The Role of Preoperative Laboratory Values in Predicting 30-Day Mortality for Femoral Neck Fractures: An In-Depth Analysis
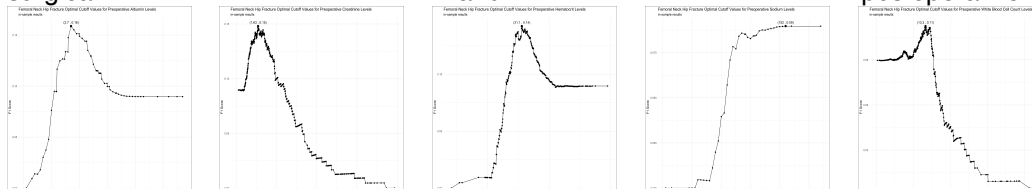
Ayomide Micheal Ayeni, Wesley J Manz, Jason Shah, Kevin Y Heo, George N Guild, Ajay Premkumar

INTRODUCTION: Hip fractures, particularly femoral neck fractures, carry significant morbidity and mortality, particularly among elderly women at higher risk. Surgical intervention is often necessary for these fractures and may lead to postoperative complications like deep vein thrombosis (DVT), pulmonary embolism (PE), and other serious deleterious outcomes. Predicting patients at heightened risk of adverse outcomes post-surgery using routine blood work results could significantly aid clinicians in tailoring perioperative management strategies, potentially improving patient outcomes and reducing healthcare costs. However, the specific preoperative laboratory values contributing to mortality are less defined and warrant further exploration. Given this context, the current study investigates the predictive value of preoperative laboratory parameters for 30-day mortality following femoral neck fractures to guide surgical decisions and postoperative care management.

METHODS: The study identified 29,826 patients who underwent procedures for femoral neck fractures using the National Surgical Quality Improvement Program (NSQIP). Preoperative lab results collected prior to surgery were analyzed after 1:4 propensity score matching and multiple logistic regressions, controlling for age, sex, American Society of Anesthesiologists (ASA) status, diabetes, smoking, and preoperative coagulation factors. Furthermore, optimal cutoffs were determined through ROC curve analysis and the F1 scoring method, evaluating the predictive power of hematocrit, white blood cell counts (WBC), albumin, creatinine, and sodium at various preoperative lab result thresholds. Mortality within 30 days after surgery served as the primary outcome of interest.

RESULTS: A total of 1,506 Patients experienced mortality. Hematocrit levels were inversely associated with mortality risk (OR=0.950, 95% CI: 0.937-0.963, p<0.001), with optimal cutoff values established at 31.1%. WBC counts, in contrast, displayed a positive correlation with mortality risk (OR=1.048, 95% CI: 1.029-1.067, p<0.001), with the most critical thresholds reached at a value of 13.3 (10^9/L). Albumin levels demonstrated a strong negative correlation with mortality risk (OR=0.489, 95% CI: 0.423-0.566, p<0.001), with the highest F1 score achieved at 2.7 g/dL. Creatinine levels were notably associated with an increased risk of mortality (OR=1.139, 95% CI: 1.070-1.210, p<0.001), with the highest F1 score reached at a cutoff value of 1.63 (mg/dL). Finally, sodium levels slightly increased the risk of mortality (OR=1.026, 95% CI: 1.007-1.045, p=0.006), with the most predictive lab value determined at 152 (mEq/L).

DISCUSSION AND CONCLUSION: This study provides meaningful insights into the predictive potential of preoperative laboratory values for 30-day postoperative mortality following femoral neck fractures. The findings demonstrate clinically significant relationships between hematocrit, WBC count, albumin, creatinine, and sodium levels and the risk of death. Importantly, each of these lab results was associated with a critical threshold value, beyond which the predictive power for mortality significantly increased. This elucidates a new understanding in preoperative patient stratification and tailoring of perioperative management. Future research should focus on validating these identified predictive markers in prospective cohorts, as well as exploring underlying mechanisms that could further explain these associations. Moreover, the development and implementation of a risk prediction tool incorporating these variables should be considered to guide surgical and postoperative care.