

## Frailty is a Vital Tool for Predicting Outcomes Following Prophylactic Femur Fixation

Omar Sbaih, Victor Koltenyuk, Nithin Kumar Gupta, Lindsey C Dixon, Vikram Singh Gill, Mallory Ogburn, Tyler Kade Williamson<sup>1</sup>, Robert H Quinn, Joseph F Alderete

<sup>1</sup>Orthopaedic Surgery

**INTRODUCTION:** The number of frail patients requiring surgical management for metastatic bone disease is rapidly rising, with prophylactic fixation indicated to minimize risk of future fracture. The role of this study is to characterize the relationship between frailty and postoperative outcomes in patients undergoing prophylactic femoral fixation (ProphFF) and compare the predictive ability of different frailty measures for adverse outcomes in this population.

**METHODS:** National database data from 2015-2021 was utilized. The study focused on patients aged  $\geq 18$  years undergoing ProphFF and those undergoing pathologic femoral fixation (PathFF). Frailty was measured using both the revised Risk Analysis Index (RAI-rev) and the five-factor modified Frailty Index (mFI-5). Primary outcomes included 30-day mortality, major complications, unplanned readmission, and unplanned reoperation, non-home discharge, and extended length of stay. Propensity score matching was employed to adjust for baseline differences of age, BMI, sex, functional status, and ASA between ProphFF and PathFF groups. Statistical methods included multivariable logistic regression and receiver operating characteristic curve analysis to evaluate the relationships between frailty measures and postoperative outcomes.

**RESULTS:** A total of 921 patients (57.7% female, median age 65 years [IQR 56–72]) undergoing ProphFF or PathFF were included. Multivariable analysis demonstrated that increasing frailty increased odds of 30-day mortality, with each 1-point increase in RAI-rev and mFI-5 associated with a 5% (OR: 1.05, 95% CI: 1.01–1.08;  $p < 0.01$ ) and 31% (OR: 1.31, 95% CI: 1.01–1.71;  $p < 0.05$ ) higher mortality risk, respectively. Propensity score-matching resulted in 842 patients (421 prophylactic and 421 pathologic). Patients undergoing PathFF had higher likelihood of mortality compared to patients undergoing ProphFF (OR: 2.79, 95% CI: 1.61–4.82;  $p < 0.01$ ). RAI-rev (C-statistic 0.73 [95% CI 0.71–0.75]) had superior discrimination for mortality compared with mFI-5 (C-statistic 0.57 [95% CI 0.54–0.59],  $p < 0.001$ ).

**DISCUSSION AND CONCLUSION:** Increasing preoperative frailty scores, particularly as measured by the revised Risk Analysis Index, were independent predictors of mortality and morbidity in patients undergoing prophylactic femur fixation. Pathologic fracture fixation demonstrated higher risk of reoperation and mortality compared to prophylactic fixation. These findings suggest that the RAI-rev may be a valuable tool for identifying high-risk patients and optimizing surgical candidate selection prior to prophylactic femur fixation, potentially improving outcomes in this complex patient population.

Variable	Mortality	Major Complication	Minor Complication	Reoperation	Readmission
Pathologic vs. Prophylactic	2.79 (1.61–4.82)**	1.49 (0.85–2.61)	1.36 (0.98–1.88)	2.80 (1.16–6.72)**	1.19 (0.81–1.75)

- indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$

**Table 4. Univariate analysis odds ratios for pathologic vs prophylactic fixation and postoperative outcomes for patients in the ACS NSQIP database after propensity score matching (2015–2020)**