

Progression of Healing Using RUST: Can We Eliminate The Cost of Early Radiographs?

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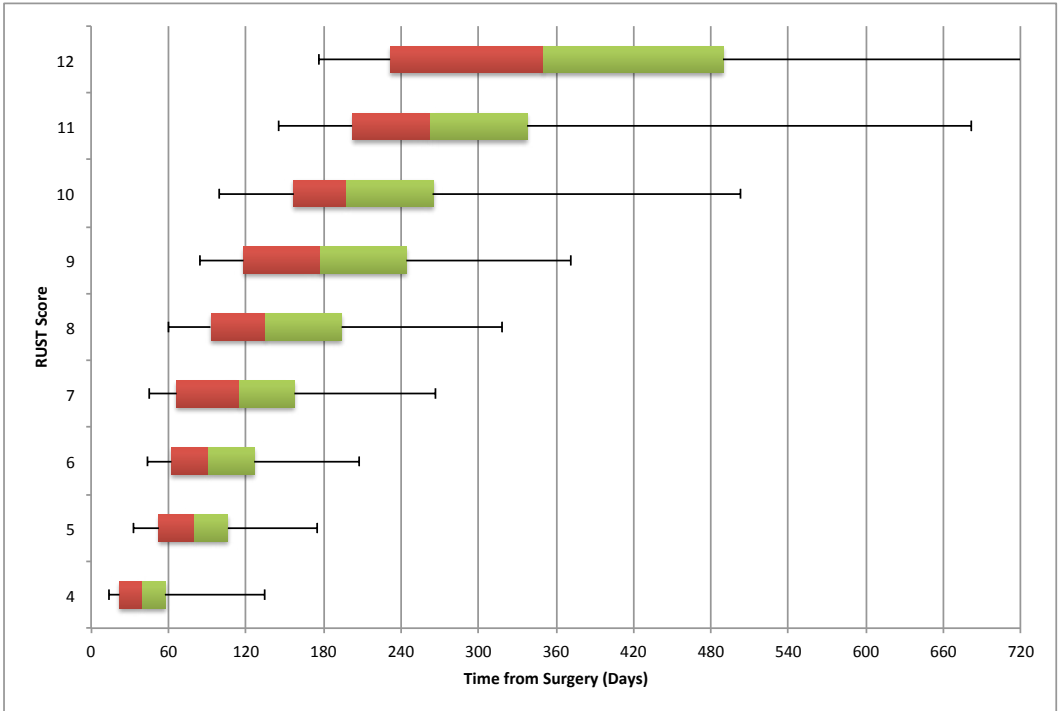
Background/Purpose: Assessment of radiographic healing for patients with tibial shaft fractures treated with intramedullary nailing remains a challenge and the ideal timing of postoperative radiographs is unknown. The Radiographic Union Score for Tibial fractures (RUST) has been popularized and demonstrates a higher intra- and interobserver reliability than prior radiographic grading systems for evaluation of union. Furthermore, studies have shown a correlation between RUST score and clinical outcome measures during healing. The purpose of this study was to report the progression of RUST scores after tibial nailing in a large sample of patients. We hypothesized that few patients would show signs of radiographic healing before 8 weeks after surgery and few would be healed (defined as RUST score of 9 based on recent studies) within 3 months after surgery. Therefore, routine postoperative radiographs may be unnecessary during the early follow-up period.

Methods: A retrospective review was performed of all tibial shaft fractures treated with intramedullary nailing at our institution from 2006-2013, a total of 604 fractures in 598 patients. Exclusion criteria were inaccessible imaging, age <18 years, definitive treatment delay >7 days, pathologic or stress fracture, or nonunion repair. Of the 480 remaining fractures, 185 had at least 6 months of radiographic follow-up and were included in the study. Baseline demographic, injury, and surgical data were collected for each patient. RUST scores were then determined for each set of follow-up radiographs. Descriptive statistics were utilized to analyze the median and variability of postoperative RUST scores.

Results: The average age was 43.7 years (range, 18-87), 47% were open fractures, and 6% were associated with compartment syndrome. Five patients in our series underwent early reoperation, three for infection and two for malalignment. In all cases the indication for reoperation was apparent on physical examination or immediate postoperative radiographs. No hardware failure was identified on follow-up radiographs within the first 3 months. The graph shows the 5th percentile, lower quartile, median, upper quartile, and 95th percentile of time from surgery for each RUST score. The 5th percentile for "any healing" (RUST = 5) was 33 days and the median time for "any healing" was 78 days. The 5th percentile and median for "healed" (RUST = 9) were 84 days and 182 days, respectively. The median time to "complete healing" (RUST = 12) was 355 days.

Conclusion: Based on RUST scores, very little radiographic healing was observed within the first 3 months after nailing and the median time to radiographic healing was approximately 6 months. Complete radiographic healing took approximately 1 year. Based on these results we are reconsidering the utility of postoperative radiographs within the first 3 months in the absence of clinical concerns such as new trauma, clinical malalignment, or infection. Little

radiographic fracture healing occurred in this time frame, no hardware failure was identified, and all early reoperations in our series were based on data from a physical examination or immediate postoperative imaging. At a list price of \$306 per study at our institution (technical and professional fees), eliminating these unnecessary radiographs would have saved an average of \$500 per patient.



PAPER ABSTRACTS