Can Proximal Junctional Angles on Discharge Radiographs Predict Junctional Complications? A Decision Tree Analysis with 2-Year Minimum Follow Up

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INTRODUCTION:
Proximal junctional complications often present on a spectrum ranging from an early increase in the proximal junctional angle (proximal junctional kyphosis [PJK]) to severe junctional collapse (proximal junctional failure [PJF]). Past studies have shown that many cases of PJK occur even before the first postsurgical follow up. Predischarge radiographs may be used to identify patients at risk for PJK before the proximal junctional cascade has begun. Purpose of the present analysis was to determine if standing predischarge radiographs can be used to predict the development of PJK after correction of adult spinal deformity (ASD).

METHODS:
This analysis is a retrospective review of 117 ASD patients who underwent posterior-only fusion of the lumbar spine (≥5 levels, LIV pelvis) at one institution (2013-2020). All patients underwent full-length standing radiographs before hospital discharge. Patients were stratified into 3 mutually exclusive groups: No PJK, PJK, or PJF. Upper instrumented vertebrae (UIV) were classified as upper or lower thoracic (UT above T8, LT T8 or below). Chi-square automatic interaction detection (CHAID) decision tree analysis was utilized to identify predischarge proximal junctional angle (PJA) thresholds associated with increased risk of PJK or PJF. Outcomes measure were 2-year radiographic PJK (Glattes’s criteria) and PJF (proximal junctional angle [PJA]>28° and ΔPJA >22° or revision for PJK before 2 years).

RESULTS:
The study cohort had a mean age 65.8±8.5, BMI 27.2±4.9, PI-L3 23.3±17.4, TPA 27.2±11.5. Mean preoperative discharge change was -24.5±15.2° PI-L3 and -14.5±9.7° TPA (all p <0.001). Stratification of the sample by outcomes of interested revealed 64 (54.7%) No PJK, 39 (33.3%) PJK, 14 (12.0%) PJF. No differences were detected between cohorts in discharge alignment, preoperative discharge change, or offset from age-adjusted alignment targets (p>0.005). Decision tree analysis showed that the first branch point depends on the UIV. Namely, most patients with an UT UIV will not develop PJK or PJF (no PJK, 31, 67.4%). For patients with an LT UIV, a second branch point occurred based on the ΔPJA. 89.5% of LT patients with a ΔPJA < 4.3° should remain free of radiographic PJK and PJF. The third branch point occurred based on the PJA at discharge. For patients with an LT UIV, ΔPJA ≥4.3°, and PJA<15.5, 55.3% develop radiographic PJF, but only 7.9% develop PJF. The highest risk group was comprised of ΔPJA ≥4.3° and PJA > 15.5°, as 57.1% of will develop PJF and 28.6% radiographic PJF.

DISCUSSION AND CONCLUSION:
Most patients with a lower thoracic UIV, ΔPJA ≥4.3°, and PJA > 15.5° develop PJF. Considering that most proximal junctional complications occur before 6 weeks, bracing or earlier follow up may be warranted in this cohort.