

The Association of 3-Month Radiographic Union Score for Tibia Fractures (RUST) With Nonunion in Tibial Shaft Fracture Patients

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Purpose: Nonunions of tibial shaft fractures have profound implications on patient quality of life, and are associated with physical and mental suffering. The Radiographic Union Score for Tibia Fractures (RUST) may serve as an important prognostic tool for identifying patients at high risk of nonunion. Using data from the Study to Prospectively Evaluate Reamed Intramedullary Nails in Patients with Tibial Fractures (SPRINT) and the Fluid Lavage of Open Wounds (FLOW) trial, we wished to explore the association of 3-month RUST scores with nonunion in patients with tibial shaft fractures treated with intramedullary nailing.

Methods: We performed a retrospective cohort study nested within 2 multi-center, randomized controlled trials. The patients included in the current study: (1) sustained a tibial shaft fracture and were enrolled in the SPRINT or FLOW randomized trials, (2) had initial operative management with intramedullary nailing, (3) showed radiographic evidence of an unhealed fracture at 3-month follow-up, and (4) their healing status (union or nonunion) was captured at 12-months postoperatively. Multivariable binary logistic regression was carried out to identify factors associated with nonunion including open versus closed injury, fracture severity, fracture gap, and 3-month RUST score. We determined the concordance statistic (c statistic) for our regression model both with and without the RUST score.

Results: Of the 155 tibial fracture patients with complete data available for analysis, the overall rate of nonunion at 12 months was 30% (n = 47). The mean 3-month RUST score in patients with nonunion at 12 months was 4.8 (standard deviation [SD] 1.1) compared to 6.3 (SD 1.7) for those healed at 12 months. In our multivariable regression analysis, open fractures conferred 5-fold greater odds of nonunion at 12 months compared to closed fractures (odds ratio [OR] 4.76, 95% confidence interval [CI]: 1.71-13.30). Furthermore, 3-month RUST scores of <4 and 5-6 were associated with a 15-fold and 6-fold greater odds of nonunion compared to a score of ≥ 7 , respectively (RUST <4: OR 15.49, 95% CI: 4.42-54.33; RUST 5-6: OR 5.70, 95% CI: 1.73-18.75). The addition of RUST scores to our adjusted regression model improved the c statistic from 0.70 (95% CI: 0.61-0.79) to 0.81 (95% CI: 0.74-0.88).

Conclusion: A third of patients with tibial shaft fractures who have failed to heal by 3 months will show nonunion at 1 year. Open fractures and lower 3-month RUST scores are associated with higher risk of nonunion at 1 year. Further research is needed to establish whether prognosis in this high-risk group can be modified.