

Evaluation of International Normalized Ratio (INR) Thresholds for Complications in Hip Fractures Treated With Intramedullary Nailing: Analysis of 20,800 Cases

Jerry Y Du MD; Nikunj Trivedi MD; Noah Joseph MD; Isaac Lapite BA; Heather A Vallier MD; George Ochenjele MD

University Hospitals Cleveland Medical Center/ Metrohealth Medical Center, Cleveland, OH, United States

Purpose: In patients with elevated International Normalized Ratios (INRs) with hip fractures, the risks of delaying surgery for correction of INR are controversial. We examined the association of stratified preoperative INR values with postoperative complications following intramedullary nailing of hip fractures.

Methods: Using the National Surgical Quality Improvement Program (NSQIP) database, we retrospectively identified patients that underwent intramedullary nailing for hip fractures from 2005-2016. Patients with preoperative INR recorded ≤ 1 day prior to surgery were stratified. The primary outcomes of interest were postoperative bleeding requiring transfusion, surgical site infection, and 30-day mortality. Multivariate regression analysis was performed to adjust for potential confounding variables.

Results: There were 20,800 patients included in this analysis. Mean age of patients was 77.2 ± 10.7 years. There were 14,864 females (71.5%) and 5936 males (28.5%). There were 8591 patients with $INR \leq 1$ (41.3%), 9184 patients with $1 < INR \leq 1.25$ (44.2%), 1934 patients with $1.25 < INR \leq 1.5$ (9.3%), 823 patients with $1.5 < INR \leq 2.0$ (4.0%), and 268 patients with $INR > 2.0$ (1.3%). Adjusting for potential confounders, the INR cohorts $1.25 < INR \leq 1.5$ (adjusted odds ratio [aOR]: 1.95, $P < 0.001$) and $1.5 < INR \leq 2.0$ (aOR: 2.21, $P < 0.001$) were associated with increased mortality; however, the $INR > 2.0$ cohort was not associated with increased mortality ($P = 0.432$). Surgical delay over 48 hours was independently associated with increased mortality (aOR: 1.79, $P = 0.004$). INR cohorts $1.25 < INR \leq 1.5$ (aOR: 2.13, $P < 0.001$) and $1.5 < INR \leq 2.0$ (aOR: 1.84, $P = 0.031$) were associated with surgical delay > 48 hours. The $1.0 < INR \leq 1.25$ ($P = 0.188$) and $INR > 2.0$ ($P = 0.857$) cohorts were not associated with surgical delay > 48 hours. Elevated INR was associated with increased risk for sepsis/septic shock ($1.5 < INR \leq 2.0$ aOR: 2.01, $P = 0.017$; $INR > 2.0$ aOR: 2.65, $P = 0.026$) and cardiac arrest ($INR > 2.0$ aOR: 4.29, $P = 0.004$), while surgical delay > 48 hours was associated with increased risk for 30-day readmission (aOR: 1.43, $P = 0.047$), sepsis/septic shock (aOR: 2.49, $P < 0.001$), and pneumonia (aOR: 2.11, $P < 0.001$). Elevated INR was not associated with increased risk for transfusion or thromboembolic events.

Conclusion: We found that a preoperative INR value within 1 day of surgery between 1.25 and 2.0 was associated with increased risk of 30-day mortality and surgical delay > 48 hours, while an INR value > 2.0 was not at increased risk. Surgical delay > 48 hours was also associated with increased risk of 30-day mortality. Delaying surgery over 48 hours to further reverse INR values past an arbitrary threshold may be associated with increased risk of mortality and was not associated with decreased risk for transfusions or thromboembolic events. We recommend surgeons attempt INR reversal but not to delay intramedullary nail surgery for hip fractures past 48 hours.