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# Quality of fracture reduction assessed by radiological parameters and its influence on functional results in patients with pilon fractures—A prospective multicentre study

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ABSTRACT

*Introduction:* The management of pilon fractures remains a challenging issue. Due to the complexity of factors that influence the outcome, it has been questioned if anatomical reductions of articular fracture are relevant. The lack of a commonly accepted assessment of quality of fracture reduction compounded the uncertainty of the importance of anatomical reduction in pilon fracture. The current study aimed to define parameters that can better assess the reduction quality and to investigate the influence of reduction quality on functional outcomes.

*Methods:* Patients with unilateral pilon fracture of the AO/OTA type 43-B or 43-C were consecutively recruited to the study and followed up for 2 years after surgery. Postoperative radiographs of the injured and the contralateral joints were evaluated and 13 radiological parameters measured by 2 independent surgeons. The reliability of the measurements for each parameter was assessed by the Intraclass Correlation Coefficient (ICC), and 4 parameters with the highest ICC scores were deemed most reliable and were selected for further analyses. Functional outcome was assessed by the Foot and Ankle Ability Measure (FAAM) for daily living and sports activities. The 4 most reliable radiologic parameters, together with 3 possible baseline confounders (age, AO/OTA fracture type, and open versus closed injury), were analysed using both univariable and multivariable analysis for their association with the FAAM scores. Secondary outcome measures including pain, ankle range of motion (ROM), quality of life (QoL), and adverse events were also reported.

*Results:* The length of lateral malleolus (LLM), anterior distal tibia angle, anterior talar shift, and length of medial malleolus scored highest on reliability in ICC assessment (ICC = 0.76, 0.72, 0.58, and 0.45, respectively). Only LLM exhibited statistical significant association with the 2-year FAAM results. At the 2-year follow-up, the injured joints on average achieved a ROM of 70.7% (95% CI = 63.9–77.6) when compared to the contralateral joints, and patients did not regain the pre-injury QoL overall.

*Conclusion:* The multivariable analysis showed that LLM (independent of age, AO/OTA fracture type, and open/closed injury) was a reliable indicator of reduction quality and a prognostic factor for patient outcome in pilon fracture surgery.



## Introduction

Pilon, pylon, or “tibial plafond” fractures are fractures of the distal tibia involving the weight bearing articular surface and the adjacent metaphysis. Pilon fractures occur in less than 1% of all

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fractures of the lower extremity [1,2], but due to the interpersonal variable anatomy, the often-complex fracture pattern including additional cartilage damage, and the delicate soft tissue envelope, management of these fractures remains a complex and challenging issue. Especially in high-energy fractures, anatomical reduction has not always been translated into good functional outcome [3–5]. Multiple factors, such as the fracture severity, quality of reduction, soft tissue involvement, and high versus low energy trauma, may greatly influence the final outcome. Some of these factors are so tightly linked that it's almost impossible to separate their effects currently. It is with this backdrop that clinicians argue if anatomical reduction of articular fractures is relevant or not [6].

There are no standard radiological parameters that surgeons use to assess the quality of fracture reduction after pilon fractures. A number of parameters have been published and were used as indicators of quality of reduction [5,7,8]. Categories such as good,

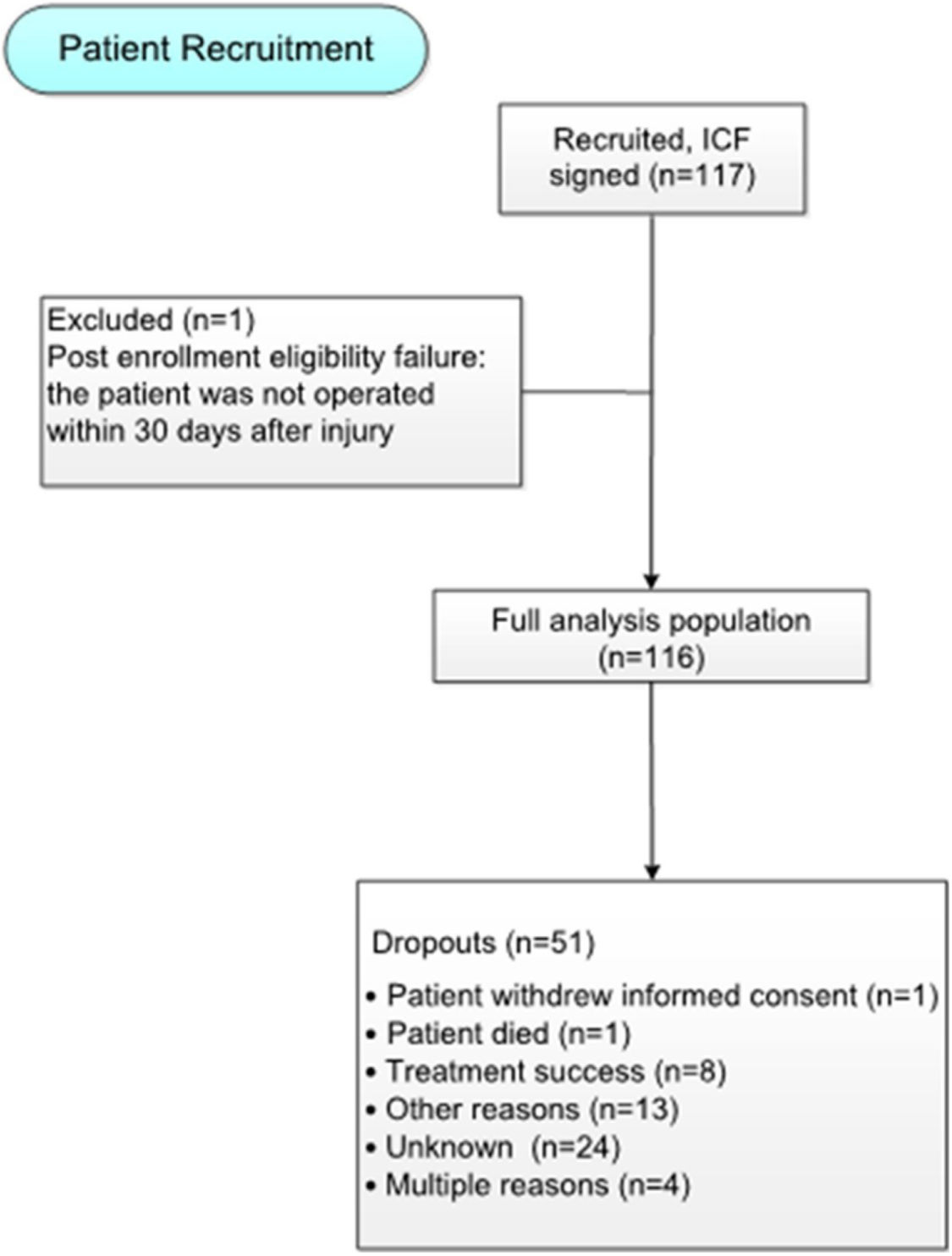


**Fig. 1.** A CONSORT (Consolidated Standards of Reporting Trials) diagram showing the flow of patients from recruitment through follow-up.

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