

Risk Factors for Failure of Repair of Diaphyseal Tibial Nonunions: A Retrospective Cohort Study of 108 Patients

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Purpose: To determine rates and risk factors for additional nonunion surgery and final radiographic healing following diaphyseal tibial nonunion repair.

Methods: All consecutive patients aged ≥ 18 years who underwent diaphyseal (AO/OTA 42) tibial nonunion repair with (exchange) intramedullary nailing (IMN) or open reduction and internal fixation (ORIF) between 2004 and 2024 with ≥ 6 months follow-up. The primary outcome was the rate of additional nonunion surgery. The secondary outcome was radiographic healing (defined as Modified Radiographic Union Score for Tibia [mRUST] ≥ 11) at final follow-up. Multivariable logistic regression was used to identify patient, nonunion, and treatment characteristics associated with additional nonunion surgery.

Results: A total of 108 patients were included (70% male; median age 42 years, range 28–53 years). Sixty patients (56%) were treated with IMN, including 53 (49%) with exchange IMN, and 48 (44%) with ORIF. Autograft was used in 39 patients (36%) and bone graft substitutes in 21 (19%). Twenty-seven patients (25%, 95% CI: 17%–33%) required additional nonunion surgery, of whom 5 (4.6%, 95% CI: 0.65%–8.6%) ultimately underwent amputation. In multivariable analysis, current smoking (OR: 4.28, 95% CI: 1.36–14.7, $p=0.015$), initial open fracture (OR: 3.94, 95% CI: 1.11–16.9, $p=0.045$), and the presence of a bone defect (OR: 9.20, 95% CI: 3.12–29.9, $p<0.001$) were associated with increased odds of additional nonunion surgery, while debridement was associated with reduced odds (OR: 0.30, 95% CI: 0.09–0.89, $p=0.038$). The final radiographic healing rate was 90%.

Conclusion: 1 in 4 patients required additional surgery for persistent nonunion and 1 in 25 ultimately underwent amputation. Initial open fractures, the presence of a bone defect, and current smoking were independently associated with treatment failure. These findings highlight the importance of smoking cessation prior to nonunion repair and adequate soft-tissue and bone defect management. Overall, 90% of patients achieved radiographic healing.