Tibial Plafond Fractures: Limited Incision Reduction with Percutaneous Fixation

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This study was a retrospective review of 18 patients with 19 pilon fractures treated with limited incision reduction and percutaneous plate fixation of the tibia. Patients were treated with either a 1- or 2-stage protocol. The latter consisted of placement of an external fixator followed by definitive reduction. The emphasis of analysis was placed on the identification of complications to the soft tissue envelope or bone-healing problems within the first 6 months after surgery. A major complication was defined as an unplanned operation within the first 6 months. Minor complications were any superficial wound defects that did not require operative intervention to resolve or any malunion or delayed union. With this protocol, no major complications were encountered. Minor complications were identified in 4 patients (4 fractures) of which 2 were minor wound problems. One patient developed a malunion, and the other had a delayed union. Four patients requested removal of prominent hardware. These results indicate that limited incision reduction and percutaneous plate fixation lead to safe methods of stabilization. The authors also provide guidance and strategies for the consistent execution of this technique. (The Journal of Foot & Ankle Surgery 46(4):261–269, 2007)

Key words: pilon fracture, limited incision, percutaneous, plafond

Fractures of the tibial plafond are complex injuries that are often associated with severe soft tissue injury. The character and pattern of skeletal injury vary depending on forces imparted to the distal tibia at the time of injury and can vary from simple rotational fracture patterns to severe articular comminution with metaphyseal defects and severe soft issue injury. This combination of osseous and soft tissue pathology creates an intellectual and technical challenge in treatment. Failure to appreciate the soft issue damage with any injury predictably leads to unforgiving complications. Historically, surgical management of the higher energy variety had significant complications (1–3), with a rate ranging from 10% to 55% (4–11). Ruedi and Allgower introduced the use of open reduction and internal fixation (ORIF) for tibial plafond fractures with good overall functional results (12). The results of their patients improved in a 9-year follow-up study (13). Because these were primarily low-energy injuries, they evaluated high-energy injuries in another study and found that the overall results were not as good as those in patients with lower-energy injuries (14). This suggests the severity of the injury and soft tissue damage predicts a less favorable prognosis. Other studies also showed good results with ORIF of tibial plafond fractures (5, 6, 15–17); however, contradictory studies were also published with poor results (7, 10, 18–20).

Although the outcomes are dependent on several factors, the optimal technique for surgical correction of more complicated pilon fractures remains controversial (4, 15, 21, 22). Surgical techniques such as limited ORIF, percutaneous reduction and fixation, and external fixation alone or in combination with internal fixation have been described with variable results (17, 23–29). Despite disagreement on the most appropriate surgical technique, these authors agree that the avoidance of soft tissue complications has to be a primary focus and factored into any surgical plan. Although anatomic reduction and stable fixation contribute to the final outcome, Watson et al found that treatment based on the degree of soft tissue compromise yielded better results (17). There is evidence to corroborate the notion that high-energy injuries generally predict a less favorable prognosis and higher risk of wound complications and infection (2, 3, 11, 22).

The ideal method of treatment would achieve excellent articular reduction and stability while minimizing soft tissue compromise and devascularization of the fracture fragments. To achieve this, a 2-stage protocol has been recommended, which consists of initial use of external fixation until the soft tissue envelope recovers sufficiently to allow for definitive ORIF of the tibia (1, 2, 22, 30–34). By means of this 2-stage protocol, some have transitioned from formal

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ORIF to a limited incisional approach for reduction (35, 36). The exposure required in this limited approach is only large enough to achieve reduction, thereby allowing for a direct approach over the fracture while maintaining the vascular soft tissue attachments to the periarticular fragments. In this study, a retrospective review was performed to evaluate the treatment of tibial plafond fractures with a modified staged protocol. We wanted to analyze the rate of complications of the soft tissue envelope to other approaches and the existing literature. In addition, we wanted to provide guidance for the consistent execution of the technique.

Patients and Methods

This review focuses on the identification of soft tissue complications in the short-term perioperative period. Patients who sustained pilon fractures that were treated with operative reduction and percutaneous delivery fixation were included in the study. Inclusion criteria were a limited or percutaneous incisional approach and percutaneous delivery of tibial fixation. Patients meeting these criteria who were operated on by 2 of the authors (J. M. S. and S. M. R.) over the past 3 years were retrospectively reviewed. All patients received their follow-up care with their respective surgeon.

Complications were defined as minor or major depending on the severity of the wound. Major complications were defined as events that required an unplanned operation as a direct result of morbidity from the fracture or the treatment method such as osteotomies for malunions or nonunions, deep infections, wounds requiring soft tissue coverage, and failures of fixation (10). All other events that did not require formal operative intervention such as superficial wounds and infections, and delayed or malunions were therefore considered minor local complications. These events were excerpted from the medical records by one of the authors (H. L. S.).

Treatment Protocol

Patients were evaluated in the emergency room where initial resuscitative maneuvers were performed if necessary. Primary assessment of the extremity was performed with respect to deformity, damage to soft tissue, and characterization of injury based on the mechanism. Open fractures were treated with emergent irrigation and debridement in the operating room. The primary indications for immediate external fixation were open fractures, grossly unstable fractures, significant shortening, and severe soft tissue damage (Fig 1, A). Two half pins were placed in the tibia above the zone of injury; 1 pin was placed in the midfoot or talus and another in the calcaneus, all from the medial side of the leg (Fig 1, B). Distal axial traction was applied across the ankle until the talus was directly under the axis of the tibia. Fluoroscopic control was used to assure proper length rotation and axial alignment (Fig 1, C). In the absence of open wounds, fracture blisters, significant shortening or instability, the injured extremity was immobilized in a short-leg, padded splint.

Thin-section computed tomography (CT) images were obtained after fixator placement to assist in incision placement and reconstruction. Definitive operative reduction was performed after sufficient time had elapsed for recovery of the soft tissue envelope. The latency between injury and definitive surgical treatment was determined by the surgeon, but was based on the recovery of the soft tissue envelope. In those cases without open wounds or blisters, resolution of ankle edema and return of skin lines were the most common determinants.

At the time of definitive reduction, the external fixator, if present, was removed. Fibular fractures were reduced and plated with a one-third tubular plate or reconstruction plate through an open or percutaneous technique. Attention was then directed to the distal tibial where the primary incision was made over the dominant fracture line as determined by CT scan (Fig 2). Exposure of the distal tibia and joint was done through the fracture corridor to minimize soft tissue dissection and maintain vital soft tissue attachments to periarticular fragments. The ankle capsule was not detached from the distal articular fragments unless absolutely necessary. The joint was reduced with manipulation through the dominant fracture exposure under fluoroscopic control. If there was minimal displacement of the articular surface, the joint was reduced with percutaneous manipulation and arthroscopic assistance with a medial and lateral portal. Temporary fixation of the reduced fragments consisted of Kirschner wires delivered through the incision or directly through the skin. Final fixation of the larger metaphyseal, articular fragments was done with screws placed through the incision or percutaneously.

A distal tibial locking plate was then tunneled subcutaneously through a 1.5-cm vertical incision just distal to the medial malleolus. The corridor for passage of the plate was developed in an extraperiosteal fashion with a long, curved packing forceps (Fig 3, A). A plate long enough to provide 2 holes proximal to the most proximal extent of the fracture was selected. It was secured to the medial surface of the tibia with percutaneously placed screws using fluoroscopic guidance. A combination of locking and nonlocking screws was used (Fig 3, B). Any widening of the syndesmosis was reduced and maintained with trans-syndesmotic fixation from lateral to medial.

Results

Eighteen patients, 12 men and 6 women, with a total of 19 tibial plafond fractures were identified. The average patient age