

Reliability of Proximal Junctional Kyphosis Measurements for Early Onset Scoliosis

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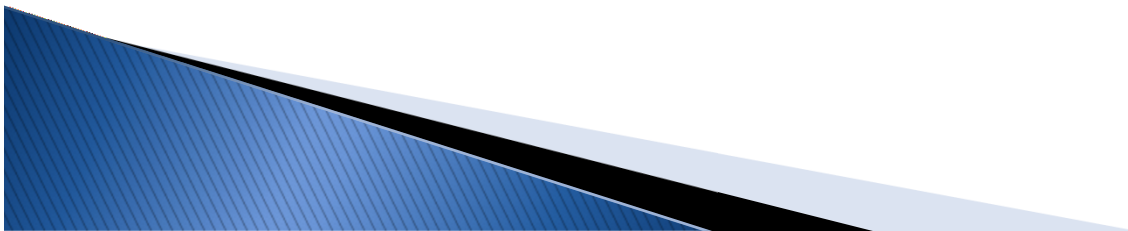
Disclosures

- ▶ **Ron El-Hawary**
 - Consultant: Depuy-Synthes, Medtronic, Halifax Biomedical I
 - Institutional Research Support: Depuy-Synthes, Medtronic
- ▶ **Ammar Al Khudairy**
Nothing to disclose
- ▶ **Luke Gauthier**
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- ▶ **Jacob Matz**
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- ▶ **John Heflin**
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Introduction

- ▶ Proximal Junctional Kyphosis (PJK) is a complication of growth friendly surgery.
 - May lead to pre-mature implant failure.
 - May affect choice of Upper Instrumented Vertebrae (UIV) at definitive fusion.



Introduction

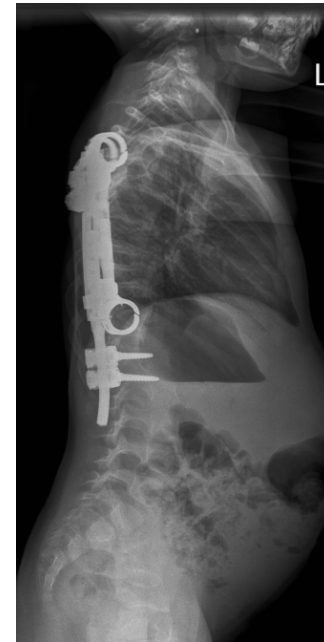
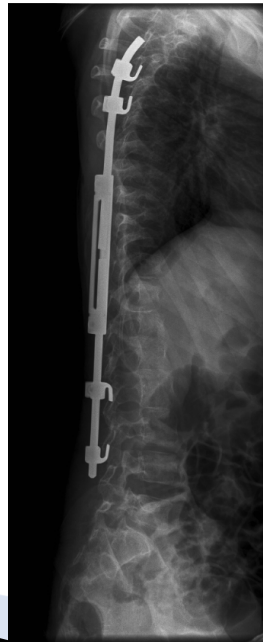
- ▶ Incidence of PJK in distraction-based surgery is not established and its definition has varied in recent studies (ICEOS 2011)

◦ CWSDSG ⁽¹⁾	31 %	<i>Spine-based</i>
◦ Skaggs ⁽²⁾	56 %	<i>Spine-based</i>
◦ CWSDSG ⁽¹⁾	25 %	<i>Rib-based</i>
◦ Karlin ⁽³⁾	7 %	<i>Rib-based</i>



Purpose

- ▶ To use three recently used definitions to report the rates of PJK for a single group of children treated with growth friendly surgery.
- ▶ To define the variability associated with these measurements.



Methods

- ▶ A multicentre review of radiographs of 36 patients with scoliosis treated with posterior distraction-based surgery.
 - January 2004–January 2008
- ▶ Inclusion criteria
 - Age 6 months – 10 years at time of diagnosis
 - Open tri-radiate cartilages
 - Treated with distraction-based implants
 - At least 2 years follow up

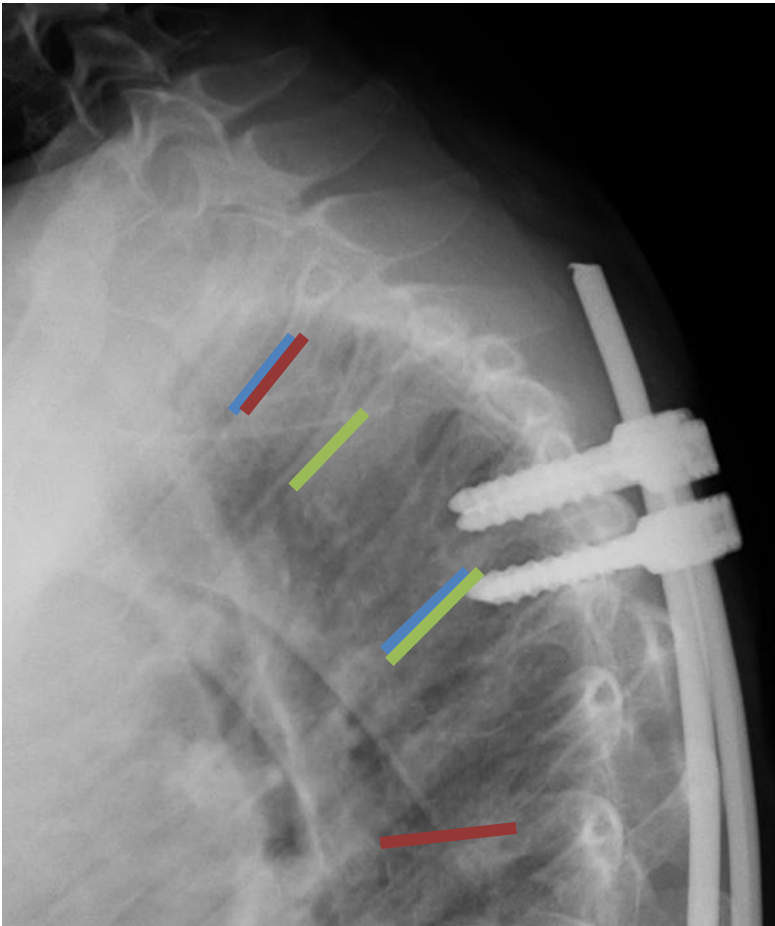


Methods

- ▶ Three radiographic definitions of PJK
 - Two raters
- ▶ Radiographic Measurement
 - (Pre-op, Immediate post-op, 2 years post-op)
- ▶ Reproducibility
 - 20 random radiographs
 - 14 days apart
 - Intra- and inter-observer agreement
 - (Wilcoxon Signed Ranks Test and Kappa analysis)



PJK Definitions



- ▶ **Definition A** $PJA \geq 10^\circ$ between the caudal endplate of UIV to the cranial endplate of the second proximal vertebrae AND $PJA \geq 10^\circ$ greater than pre-operatively
- ▶ **Definition B** $PJA > 10^\circ$ between the caudal endplate of 2 vertebrae below the UIV to the cranial endplate of 2 vertebrae above the UIV AND $PJA \geq 10^\circ$ greater than pre-operatively
- ▶ **Definition C** $PJA > 20^\circ$ between the caudal endplate of the UIV to the cranial endplate of the first proximal vertebrae
- ▶ PJA: Proximal Junctional Angle

Results

- ▶ Mean age at the time of surgery was 5.7 yrs.
- ▶ Rates of PJK between Rib-based and Spine-based implant was similar.

Measure	Rate of PJK
Definition A	8 %
Definition B	33 %
Definition C	3 %

Results

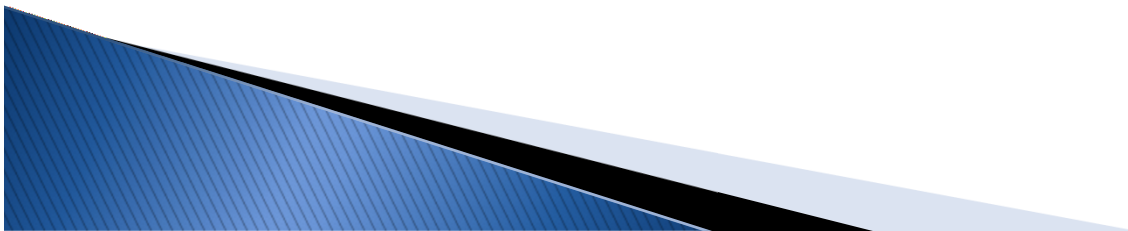
	Inter-observer agreement	Intra-observer agreement
Definition A	50%	31%
Definition B	41%	48%
Definition C	47%	68%

	Inter-observer agreement	Intra-observer agreement
Definition A	Moderate	Poor
Definition B	Poor	Poor
Definition C	Poor	Moderate



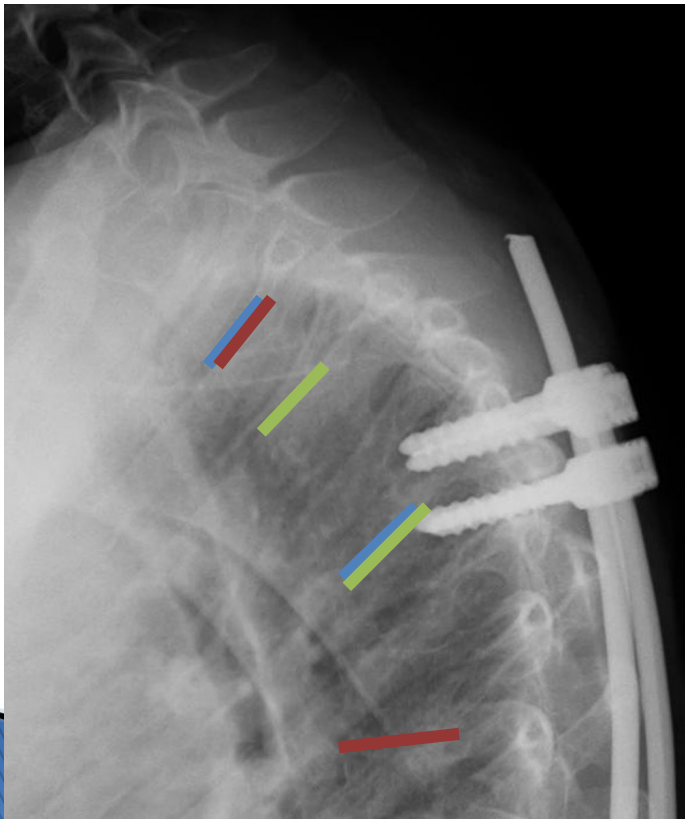
Discussion

- ▶ There is little evidence available on PJK for distraction-based surgery for EOS.
- ▶ Current definitions of PJK yield variable results and demonstrate moderate inter and intra-rater agreement at best.



Discussion

- ▶ Increasing the number of segments measured could contribute to an increased rate of PJK.




- ▶ Definition A
 - ▶ PJK = 8%
- ▶ Definition B
 - ▶ PJK = 33%
- ▶ Definition C
 - ▶ PJK = 3%

Discussion

- ▶ UIV level close to the cervical–thoracic junction could affect PJA measurements and reliability.
 - Lordotic–kyphotic junction
 - Anatomical crowding in the upper thoracic region



Conclusions

- ▶ For the same cohort of patients, different definitions for PJK resulted in different rates of PJK (3%–33%).
 - ▶ Poor inter-rater agreement was found
 - Except for definition A (moderate)
 - ▶ Poor intra-rater agreement was found
 - Except for definition C (moderate).
 - ▶ Efforts should be made to unify a definition for PJK.
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Thank You



IVWK Health Centre



References

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3. Li Y., Karlin L. Proximal Segmental Kyphosis After Vertical Expandable Prosthetic Titanium Rib Insertion. The 5th International Congress on Early Onset Scoliosis and Growing Spine (ICEOS); Orlando, Florida. Journal of Children's Orthopaedics: Springer-Verlag.



Results

Comparison	Odds Ratio	P-Value
Definition A & B	0.18	0.009
Definition A & C	3.00	0.303
Definition B & C	16.67	0.001