The Effect of Preoperative Rehabilitation on Adult Spinal Deformity Patient Outcomes, Patient Recovery Kinetics, and Cost Effectivenes

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INTRODUCTION: Adult spinal deformity (ASD) is a debilitating disorder of the lumbar and thoracic spine that significantly impacts patient quality of life. Surgical correction is a proven treatment option that provides functional restoration and pain relief. Preoperative rehabilitation programs have recently been implemented to prepare patients for surgery and to promote patient health. The purpose of this study was to identify the effect of preoperative rehabilitation on surgical ASD patient outcomes.

METHODS: ASD patients with baseline (BL) and two-year (2Y) follow-up were included if they had preoperative rehabilitation data. Patients were divided into 2 groups: those who had preoperative rehabilitation (Prehab+) and those who did not (Prehab-). Prehab consisted of physical and mental components. Patients were excluded if they presented with any of the following at BL: severe neurological deficit (< 3/5), minimal ambulation, or current depression/anxiety. Normalized HRQL scores at BL and follow-up intervals (6W, 1Y, 2Y) were generated. Normalized HRQLs were plotted and area under the curve was calculated, generating one number describing overall recovery (Integrated Health State [IHS]). Cost was calculated using the PearlDiver database. Cost per Quality-Adjusted Life Year (QALY) at 2Y were calculated. Means comparison tests and Multivariable regression analysis assessed patient reported outcomes and cost adjusting for baseline and surgical characteristics.

RESULTS: The study included 464 patients, with 186 in the preoperative rehabilitation group (Prehab+) and 278 in the non-rehabilitation group (Prehab-). Prehab+ patients were older (65.5 ± 11.8 vs. 57.2 ± 14.9 years; $p < 0.001$), had a higher Charlson Comorbidity Index (CCI) (2.2 ± 1.7 vs. 1.5 ± 1.6; $p < 0.001$), and a higher BMI (28.4 ± 6.0 vs. 26.2 ± 5.0; $p < 0.001$). They also exhibited higher rates of comorbidities such as hypertension, arthritis, and diabetes compared to the Prehab- group. Despite these differences, Prehab+ patients achieved significantly better outcomes.

Prehab+ patients had shorter lengths of stay (LOS) (7.0 ± 4.3 vs. 7.8 ± 4.1 days; $p = 0.045$) and lower estimated blood loss (1177.0 ± 1325.3 ml vs. 1532.8 ± 1410.7 ml; $p = 0.006$). Transfusion rates were also lower in the Prehab+ group (54% vs. 67%; $p = 0.003$). Early discharge was more common in the Prehab+ group, with significantly more patients discharged within three days (13.0% vs. 3.2%; $p < 0.001$). SICU admission rates were lower in Prehab+ patients (51.6% vs. 65.4%; $p = 0.003$).

Prehab+ patients had a lower rate of overall complications (69.9% vs. 78.4%; $p = 0.038$) and medical complications (16.7% vs. 24.8%; $p = 0.036$). The reoperation rate was significantly reduced in the Prehab+ group (18.3% vs. 33.5%; $p < 0.001$). Multivariate analysis confirmed that Prehab+ patients had a lower risk of complications (OR: 0.6; 95% CI: 0.42–0.87; $p = 0.035$) and reoperation (OR: 0.38; 95% CI: 0.24–0.61; $p < 0.001$).

Prehab+ patients also demonstrated superior health-related quality of life (HRQL) outcomes at two years, including higher rates of achieving the minimal clinically important difference (MCID) in SF-36 PCS at 6 weeks (42.9% vs. 15.1%; $p = 0.003$) and SRS-22r total score at one year (OR: 3.11; 95% CI: 1.16–8.4; $p = 0.024$). Cost-effectiveness analysis revealed that Prehab+ patients had a lower cost per QALY at two years ($14,463 vs. $45,515; $p < 0.05$).

DISCUSSION AND CONCLUSION: Preoperative rehabilitation appears to be significantly associated with a shorter length of stay, better reported clinical outcomes, greater utility gained, costs by procedure and cost effectiveness at two-year follow-up following adult spinal deformity surgery