Minimally Invasive Approach Associated With Lower Resource Utilization And Lower Cost After Valve Surgery

Objective
To investigate the effect of minimally invasive surgery (MIS) on resource utilization, cost, and other postoperative outcomes in patients undergoing left heart valve operations.

Method
Data were prospectively collected and retrospectively reviewed for all patients undergoing single valve surgery (aortic valve replacement, mitral valve replacement, mitral valve repair) at a single center from 2018–2021. Patients were stratified by surgical approach: MIS vs. full sternotomy (FS). Baseline characteristics and postoperative outcomes were compared using Mann-Whitney U tests or Fisher's exact tests and reported as medians and interquartile ranges [IQR] or frequencies and proportions with \( p < 0.05 \). Primary outcome was high resource utilization (HRU), defined as (1) direct procedure cost in the highest quartile (2) either postoperative LOS > 7 days or 30-day readmission. Secondary outcomes were length of stay (LOS), 30-day readmission, operative mortality, and major morbidity.

Results
Of 588 patients included in the study, 383 (65.1%) underwent MIS and 205 (34.9%) underwent FS. Of the MIS cohort, all utilized a multimodal ERAS protocol and 233 (60.8%) had right mini thoracotomies. There were more females and patient with lower BMIs undergoing MIS. The MIS group contained a significantly lower proportion of patients in the HRU category: the MIS group underwent fewer operations with a direct cost higher than the 75th percentile ($35.8k) compared to the FS group (16.5% vs. 41.0%; \( p < 0.001 \)). The MIS group also contained fewer patients with either a postoperative LOS > 7 days or readmission within 30 days (26.6% vs. 51.7%; \( p < 0.001 \)). Median LOS was shorter in the MIS group (4 days vs 6 days; \( p < 0.001 \)). Median direct cost was also lower in the MIS group when compared to the FS group ($23,000 vs. $32,300; \( p < 0.001 \)) (Fig. 1a-c). Postoperative complications such as atrial fibrillation, bleeding requiring reoperation, in-hospital mortality, hospital readmission, ICU readmission, reintubation, renal failure, stroke, 30-day mortality, and pneumonia showed no significant difference between the MIS and sternotomy groups (Fig. 1d). MIS patients were also more likely to undergo on-table extubation and less likely to receive intraoperative and postoperative transfusions.

Conclusion
Left-heart valve surgery via MIS approach correlated with lower rates of HRU and lower direct cost relative to full sternotomy with no concomitant increase in postoperative complication rate.

Figure 1 Comparison of (a) high-resource utilization, (b) postoperative length of stay, (c) total direct costs, and (d) postoperative complications, mortality, and readmission for patients undergoing minimally invasive versus full sternotomy operations for single valve operations (aortic valve replacement, mitral valve replacement, mitral valve repair).