

**Postoperative Surgical-Site Infection in Femoral Shaft Fractures Treated with a Reamed Intramedullary Nail Is the Greatest Predictor of Nonunion**

*Joshua Michael Wallentin-Flores, MD; Kent Kraus, MD; Payton Keith Arnold, MS; Ishani Sharma, BA; Brian Mullis, MD; Roman Natoli, MD*

*Indiana University School of Medicine Department of Orthopaedic Surgery, Indianapolis, Indiana, UNITED STATES*

**Purpose:** Femoral nonunion has a debilitating effect on patient quality of life. The rate of femoral shaft nonunion is generally accepted to be in the 3% to 5% range. Although multiple risk factors have been identified for femoral nonunion after intramedullary nail (IMN) fixation, there is insufficient understanding to allow adequate prediction of nonunion. We investigated a constellation of patient and injury-specific risk factors, as well as potential surgeon-influenced risk factors, associated with nonunion.

**Methods:** We performed a retrospective case control study at 2 urban Level I trauma centers. 1137 patients with femoral shaft fractures treated with IMNs were identified. All 64 patients with nonunions were assessed; additionally, data were collected from 256 randomly selected patients who went on to union to form 1:4 cohorts. Risk factors including demographics, comorbidities, surgical treatment, and injury-related characteristics were evaluated through clinical notes and radiographs. A bivariate analysis was performed, and variables with significant associations ( $P < 0.05$ ) were included in a multivariate prediction model.

**Results:** The overall nonunion rate was 5.6% (64/1137). Bivariate analysis demonstrated a significant association between nonunion and presence of medial comminution ( $P = 0.006$ ), AO classification ( $P = 0.008$ ), Winquist classification ( $P < 0.001$ ), segmental defect ( $P < 0.001$ ), fracture distraction ( $P = 0.01$ ), Gustilo type ( $P = 0.002$ ), pulmonary injury ( $P = 0.04$ ), vascular injury ( $P = 0.03$ ), postoperative surgical-site infection (SSI) ( $P < 0.001$ ), and smoking status ( $P < 0.001$ ). In multivariate analysis, open fracture (odds ratio [OR] 2.39 [1.16-4.93,  $P = 0.02$ ]), tobacco use (OR 3.01 [1.62-5.58,  $P < 0.001$ ]), postoperative SSI (OR 7.52 [1.62-34.88,  $P = 0.01$ ]), and presence of any fracture distraction post-IMN (OR 2.81 [1.32-5.96,  $P = 0.007$ ]) remained significant risk factors for nonunion.

**Conclusion:** In our multivariate analysis, increased risk of femoral shaft nonunion was associated with open fracture, tobacco use, postoperative SSI, and fracture gap post-IMN. This information may help to establish a profile of those patients who require closer follow-up and, possibly, earlier intervention. Decreasing fracture gap and mitigating SSI risk are potentially surgeon-modifiable risk factors that can be addressed during the index procedure.