

Coronal Imbalance in Adult Spinal Deformity Patients That Develop Proximal Junctional Failure

Colan JA, Adida S, Hudson JS, Legarreta A, McCarthy D, Fernández-de Thomas R, Shanahan RM, Jawad-Makki MAH, Agarwal N, Okonkwo DO, Hamilton DK, Buell TJ

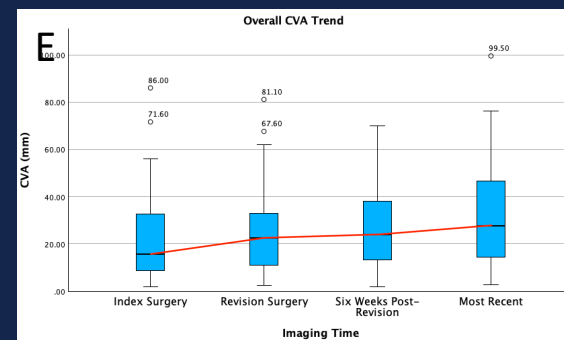
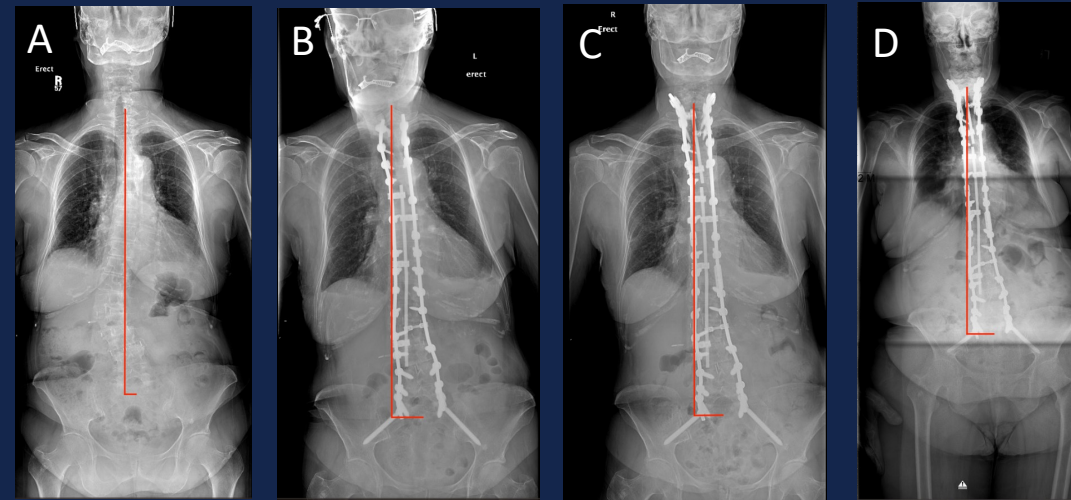
Introduction

- Long-segment fusion is utilized to treat symptomatic adult spinal deformity (ASD) but is associated with high rates of complications.¹
- Proximal junctional kyphosis (PJK) is a radiographic finding that occurs at the proximal junction between fused and mobile spinal segments with incidence rates as high as 46%.²
- PJK can lead to proximal junctional failure (PJF) which entails vertebral fracture, disruption of the posterior ligamentous complex, and/or instrumentation failure with neurological deficit.³
- This study aims to investigate the coronal plane after ASD surgery and the progression of PJK/PJF.

Methods

A retrospective review of 1180 ASD patients who underwent surgical correction at a single institution (2009-2021) was performed. Inclusion criteria included a diagnosis of PJF following posterior instrumented fusion to the pelvis and deformity in the sagittal/coronal plane. Fifty-four patients met the inclusion criteria. Patients were then divided into three groups based on the location of their uppermost instrumented vertebra (UIV): upper thoracic (UT, T2-T6, n=10), lower thoracic (LT, T8-T11, n=35), and lumbar spine (L, L1-L3, n=9). Radiographic parameters, including the major scoliotic curve (MSC), coronal and sagittal proximal junctional angle (cPJA/sPJA), and the coronal and sagittal C7 vertical angles (CVA/SVA), were recorded before primary surgery, before revision surgery for failure, and at both 6-week and final follow-up following revision.

Results



Location of UIV	Upper	Lower	Lumbar
	Thoracic	Thoracic	
Coronal			
Δ CVA (mm)	3.96 (19.85)	-1.34 (21.91)	7.12 (7.91)
Δ cPJA°	1.6 (1.14)	1.6 (3.91)	8.0 (8.72)
Δ MSC°	-10.0 (3.39)	-13.4 (9.48)	-5.4 (17.01)
Sagittal			
Δ SVA (mm)	-42.8 (86.8)	15.9 (38.4)	48.6 (58.5)
Δ sPJA°	19.1 (11)	14.8 (4.0)	16 (9.0)

Figure 1: Standing Radiographs of PJF with a progressive coronal imbalance from index surgery (A), revision surgery (B), six weeks post-revision (C), and at final follow-up (D). A graph displays an overall trend of increasing CVA across all UIVs following long-segment fusion (E).

Conclusion

In this study, patients with a UIV in the lumbar spine had more coronal tilt and sagittal imbalance following revision surgery for PJF than patients with a UIV in the upper thoracic and lower thoracic spine. Further investigation is warranted of proximal junctional pathology and its implications on coronal plane deformity progression.

References

1. Diebo BG, Shah NV, Boachie-Adjei O, Zhu F, Rothenfluh DA, Paulino CB, Schwab FJ, Lafage V. Adult spinal deformity. *Lancet*. 2019 Jul 13;394(10193):160-172. doi: 10.1016/S0140-6736(19)31125-0. Epub 2019 Jul 11. PMID: 31305254.
2. Hart RA, McCarthy I, Ames CP, Shaffrey CI, Hamilton DK, Hostin R. Proximal junctional kyphosis and proximal junctional failure. *Neurosurg Clin N Am*. Apr 2013;24(2):213-8.
3. Hostin, Richard MD*, International Spine Study Group et al. Incidence, Mode, and Location of Acute Proximal Junctional Failures After Surgical Treatment of Adult Spinal Deformity. *Spine* 38(12):p 1008-1015, May 20, 2013.