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At What Levels Are Free-Hand Pedicle Screws More Frequently Malpositioned in Children?

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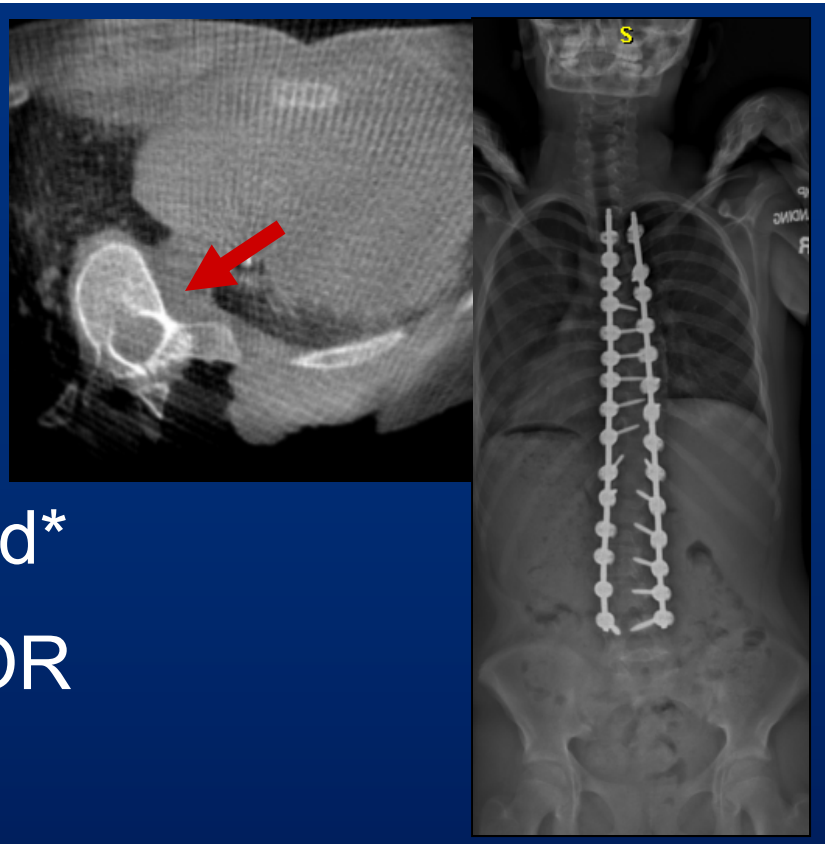
No Disclosures for the above authors.

Background



- Up to 5-10% of freehand pedicle screws in children reported to be malpositioned*
- 1 in 300 patients return to OR for screw malposition‡
- We hypothesized that screw malposition would be more frequent in deformity and in the apical concavity

*Ledonio, Polly et al., 2011; Ughwanogho, Patel et al., 2012; ‡ Dede et al., SRS 2013; Parker, McGirt et al., Neurosurgery 2011, Hicks et al, Spine 2010, Di Silvestre et al., Spine 2007

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Methods

- Of 333 pediatric patients, 85 patients (605 screws) had incidental CT after spine surgery
- Screws rated according to Kim & Lenke et al. 2004
- Satisfactory interrater reliability for screw malposition (Cohen's kappa 0.71 ± 0.16)

< 2 mm	2 - 4mm	> 4 mm
Mild	Moderate	Severe
Safe	Probably Safe	Questionably Safe?

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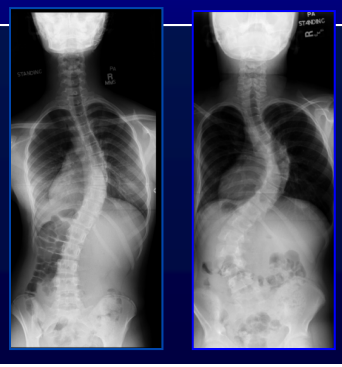
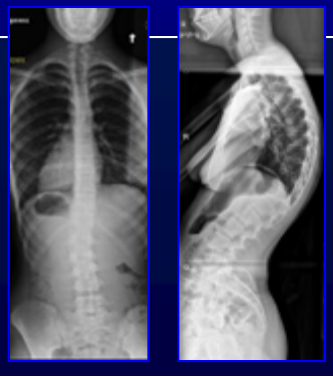
Study Patients < 18 Yrs with CT

85 patients
605 Screws

Coronal Deformity
250 Screws



No Coronal Deformity
355 Screws



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Demographics

	Coronal Deformity (n=35)	No Coronal Deformity (n=50)	P-value
Mean age at surgery (yr)	12.5 (2.2-17.7)	15.9 (7.3-17.9)	**<0.0001**
Male/ Female	11/24	25/25	0.088
Mean screws /patient (range)	7.1 (2-25)	7.1 (1-14)	0.99
Mean levels fused (range)	12.4 (3-17)	5.4 (2-12)	**<0.0001**

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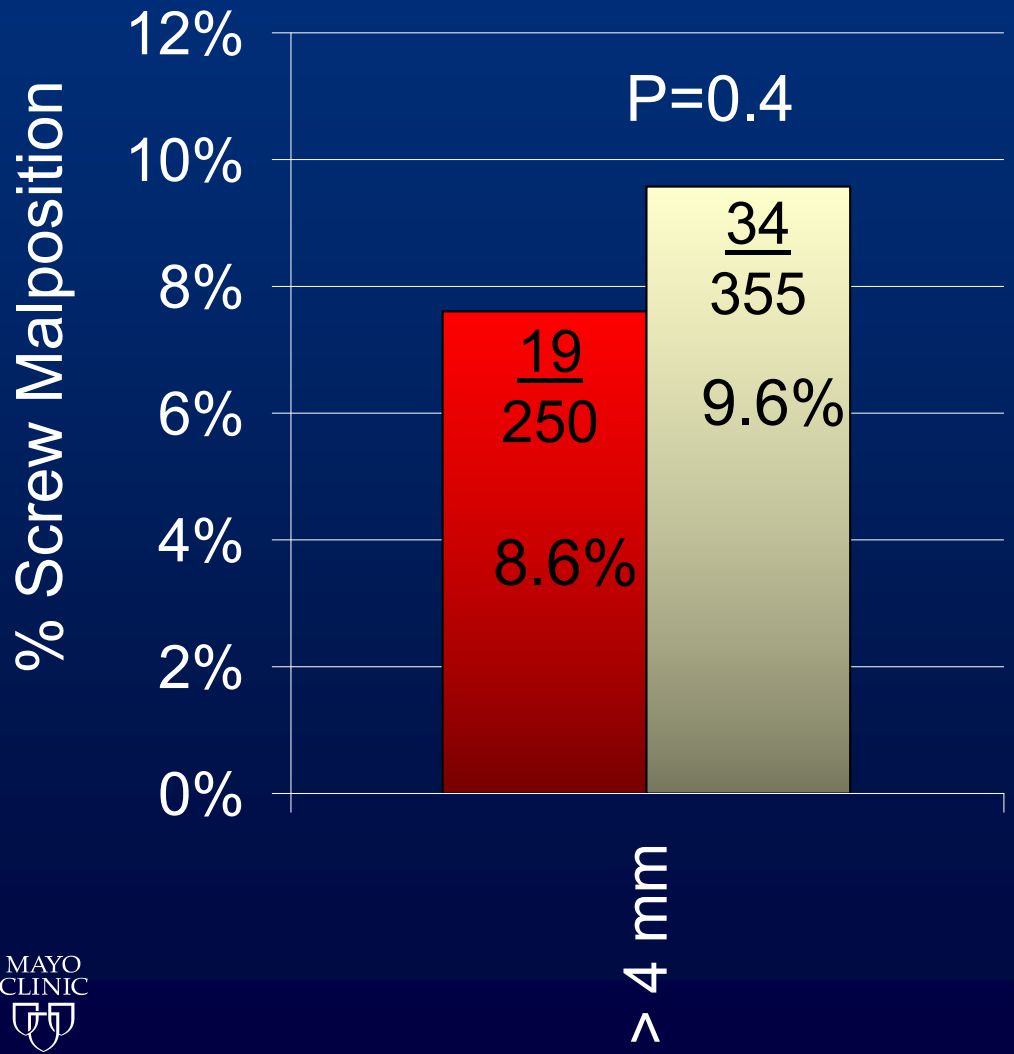
No Detected Difference in Severe Screw Malposition with Coronal Deformity



Coronal Deformity

No Coronal Deformity

Breeches in coronal deformity more frequently medial (8/19 vs. 6/34 breaches, p=0.005)

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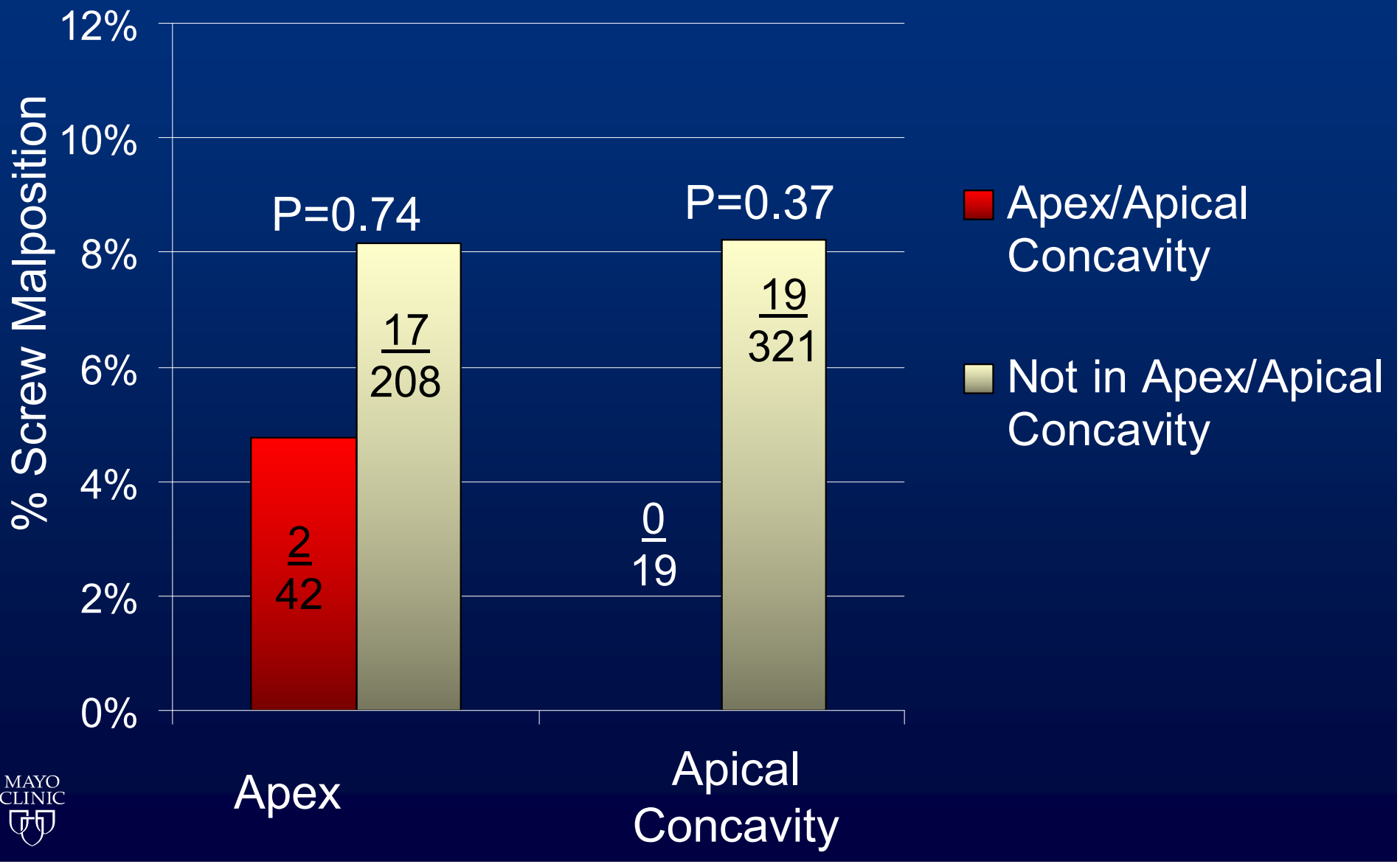
No Detected Difference in Severe Screw Malposition at Apex/Apical Concavity



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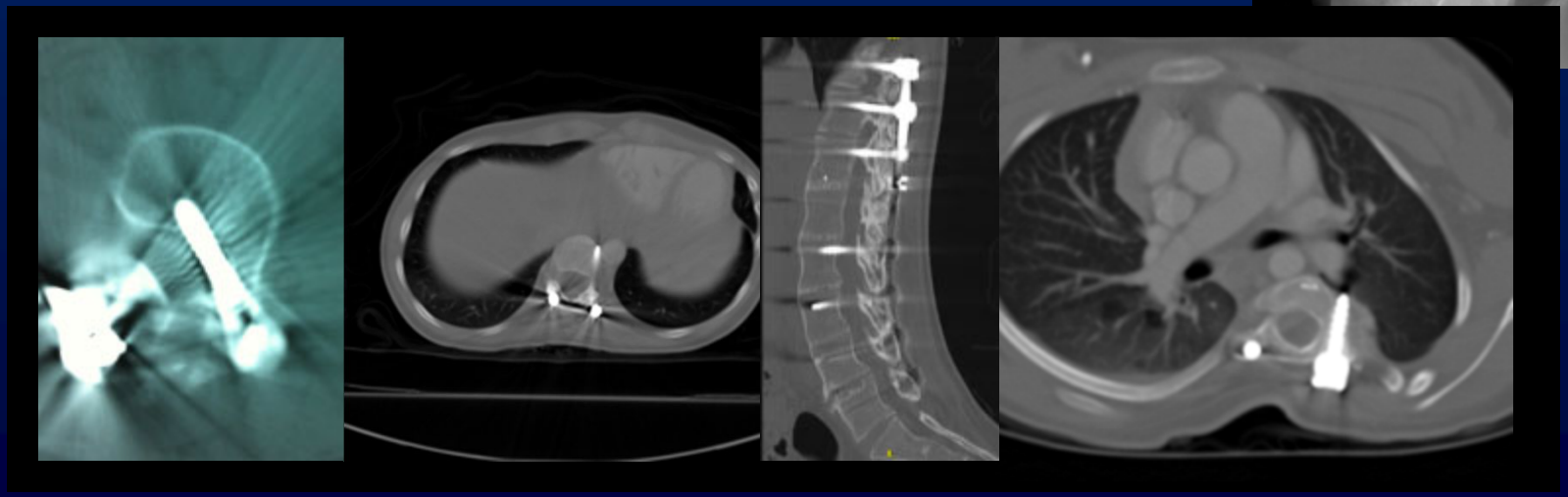
Limitations

- May be underpowered for apical concavity screws
- Possible screw drop out at apical concavity (lowering reported rate of malposition)
- Only incidental CTs (not all patients)



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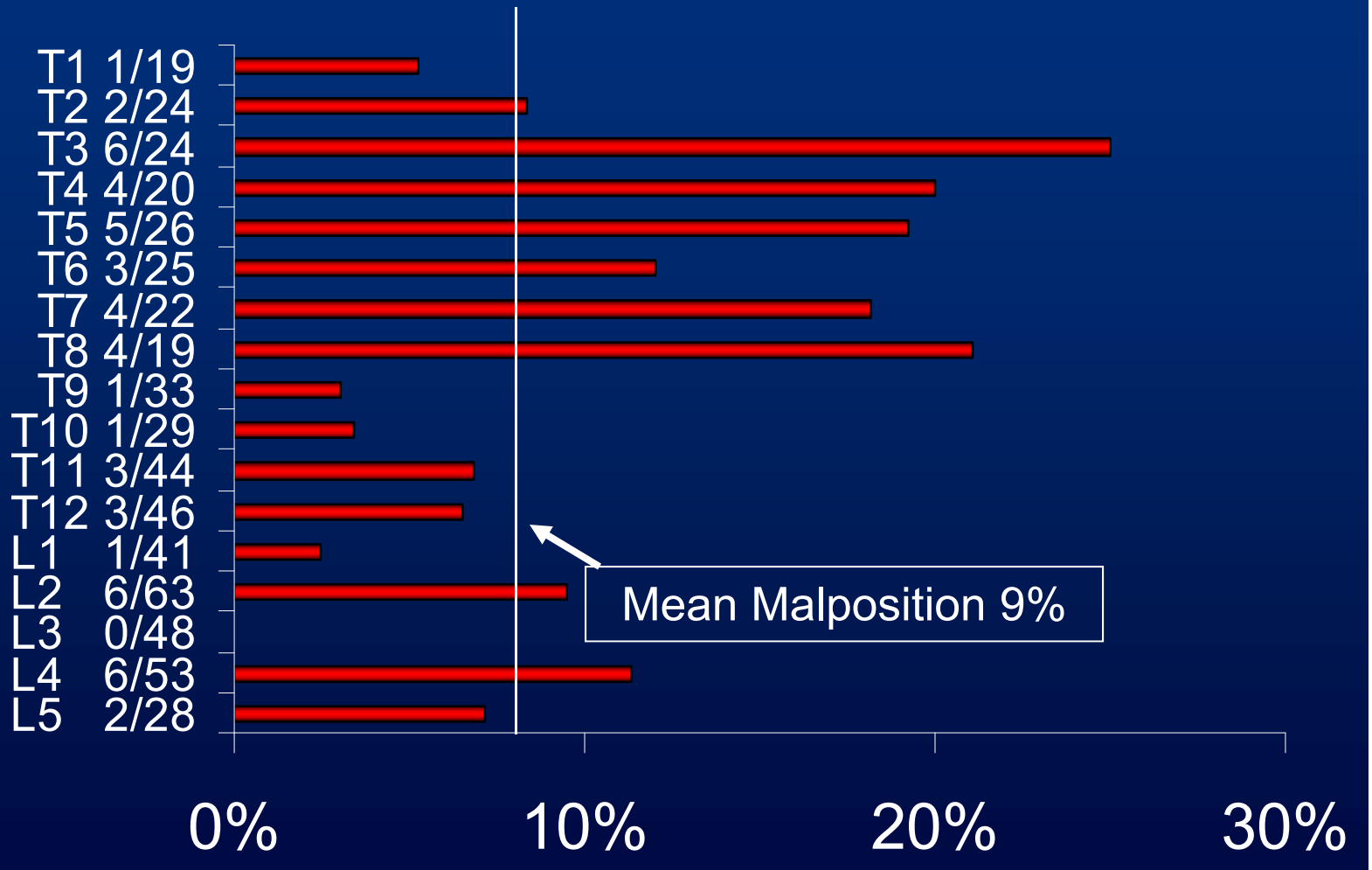
Rate of Screw Malposition (<4 mm) on CT by Spinal Level



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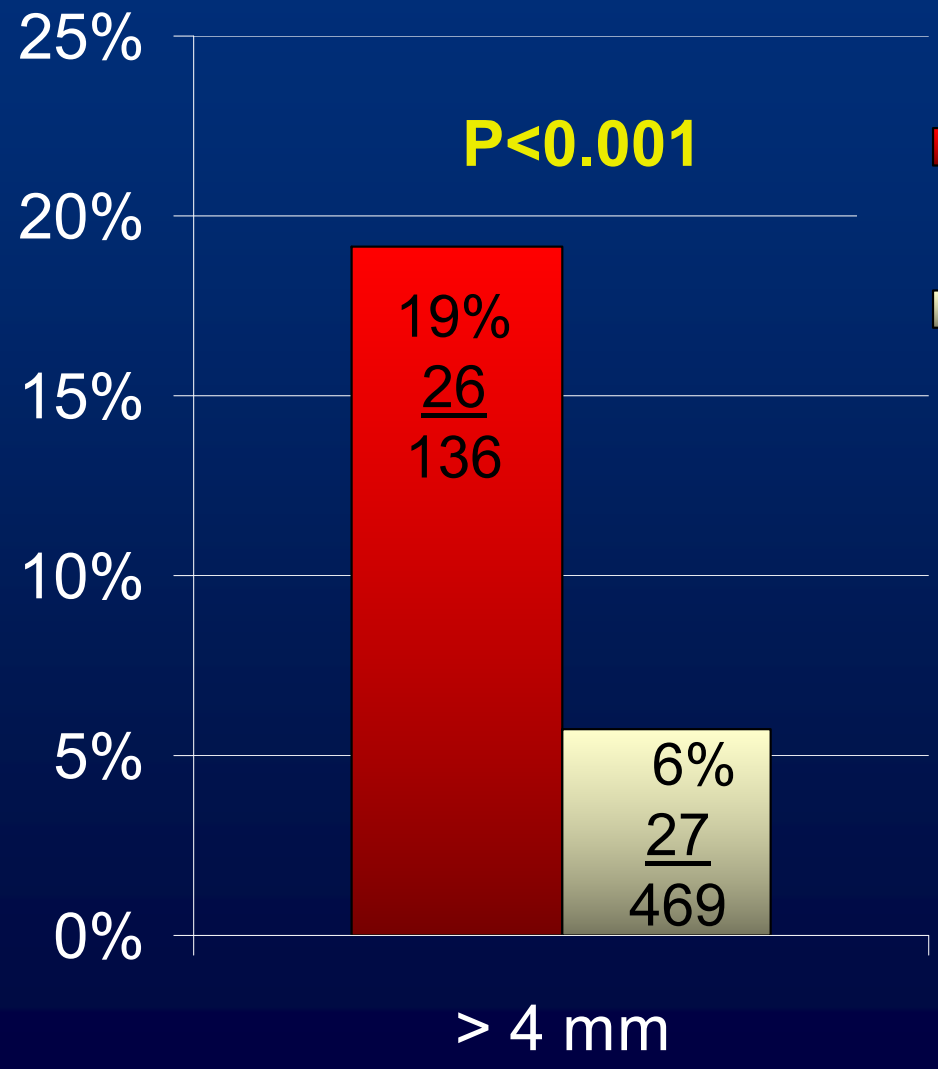
Severe Malposition Most Common at T3-T8



T3-T8

All Other Levels

Odds ratio for malposition T3-8: 3.9 (2.2-6.9).

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Discussion

Rate of freehand pedicle screw malposition:

- *Ughwanagho, 2012 (intraop CT, AIS):*
  9% of screws with breaches of > 4mm

Regions of pediatric pedicle screw malposition:

- Privitera et al., 2013: 14% in upper construct (esp. T1, T2) vs. 8% overall
- Larson, Santos, Polly et al., 2012 (CT-navigated screws, intraoperative revision): 4-10% rate in upper thoracic spine (T2-T8, 29/434) 6.7% vs. 1.2% (7/550)
- Current study: 19% rate T3-T8 vs. 6% (OR 3.9)

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Conclusions

- Similar rates of severe malposition for coronal deformity and non-deformity patients
- More medial compared to lateral breeches in deformity patients
- T3-T8: Nearly 4x higher rate of screw malposition using free hand technique
  - Consider additional measures at these levels
    - Additional fluoroscopy
    - Extra vigilance for trainees
    - Navigation/Check-spin

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