Perioperative Outcomes and Cost Effectiveness of Robotic Minimally Invasive Adult Spine Surgery

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INTRODUCTION: Adult spine surgery has undergone major advancements with the increasing use of robotic assistance and navigation. As robotically assisted surgery becomes a greater part of surgical technique, it is important to examine clinical, surgical, and cost outcomes for those undergoing minimally invasive spine surgery through robotically assisted intraoperative navigation and screw usage.

METHODS: Inclusion criteria were minimally invasive spine fusion patients >18yrs with complete baseline (BL) and perioperative (90d) radiographic/HRQL data. Patients were grouped by utilization of robotic assistance: Robotic vs. Non-Robotic. ANCOVA and logistic regressions were utilized to assess differences in outcomes, including complications, reoperations, and HQRLs, while accounting for covariates as appropriate. Utility data was calculated using ODI converted to SF-6D using published conversion methods. QALYs utilized a 3% discount rate to account for residual decline to life expectancy (78.7 years). Complications, comorbidities (CC), major complications, and comorbidities (MCC) were assessed according to CMS.gov manual definitions.

RESULTS: 122 minimally invasive spine patients (Age: 56.1±11.4 years, 48% female, BMI: 31.6±6.72 kg/m2, CCI: 2.68±1.41) included. 66% of patients (n=81) underwent Robotic surgery, 34% Non-Robotic. There are no significant differences in baseline age, gender, and BMI between groups. However, robotic patients had significantly lower CCI compared to non-robotic patients (2.12 vs. 1.72, p<.001). Surgically, robotic patients had significantly lower EBL (1524ml vs 2252mL, p=.023). Robotics were found to be 46.6% less likely to have complications overall (21.4% vs. 37.9%, OR: .544 [3.33, 8.28] p=.016). They also had lower odds of reoperations (OR: .68 [1.23, 5.55] p <.005), and readmissions (OR:.75 [2.53, 3.98], p=.035) within 90 days. Mean cost at 90 days postoperatively was $31,101 for Non-Robotic vs. $27,243 for Robotic patients, with mean QALYs gained being greater for Robotic patients (0.53 for Non-Robotic patients vs. 0.66 for Robotic). This equated to mean cost utility at 90 days to be lower for non-robotic patients: $195,456 for Non-Robotic vs. $153,787 Robotic.

DISCUSSION AND CONCLUSION: Patients undergoing minimally invasive robotic surgery demonstrated lower odds of readmission and reoperation compared to their non-robotic counterparts. These outcomes suggest that use of robotic assistance in thoracolumbar spine surgery has the potential to minimize patient complications in the perioperative period and improve cost effectiveness.