The Risk Analysis Index is Superior to the Modified 5-Factor Frailty Index for Predicting 30-Day Mortality Following Arthroplasty for Femoral Neck Fractures

Ethan Parisier, Victor Koltenyuk, Nithin Kumar Gupta[1], Lucy Wang, Jack Weick[2], Anthony Perugini[2]
[1]Department of Orthopaedic Surgery, [2]Department of Orthopaedic Trauma and Reconstructive Surgery

INTRODUCTION:

With the aging United States population increasing proportionately to the general population, the incidence of femoral neck fractures has risen dramatically. Despite advances in perioperative and intraoperative management, one-year mortality remains high at approximately 30%. To improve outcomes, preoperative risk stratification tools, such as frailty assessments like the Modified Five-Factor Frailty Index (mFI-5) or the Risk analysis Index (RAI), may be critical in evaluating peri/postoperative needs for high-risk patients. The goal of this study was to evaluate the utility of frailty as measured by the Risk Analysis Index (RAI) and 5-Item Modified Frailty Index (mFI-5) for predicting 30-day mortality in patients undergoing hemiarthroplasty (HA) or total hip arthroplasty (THA) for femoral neck fractures.

METHODS:

The ACS-NSQIP database was queried from 2015 to 2020 for patients 18 or older undergoing HA or THA for femoral neck fractures. The primary outcome was 30-day mortality. Secondary outcomes included unplanned readmissions, unplanned reoperations, extended length of stay, and major complications within 30 days. Multivariate regression was used to evaluate predictive value, and a receiver operating curve was used to assess the accuracy of frailty, respectively.

RESULTS:

A total of 14,913 patients with surgically managed femoral neck fractures were included in this study (HA = 9,372 and THA = 5,541). As defined by the RAI frailty tier, 2,400 patients were robust, 5,794 were normal, 7,039 were frail, and 1,308 were very frail. As defined by the mFI-5 frailty tier, 4,045 patients were robust, 6,425 were prefrail, 3,537 were frail, and 906 were severely frail. In patients undergoing THA, when stratified by RAI frailty group, there were 1,654 (27.6%) Robust patients, 2,496 (41.7%) Normal, 1,658 (27.7%) Frail, and 183 (3.05%) Very Frail patients . Stratification by mFI-5 score demonstrated 2,007 (36.2%) Nonfrail patients, 2,326 (41.9%) Prefrail, 1,006 (18.2%) Frail, and 202 (3.6%) Severely Frail. In patients undergoing HA, when stratified by RAI frailty group, there were 746 (7.07%) Robust patients, 3,298 (31.3%) Normal, 5,381 (51.0%) Frail, and 1,125 (10.7%) Very Frail patients. Stratification by mFI-5 score demonstrated 2,038 (21.7%) Nonfrail patients, 4,099 (43.7%) Prefrail, 2,531 (27.0%) Frail, and 704 (7.5%) Severely Frail.

Frailty as measured by mFI-5 and RAI was predictive of increased odds of 30-day mortality in HA (RAI = OR: 1.46, 95% CI: 1.31-1.64; mFI-5 = OR: 1.10 (1.08-1.12, p<0.001 for both)) and THA (RAI = OR: 1.15 (CI: 1.106-1.190, p<0.001), mFI-5 = OR: 1.50 (CI: 1.167-1.923, p = 0.002)). The RAI demonstrated superior risk discrimination when compared to the mFI-5 for THA (RAI = C-statistic: 0.84, 95% CI: 0.45-0.83 vs. mFI-5 = C-statistic: 0.69, 95% CI: 0.68-0.71) and HA (RAI = C-statistic: 0.74, 95% CI: 0.73-0.75 vs. mFI-5 = C-statistic: 0.62, 95% CI: 0.61-0.63).

DISCUSSION AND CONCLUSION:

In this cross-sectional study of a multicenter national database analyzing 14,913 patients, frailty, as measured by both the RAI and the mFI-5, was an independent predictor of 30-day mortality in patients with femoral neck fracture who underwent THA or HA. Notably, the RAI demonstrated greater odds of mortality with increasing frailty status when compared to the equivalent mFI-5 frailty group for both THA and HA. Further, the RAI was shown to have superior discriminatory ability compared to the mFI-5, achieving a clinically meaningful (C-statistic > 0.70) accuracy for both THA and HA. These findings support the utility of the RAI for preoperative risk assessment, which is crucial in the face of an aging population and rising incidence of femoral neck fractures. These findings show that the RAI is an accurate risk identification tool in these patients and may be a powerful method for gauging preoperative risk in patients undergoing hip arthroplasty for femoral neck fractures.