

Treatment of Bone Defects in Open Tibia Fractures Treated with an Intramedullary Nail

William Obremskey, MD; Paul Tornetta, III, MD; Saam Morshed, MD, PhD; Robert V. O'Toole, MD; Joseph R. Hsu, MD; Ellen MacKenzie, PhD; Katherine Frey, MPH; Michael Bosse, MD; Jason Luly, MS; Major Extremity Trauma Research Consortium METRC Consortium (multiple study sites)

Purpose: This investigation intended to evaluate a cohort of patients with bone loss after open tibia fractures. We also test a definition of a critical size defect (> 2.5 cm mean) with respect to secondary grafting and major secondary procedures to the aprioi definition of > 1 cm and $> 50\%$ cortical loss up to 2.5 cm.

Methods: 18 centers reported patients ≥ 18 yo with open tibia fractures (OTA 42) with an IMN over 5 years. Data was tabulated for patients with a bone defect of > 1 cm and $\geq 50\%$ cortical loss. Patients were followed for 13 months. Secondary procedures including bone graft, revision fixation, and flap coverage were modeled to estimate the number of expected secondary procedures. This analysis was performed for the group as a whole and also for those with and without a defect (>2.5 cm). Complications were analyzed using Kaplan Meier analysis. Union was assessed using the mean modified RUST (mRUST) score for 3 surgeons. An mRUST score of > 9.5 has been validated as a reliable assessment of union. 123 had a final X-Ray for the mRUST.

Results: 132 patients, age 36 ± 14 with a mean defect size of 2.6 ± 1.9 cm were followed for 302 ± 89 days. 31% had flap coverage. 34% had a defect > 2.5 cm (avg 4.5 ± 1.9 cm) and the other 87 did not (avg $1.6 \pm .57$ cm). Some type of grafting was performed in 48% patients at an average of 119 ± 95 days after definitive fixation. Grafts used were autograft alone (44%), autograft with allograft with or without orthobiologics (41%), and allograft alone (11%). 40% grafts used an orthobiologic. PMMA was used in only 16% of cases. The expected number of procedures was 1.45 (95% CI: 1.12 – 1.85) and 1.02 (95% CI: 0.81 - 1.25) for those with and without defects > 2.5 cm, respectively. The risks of complications by 13 months were: infection 14%, amputation 7%, and flap failure 12%. Grafts were used in 58% of those with a defect (> 2.5 cm average) and 42% of those without ($p=0.1$). Mean mRUST scores were 10.7 for all groups.

Conclusion: This high risk group had 31% requiring flap coverage; salvage was possible in 93% with a 14% infection and 12% flap failure rate. A variety of grafting material was utilized. The expected secondary surgery events within 12 months was higher for the larger defects (1.45 vs 1.02; $p=0.03$). In patients who had a defect (>2.5 cm mean of four cortices) only 58% had a graft of some kind. 42% of patients with a defect using the criteria (> 1 cm and $> 50\%$ diameter to < 2.5 cm) had a bone graft in the first year.