

**Risk Factors for Nonunion of Distal Femur Fractures**

*Ryan Cone, MD; Kyle Cichos, BS; Yvonne E. Chodaba, MD; Alexander Roszman, MD; Gerald McGwin, MS, PhD; Clay A. Spitler, MD*  
*University of Alabama Birmingham Medical Center, Birmingham, AL, United States*

**Purpose:** Distal femur fracture are challenging injuries and represent a significant source of patient morbidity. In some series, treatment with lateral locked plating (LLP) has high rates of nonunion, and with a paucity of clinical data on intramedullary nailing (IMN), there is continued debate over the optimal construct choice in the treatment of distal femur fractures. The purpose of this study was to identify patient comorbidities, injury characteristics, fixation constructs, and construct variables that are associated with increased risk of distal femur nonunion.

**Methods:** After IRB approval was obtained, a retrospective review of all OTA 33A and 33C distal femur fractures over a 17-year period (2004-2020) was performed at a single Level I trauma center. Minimum 6-month follow-up was required and all periprosthetic fractures were excluded. Nonunion was defined as a return to the operating room for management of inadequate bony healing with persistent pain and or broken implants. The nonunion group included staged bone grafting of segmental bone defects. Patient demographics, comorbidities, injury characteristics, fixation type, and construct variables were assessed for association with distal femur fracture nonunion.

**Results:** A total of 439 patients were identified who met inclusion criteria. There were no differences in age, sex, mechanism of injury, ISS, and time to surgery between the groups. Increased body mass index ( $P = 0.01$ ), open fracture ( $P < 0.0001$ ), and postoperative infection ( $P < 0.0001$ ) were associated with nonunion. AO/OTA 33C2 and 33C3 fractures had higher rates of nonunion (14.7% and 24.8% respectively,  $P = 0.0002$ ) than other fracture types. There was a significant difference in nonunion rate based on implant type favoring nail + plate and retrograde IMN over titanium and stainless steel lateral locked plating (3.0% vs 7.1% vs 15.8% vs 20%,  $P = 0.0002$ ) in spite of similar fracture characteristics between the groups. There was no difference in nonunion rate based on implant metallurgy (titanium 12.7% vs stainless steel 23.5%,  $P = 0.248$ ), and no difference in average plate length (11 vs 11,  $P = 0.86$ ).

**Conclusion:** In spite of similar fracture complexity in both groups, articular fixation and the use of an intramedullary nail or a nail / plate construct led to significantly lower rates of distal femoral nonunion than lateral locked plating. Obesity, increasing fracture complexity (AO 33C2 and 33C3), and open fracture also carry a significantly increased rate of fracture nonunion. Plate metallurgy and plate length do not appear to play a role in the development of nonunion.