Mechanical Failure in Adult Cervical Deformity Patients: Analysis of Clinical and Radiographic Outcomes in Patients with Ten-Year Follow Up

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INTRODUCTION: Mechanical complications may present a serious and debilitating risk to patients undergoing cervical deformity (CD) surgery. However, there is a paucity of current literature describing the rates, outcomes, and predictors of mechanical complications and failure beyond the two-year mark.

METHODS: Operative CD patients ≥18yrs with pre-(BL) and up to ten-year (10Y) postop radiographic/HRQL data were assessed. Patients were categorized as having suffered mechanical failure (Failed) or not (Not Failed) at any point after index surgery. Patients were further stratified by failure within 2Y or between 5-10Y post-op. Mechanical failure was defined as: instrumentation failure (rod fracture, screw failure), boney failure, pseudoarthrosis, or junctional failure [DJK, or DJK requiring reoperation (DJF)]. Differences in demographics, radiographic parameters, and complication rates were assessed via means comparison analyses. Conditional backstep binary regression analysis was used to identify predictive factors for mechanical failure. Conditional inference tree (CIT) determined thresholds for significant predictors.

RESULTS: 86 CD pts met inclusion criteria (59.55 \pm 10.19yrs, 66%F, BMI:28.03 \pm 7.28kg/m2). 10.6% of patients underwent 3-column osteotomy. By 10Y post-op, 19 (22%) of patients experienced mechanical failure in the observed cohort, with 11.6% (n=10) of Failed patients suffering instrumentation failure. At BL, Failed patients were more likely to have a prior history of neurological disorders or obesity (BMI > 30 kg/m2) (both p<.001), but were otherwise equivalent in BL radiographic markers (all p>.05). Furthermore, Failed patients were significantly more likely to present as Frail (p=.040) or SF (p=.021). However, Failed patients did report significantly worse BL NSR Neck pain scores (p<.001) compared to Not Failed patients. Surgically, Failed patients were more likely to undergo combined approach (p=.023), especially if severely frail (p<.001). BMP use and total dose was noted to be significantly higher in the junctional failure cohort (both p<.001).

DISCUSSION AND CONCLUSION: Instrumentation failure in the absence of junctional failure in cervical deformity surgery remains exceedingly rare. Furthermore, while patients with mechanical failure demonstrate increased reoperation rates overall, rates do not differ significantly between patients with instrumentation versus junctional failure. Predictive modeling revealed increased BMI, increased osteotomy grades, and severe baseline cervical radiographic parameters to be synergistically associated with mechanical failure within two years of surgery.