesy of Peter Newton
Apical Fusion/VCR, Growth Guidance
“Shilla”
Apical VCR + “Shilla”

4 years old  4.5 years  7 years  11 years  Final Fusion 13 years
Conclusion

• To Much Kyphosis
  1. Increase anchor density (> 5)
  2. Preoperative traction +/- staged anchor implantation
  3. Implant ➔ smaller or more controllable
  4. Change Growth Friendly method