Are Proximal Rib Anchors Protective Against Rod Breakage in Distraction-Based Growing Rods?

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Disclosures

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CHILDREN'S OPAEDIC CENTER

Which Rods Break More?

Rib anchors Not Fused Spine anchors Fused



Ribs Move, Hooks on ribs have "slop" - not fused



Weeping Willow Bends

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Methods

- retrospective, multi-center study
- Distraction Based Growing Rods (Not VEPTR)
- Inclusion criteria:
 - ≥ 2 years follow-up
 - <9 years-old at index surgery</p>
- Cox Proportional Hazards Model was used for statistical analysis to account for varying lengths of follow-up in regard to rod breakage events.





Results

- 175 subjects met criteria and were included in this study:
 - 33 subjects had <u>rib</u>-anchored growing rods
 - 142 subjects had spine-anchored growing rods
- Mean follow-up: 55 months (range, 24-152 months)





Results of Univariate Analysis

	Hazard Ratio	p-value
Preoperative Cobb Angle	1.021	0.006
Rib Vs. Spine Anchors	0.233	0.045
Age at Index Surgery	1.003	0.647
Number of Growing Rods	1.073	0.825
# of Instrumented Vertebrae	1.046	0.457
Number of Lengthenings/Year	1.046	0.457
Subject Diagnosis	1.016	0.876
Rod Metal	0.856	0.636
Rod Diameter	0.809	0.171





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Results of Univariate Analysis

	Hazard Ratio	p-value		
Preoperative Cobb Angle	1.021	0.006		
Rib Vs. Spine Anchors	0.233	0.045		
Age at Index Surgery	1 3	0.647		
Number of G		0.825		
# of !		0.457		
Proximal spine-anchored rods have 3.6x increased risk of rod breakage (p=0.045)				





CHILDREN'S ORTHOPAEDIC CENTER

Results of Multivariate Analysis

	Hazard Ratio	p-value
Preoperative Cobb Angle	1.019	0.013
Rib vs. Spine Anchors	0.273	0.074

However, after adjusting for preoperative Cobb Angle, our result did not reach statistical significance (p=0.074) as higher preoperative Cobb angles are also associated with an 18% increased risk of breakage per 10° increase in Cobb angle (p=0.013).





Take Home Points

- Proximal rib-anchored growing rods may be protective against rod breakage
- This may be a result of "slop" at the hook-rib interface in addition to the normal motion of the costovertebral joint







References

- 1. Akbarnia BA, Mundis GM, Jr., Salari P, Yaszay B, Pawelek JB. Innovation in Growing Rod Technique: A Study of Safety and Efficacy of a Magnetically Controlled Growing Rod in a Porcine Model*. *Spine*. *Dec 3* 2011.
- 2. Bess S, Akbarnia BA, Thompson GH, et al. Complications of growing-rod treatment for early-onset scoliosis: analysis of one hundred and forty patients. *The Journal of bone and joint surgery*. *American volume*. *Nov 3 2010*;92(15):2533-2543.
- 3. Elsebai HB, Yazici M, Thompson GH, et al. Safety and efficacy of growing rod technique for pediatric congenital spinal deformities. *Journal of pediatric orthopedics*. *Jan-Feb* 2011;31(1):1-5.
- 4. Schroerlucke SR, Akbarnia BA, Pawelek JB, et al. How Does Thoracic Kyphosis Affect Patient Outcomes in Growing Rod Surgery? *Spine*. *Dec* 28 2011.
- 5. Teli M, Lovi A, Brayda-Bruno M. Results of the spine-to-rib-cage distraction in the treatment of early onset scoliosis. *Indian journal of orthopaedics*. Jan 2010;44(1):23-27.
- 6. Yang JS, Sponseller PD, Thompson GH, et al. Growing rod fractures: risk factors and opportunities for prevention. *Spine*. *Sep* 15 2011;36(20):1639-1644.



