

Can a Tibia Shaft Nonunion Be Predicted at Initial Fixation? Applying the Nonunion Risk Determination (NURD) Score to the SPRINT Trial Database

Gerard P. Slobogean, MD¹; Kevin O'Halloran, MD²; Nathan O'Hara, MHA³; Renan Castillo, PhD⁴; Sheila Sprague, PhD⁵; Mohit Bhandari, MD, FRCSC, PhD⁶; Robert V. O'Toole, MD²; SPRINT Investigators⁷

¹University of Maryland, Baltimore, Maryland, USA;

²University of Maryland, Shock Trauma Center, Baltimore, Maryland, USA;

³University of Maryland School of Medicine, Baltimore, Maryland, USA;

⁴Johns Hopkins School of Public Health, Baltimore, Maryland, USA;

⁵McMaster University, Ontario, CANADA;

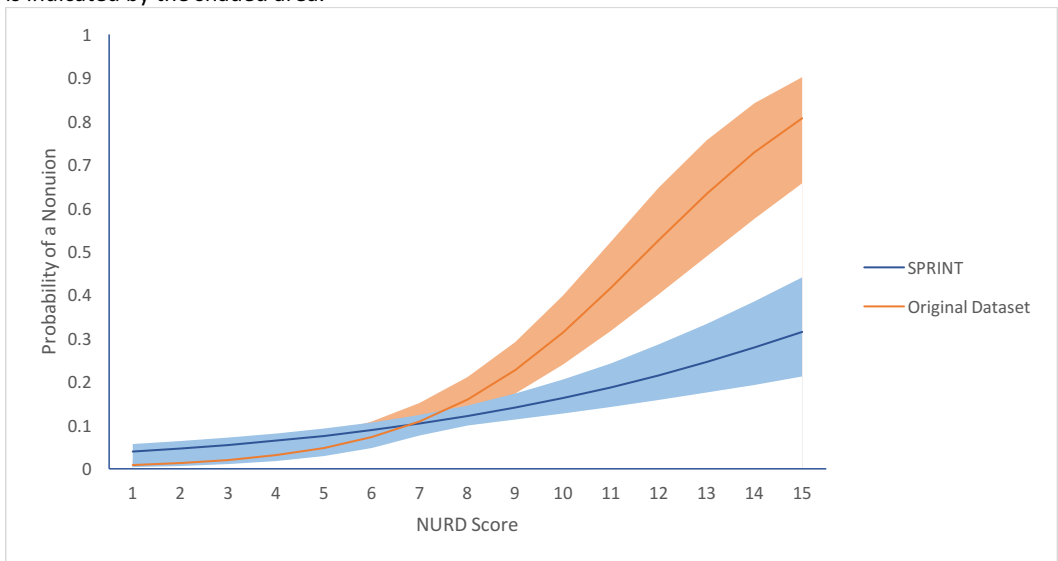
⁶MacOrtho Research, Ontario, CANADA;

⁷Shock Trauma Baltimore, Maryland, USA

Background/Purpose: The Nonunion Risk Determination (NURD) score was developed using a cohort of 376 patients to reliably predict tibia shaft nonunions at the time of initial intramedullary nail fixation. The scoring system was developed in a single Level I trauma center and assigns points based on seven commonly collected variables: American Society of Anesthesiologists (ASA) score, percent cortical contact, male gender, open fractures, chronic disease status, compartment syndrome, and use of flap. Points are subtracted for spiral fractures and low-energy fractures. The purpose of this study was to compare NURD scores of patients in the original cohort to the 1226 patients included in the SPRINT (Study to Prospectively Evaluate Reamed Intramedullary Nails in Tibial Fractures) multicenter trial to determine the predictive accuracy of the tool.

Methods: Patients with no cortical contact were excluded from both data sets. The charac-

Figure 1 Probability of a tibia shaft nonunion for a given NURD score. A 95% confidence interval is indicated by the shaded area.



The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.

teristics of patients in the two data sets were compared using X2 tests. Receiver operating characteristic (ROC) curves were used to calculate the probability with confidence intervals of a nonunion as predicted by a NURD score in each of the two data sets. The mean difference of the probabilities was compared at each scoring increment using t tests.

Results: Despite the patient characteristics differing ($P < 0.05$) in almost every scoring variable including ASA score, cortical contact of 100% and 25%, open fractures, chronic disease status, the use of flaps, spiral fractures, and low energy, the NURD score has similar predictive probability in the two data sets. 83% of the original sample population and 88% of the SPRINT data set had NURD scores of 8 or less. The difference in the probability of a nonunion remained less than 4% within that range (Fig. 1). In NURD scores of 9 or greater, patients in the original data set had a substantially higher probability of a nonunion ($P < 0.001$).

Conclusion: The NURD score demonstrates high predictability in the majority of the SPRINT cohort. Overall the SPRINT data set had a much lower nonunion rate (8.6% vs 14.6%, $P = 0.001$) and a smaller proportion of their sample in the higher ranges of the NURD score (12% vs 17%, $P = 0.02$). Comparisons at the upper ranges of the NURD score highlights the increased variability in predicting nonunions when a multitude of risk factors are present in tibia shaft fracture patients.