

**Predicting Need for Bone Grafting for Tibial Nonunion Due to Traumatic Bone Defects**

**Michael A. Quacinella, DO**; Jacquelyn S. Pennings, PhD; Paul Tornetta, III, MD, PhD, FIOTA; Saam Morshed, MD, PhD; Joseph R. Hsu, MD; Katherine Frey, PhD; Renan C. Castillo, MD; Michael J. Bosse, MD; William T. Obremsky, MD, MPH, FIOTA; and METRC

**Purpose:** This study evaluates the individual magnitude of cortical bone loss as well as the mean radiographic apparent bone gap (RABG) in predicting bone graft (BG) in open tibia shaft fractures with traumatic bone loss and an intramedullary nail (IMN).

**Methods:** This was a secondary analysis of a retrospective review of open tibia fractures with IMN and bone defect (BD) >1 cm and ≥50% of tibia circumference in adult patients at 18 Level I trauma centers. Radiographs assessed BD on the 4 tibial cortices, and BGs >90 days were considered necessary due to a nonunion. Logistic regression models were used to analyze BD size variables, summarized in different ways to predict need for BG.

**Results:** 121 tibias were identified. 43 (35.5%) had a BG and 78 (64.5%) did not. Median sizes of anterior, posterior, medial, and lateral BDs were 2.1 cm. 56 (46.3%) had all 4 cortices involved, 32 (26.4%) had 3, 30 (24.8%) had 2, and 3 (2.5%) had 1. Significant odds ratio (OR) findings for needing a BG included: a 7.3x increase if there were 4 defects >1 cm (OR = 7.3, 95% confidence interval [CI] = 2.7-19.6, P<0.001) and 2.4x increase when the RABG defect is >2.5 cm (OR = 2.4, 95% CI = 1.1-5.2, P = 0.031). Significant OR findings for decreased risk of needing a BG included a 3.3x decrease if at least 2 defects were <1 cm (OR = 3.3, 95% CI = 1.5-7.2, P = 0.002), and a 2.9x decrease when at least 1 defect was 0 cm (OR = 2.9, 95% CI = 1.3-6.2, P = 0.008).

**Conclusion:** Defect size and cortical involvement percentage can predict nonunion and the subsequent need for BG in tibial fractures with BD. Four cortices with defects >1 cm and mean RABG >2.5 cm have increased risk for a BG. There is decreased risk when 2 cortices are <1 cm or 1 cortex has no BD.