

Predictive Value of the 5-Item Modified Frailty Index in High-Complexity Thoracolumbar Spine Surgery

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Introduction

Frailty has emerged as a key determinant of postoperative outcomes in spine surgery, yet its predictive performance in patients undergoing high-complexity thoracolumbar procedures remains insufficiently characterized. This study evaluated the predictive validity and clinical utility of the 5-item Modified Frailty Index (mFI-5) for major postoperative complications in high-complexity spine surgery.

Materials and Methods

A retrospective cohort study was conducted, including adult patients undergoing high-complexity thoracolumbosacral spine surgery at a tertiary referral center between 2017 and 2020. Frailty was assessed using the American College of Surgeons mFI-5. The primary outcome was the occurrence of a major postoperative complication within 90 days, graded according to the Clavien-Dindo classification. Surgical complexity was classified based on procedural invasiveness and technical demands. Predictive performance was assessed through discrimination (AUROC), calibration testing, and diagnostic accuracy for the predefined cutoff of $\text{mFI-5} \geq 2$.

Results

Among 125 included patients, 23 (18.4%) developed major complications after a high-complexity procedure. The mFI-5 showed acceptable discrimination (AUROC: 0.75; 95% CI: 0.65–0.85). Complication rates increased progressively across frailty categories, from 4.4% in patients with mFI-0 to 15.6% in those with mFI-1 and 40.0% in those with $\text{mFI} \geq 2$. Ordinal regression confirmed a significant increase in complication risk per frailty category (OR: 3.73; 95% CI: 1.85–7.53; $p < 0.001$). Calibration metrics indicated adequate model fit. Using the predefined cutoff ≥ 2 , specificity was 79.4%, and the negative predictive value was 90.2%.

Conclusion

The mFI-5 provides clinically meaningful risk stratification in high-complexity thoracolumbar spine surgery and may be particularly useful for identifying lower-risk surgical candidates. Prospective multicenter validation is warranted.