

Predicting Deep Surgical Site Infections in High-Risk Tibial Plateau and Pilon Fracture: A Secondary Analysis of the VANCO Trial

Nathan N O'Hara; Renan C Castillo MD; Anthony R Carlini MS; Yanjie Huang MSc; Michael J Bosse MD; William T. Obrebsky MD; Joshua Layne Gary MD; Manjari Joshi MBBS; Robert V O'Toole MD; Vanco R METRC PhD

METRC, Baltimore, MD, United States

Purpose: Patients with tibial plateau and pilon fractures are known to be at a high risk for a surgical site infection (SSI). However, the factors that elevate the risk in this population are not well defined. The purpose of this study was to develop and internally validate a deep infection risk score for tibial plateau and pilon fracture patients.

Methods: This prognostic study utilized data from the VANCO trial, a randomized controlled trial of operative fixation of 980 tibial plateau and pilon fracture patients at high risk of infection (mean age, 46 years; standard deviation [SD], 14; 63% male). The primary outcome was a deep SSI that required operative debridement. We used Cox proportional hazard regression, with an initial model that included 14 candidate factors: age, sex, smoking status, insurance status, income, American Society of Anesthesiologists physical score, diabetes, hypertension, alcohol abuse, cardiac arrhythmia, fracture location, soft-tissue damage (Tscherne III or Gustilo-Anderson III), time (skin to skin) in the operating room, and tourniquet use. Backward stepwise modeling was used to select prognostic factors based on a minimum Akaike Information Criterion. We used 300 bootstrap repetitions to internally validate the model. A deep infection risk score was created with the final model, and its performance was evaluated based on discrimination (area under the curve [AUC]) and calibration (linear slope).

Results: The overall rate of a deep SSI at 6 months was 8.1% (95% confidence interval [CI]: 6.3 to 9.8). Our prognostic model determined that the risk of a deep SSI was increased with 3 factors: soft-tissue damage (hazard ratio [HR]: 2.8, 95% CI: 1.8 to 4.4), increased patient age (HR: 1.2 per decade, 95% CI: 1.0 to 1.4), and increased time in the operating room (OR) (HR: 1.04 per 15 minutes, 95% CI: 1.0 to 1.1). These findings were used to develop a risk score that assigned 25 points for a soft-tissue injury, 5 points for each decade of age, and 1 point for every 15 minutes of OR time. Scores of less than 30 had a 2% median risk of a deep SSI (interquartile range [IQR]: 1 to 5%). Scores between 30 and 40 had a 5% median risk of a deep SSI (IQR: 4 to 6%). Scores between 40 and 70 had an 11% median risk of a deep SSI (IQR: 10 to 13%). Score exceeding 70 had a 27% median risk of a deep SSI (IQR: 18 to 42%). Overall, the model was well calibrated (slope = 0.91) and had moderate discriminative ability (AUC = 0.67, 95% CI: 0.61 to 0.73).

Conclusion: Substantial soft-tissue damage, increased age, and a longer operative duration increased the risk of a deep SSI after plate and screw fixation of tibial plateau and pilon fractures. Surgeons may want to consider more aggressive infection prevention and wound surveillance strategies for these high-risk patients.