

Evaluating the Efficacy of Small Caliber Intramedullary Nails for Tibial Shaft Fractures

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INTRODUCTION:

Tibial shaft fractures are commonly treated with intramedullary nail (IMN) fixation. Previous work has reported that the use of a 10mm or greater nail diameter many improve clinical outcomes, but the rational for this is unclear. We hypothesized that small-caliber nails (SCN) (diameter 8 or 9 mm) are equally effective compared to large-caliber nails (LCN) (diameter > 10 mm) in the treatment of tibia fractures, with regard to union rate, restoration of alignment, and reoperation rates.

METHODS:

A retrospective study of patients with tibial shaft fractures who received IMNs was conducted at a single Level 1 trauma center. Patient characteristics included age, sex, body mass index (BMI), smoking status, and other comorbidities. IMN diameters were collected, along with occurrences of nonunion, malunion, and revision surgeries. Radiographic parameters including residual fracture angulation and translation in both the sagittal and coronal planes were measured on postoperative and final follow-up films. Finally, the mechanical axis of the tibia was also measured at the same timepoints.

RESULTS:

There were 103 patients included in the study (Average age: 44.8, BMI: 29.1, 47.6% female, 50.5% with smoking history, average follow-up length: 6.0 months). Sixty-four (62.1%) patients had an SCN versus 39 (37.9%) with an LCN.

The nonunion rates for patients with treated with SCN versus LCN were not significantly different (5 patients (7.8%) versus 6 patients (15.4%); $p=0.2$). Rates of revision surgery were also not significantly different (6 patients with an SCN (9.4%) versus 7 patients with an LCN (17.9%); $p = 0.2$).

Residual displacement and fracture angulation in the sagittal plane were higher for the SCN cohort (1.8mm vs. 1.5mm; $p<0.05$ and 1.7° versus 1.3° ; $p<0.05$). Increased angular deformity was noted among the SCN cohort, as measured by deviation from the normal mechanical axis (3.4° versus 3.1° ; $p<0.05$). Residual displacement and fracture displacement in the coronal plane were not different (1.8 mm vs. 1.5 mm; $p<0.05$ and 1.7° vs. 1.3° ; $p<0.05$).

DISCUSSION AND CONCLUSION:

Nonunion rates, revision rates, and coronal alignment were not significantly different between patients treated with small caliber and large caliber IMNs for tibial shaft fractures. The large caliber nail group had better alignment in the sagittal plane.

Table 1: Evaluating differences in radiographic outcomes between small-caliber versus large-caliber nails for tibial shaft fractures at final follow-up.

Outcome	Small-Caliber Nails	Large-Caliber Nails	P-Value
Nonunion	5 patients (7.8%)	6 patients (15.4%)	0.2
Revision Surgery	6 patients (9.4%)	7 patients (17.9%)	0.2
Coronal Fracture Displacement / Angulation	1.3 mm / 1.5°	1.9 mm / 1.4°	0.1 / 0.1
Sagittal Fracture Displacement / Angulation	1.8 mm / 1.7°	1.5 mm / 1.3°	<0.05 / <0.05
Deviation from Neutral Mechanical Axis (Varus)	3.4°	3.1°	<0.05