## Cost-Benefit of Enhanced Recovery After Surgery Protocols in Adult Spine Deformity surgery

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INTRODUCTION: Enhanced Recovery After Surgery (ERAS) has been shown to accelerate patient recovery while reducing costs and maintaining high-quality patient care. The long-term effects after implementation in adult spine deformity (ASD) patients remains under-studied.

METHODS: Patients ≥18yrs undergoing thoracolumbar fusion with complete pre-(BL) and up to 5-year(5Y) radiographic and clinical outcome data were stratified by enrollment in an ERAS protocol (ERAS+ vs ERAS-). Differences in demographics, clinical outcomes, radiographic alignment parameters, peri-operative factors and complication rates were assessed via means comparison analysis. Logistic regression analysed differences while controlling for baseline disability and deformity. Quality gained was calculated from ODI to SF-6D and translated to quality-adjusted life years (QALYs). Cost was calculated using the PearlDiver database and CMS definitions for complications and comorbidities.

RESULTS: 477 patients were included (Age: 59.9 ± 14.4 years, BMI: 27.0 ± 5.5 kg/m2, CCI: 1.64 ± 1.67). 81% of patients were female. 40% of patients were ERAS+. At baseline, ERAS+ patients were older (66.6 vs 60.6 years, $p<0.001$), had higher BMI (28.8 vs 26.8, $p=0.004$) and had worse deformity (PI-LL 22.8 vs 14.8, $p=0.001$, and GAP score 8.9 vs 7.6, $p=0.009$). There were no significant differences in HRQLs at BL. Controlling for baseline deformity and BMI, ERAS+ patients were less likely to experience mechanical complications (OR 0.48, 95% CI: 0.23-0.99, $p=0.049$). HRQL metrics were similar between groups at all timepoints. At 2 years, ERAS+ had lower overall cost ($78,599 vs $88,535, $p=0.034$), but equivocal QALYs gained compared to ERAS- (0.174 vs 0.171, $p=0.897$). ERAS+ patients also had lower reoperation rates at 2 years (9.3 vs 23.5%, $p=0.023$). Although less likely to be influenced by ERAS protocols, ERAS+ patients followed up at 5 years still demonstrated lower overall costs ($73,781 vs $84,228, $p=0.032$), lower reoperation rates (9.3% vs 23.5%, $p=0.023$) and lower reoperation costs ($8675 vs $18,834, $p=0.012$); despite similar clinical outcomes between both groups.

DISCUSSION AND CONCLUSION: Although ERAS impact is predominantly studied in the peri-operative period, the long-term effects are worth considering. Despite worse baseline deformity, ERAS+ patients achieved similar functional outcomes to ERAS- patients, with lower reoperation rates and lower overall costs at 2 years. It is also worth noting that some ASD patients may not be suitable candidate for ERAS based on neurological deficits and functional decline.