

Posttraumatic Osteoarthritis Risk Relative to Intra-Articular Calcaneal Fracture Severity

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Background/Purpose: Patients with high-energy intra-articular fractures (IAFs) face a significant risk of posttraumatic osteoarthritis (PTOA). Objective CT-based measures of fracture energy have been used to link fracture severity to PTOA risk following IAFs of the distal tibia but not the calcaneus. The Sanders classification is used as a prognostic marker for long-term clinical outcomes but has not been correlated with fracture energy. The purpose of this study was for the first time to objectively measure fracture energy in a series of calcaneal fractures and to establish the relationships between it and the Sanders classification, the quality of the surgical reduction, and clinical outcome in patients with intra-articular calcaneal fractures.

Methods: 18 patients with 19 IAFs of the calcaneus were consented for this IRB-approved study; they are the first to be analyzed from a series of 120 cases treated with percutaneous reduction and screw fixation that have been identified and are being followed. Preoperative CT scans were used to classify fractures according to Sanders et al and to assess their severity. Fracture severity was quantified by computing fracture energy using a CT-based image analysis methodology. Three experts independently measured the maximum articular stepoff from postoperative CT. PTOA development was graded using the Kellgren-Lawrence (KL) scale and outcomes were assessed with VAS (visual analog scale) pain scores for patients with >18-month follow-up. Because the measures to be compared mix ordinal and continuous values, agreement was assessed using concordance—the probability that the fracture energies correctly discriminate between pairs of Sanders classification and/or KL scores.

Results: The 19 calcaneal fractures analyzed for fracture severity ranged from Sanders class II to IV. Their fracture energies ranged from 12.3 to 24.5 J. A concordance of 0.75 was observed between Sanders classification and fracture energy. Ten patients with 11 IAFs were assessed for PTOA development, based on a follow-up time >18 months (range, 20-74 months) postinjury. There was a complex relationship observed between fracture energy, Sanders classification, articular stepoff, and KL grade. Interestingly, for those cases having an articular stepoff ≤ 2 mm, PTOA risk increased with fracture energy (Fig. 1). There was no such relationship observed between Sanders classification and KL grade.

Conclusion: The results suggest that fracture severity is more predictive of PTOA risk than is the Sanders classification. The residual articular stepoff is a likely confounder influencing PTOA risk when evaluating fracture energy versus KL grade. Due to a small sample size, statistical significance could not yet be conclusively established. These data suggest that higher initial injury severity as assessed by an objective metric could predict an increased risk of PTOA. This has implications for evaluation and treatment of calcaneal fractures with the aim of forestalling PTOA.

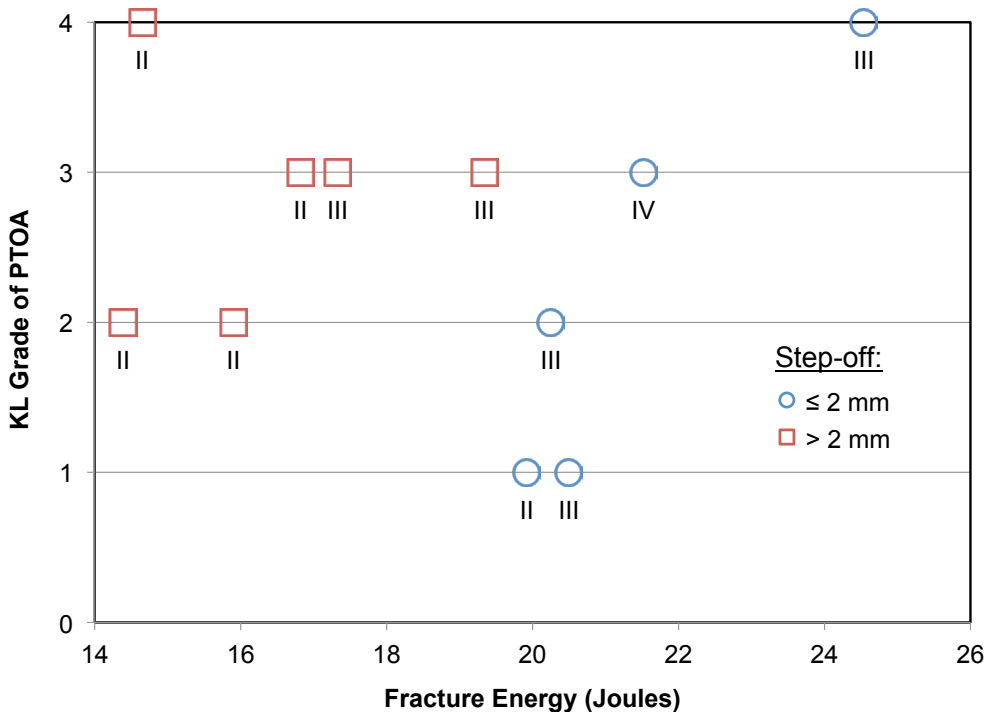


Figure 1. Fracture energy vs KL Grade. Labels below data points indicate the Sanders fracture classification.

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.