

Financial Impact of Complications in Adult Spinal Deformity Surgery: Cost Effectiveness Analysis of Outcomes

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INTRODUCTION:

Adult spinal deformity (ASD) corrective surgery is often a highly invasive procedure with the potential for immediate and long-term complications. However, long-term cost impact of each complication has yet to be assessed. This study sought to identify cost effectiveness of complications on patient's perioperative course after ASD corrective surgery.

METHODS: Operative ASD patients (scoliosis >20, SVA>5cm, PT>25, or TK>60) ≥18 years with 2 year data were included. Surgical costs, including cost of complications, were calculated based on 2021 average Medicare reimbursement by CPT code. Complications occurred within 2 years postoperatively and were divided in major and minor groups according to patient response. Complications included: mechanical (rod fracture, rod dislocation, screw breakage, interbody dislocation, pseudoarthrosis), medical (cardiopulmonary, gastrointestinal, infection), PJK/PJF, mechanical combined, revision. Patients were ranked into tertiles by surgical cost for each group. Highest tertiles were propensity score matched (PSMd) to account for differences in baseline age and deformity. *Smith et al Best Clinical Outcome (BCO)* defined as: ODI <15 and SRS-Total score >4.5. Multivariable logistic regressions controlling for invasiveness assessed outcomes with complications groups compared to without complication and achievement of BCO.

RESULTS:

A total of 474 (59.9±14.7yrs, 27.3±5.3kg/m², CCI: 1.63±1.6, FI: 3.12±1.65) were included. After PSM, 237 patients remained in each group with an average reimbursement (Table 1). PSMd groups had similar demographics and baseline deformity (all p>.05). By 2 years, complication rates: 46% ≥1 complication, 18% major, 26% required reoperation. Average cost for index surgery was \$30,553.34. Reoperation (\$56,352.84), any mechanical complication (\$52,325.07), and PJF (\$58,620) were the highest cost contributors within 2 years of index surgery (all p<.05). Similarly, those with lowest cost utility were Cardiopulmonary (\$119,988.32), any mechanical (\$129,197.71), and reoperation (\$140,181.19), indicating importance of cardiac optimization preoperatively. Complications with the highest cost utility were implant related: Rod Fracture (\$21,988.28), Screw Breakage (\$29,115.46), further indicating the complexity of complication deters from overall utility. Compared to without complication, odds of MCID in ODI were 48.6% lower across groups (OR: 0.51 [.280, .945], p=.032). Any mechanical complication had worsening MCID achievement in 2-year follow up (69% vs. 20%, p=0.06). Those with PJK had 57% lower odds of BCO (33% vs. 54%, OR: .33, [0.2, 0.9] p= 0.023). Development into PJF further negated with 97% lower odds (OR: 0.071, [.006, .866], p=.038), with similar odds for those with pseudoarthrosis (OR: .12, p=.029). Similarly, rod dislocation negatively impacted rates of BCO (40% vs. 15.2%, p=.029). Out of medical complications, cardiopulmonary had the lowest odds of BCO (OR: .25, [1.74, 2.18], p<.001), followed by infection (OR: .43, [1.17, 2.98], p<.001).

DISCUSSION AND CONCLUSION: Mechanical complications had the single greatest impact on cost-utility after adult spinal deformity surgery, but less so after two years. Understanding the cost-utility of specific interventions at certain timepoints may mitigate economic burden, thus focusing effort on prophylaxis against mechanical and alignment-based complications.