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Case Series

Extensile Approach: The Workhorse to High Energy Pilon Fractures - A Case Series

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Abstract

Background: Selection of appropriate surgical approach plays an important role to allow adequate exposures and visualization of operative site and ensure good surgical outcome. This holds especially true for open reduction and internal fixation of high-energy pilon fractures. This is a retrospective study of twelve patients with the extensile approach to high energy pilon fractures, and the aim is to assess the soft tissue outcome and complications.

Methods: Total of twelve patients with high-energy pilon fracture involving articular and metaphyseal-diaphyseal junction extension, underwent extensile approach during ORIF, from April 2021 to March 2022 were included in this study. Demographic data was obtained including pre- and post-operative radiographs, treatment methods, intraoperative photos, complications. Eleven patients underwent staged surgery, spanning external fixator were applied for soft tissue care prior to the definitive surgery. One patient who presented late to our center avoided the staged surgery. During the definitive surgeries, tibia and fibula were approached via extensile; and lateral respectively and stabilized with locking plates.

Results: With this approach, the surgical field was well exposed for visualization, reduction and fixation. Intra-articular surface, Chaput tubercle and medial malleolus were able to be accessed without difficulties. Early complications such as wound edge necrosis were noted at the junction of the distal lateral corner of the incision in six patients, but resolved with dressing alone. Another two patients had superficial infection over the wound edge necrosis, requiring oral antibiotic and dressing.

Discussions: There are various approaches for pilon fractures, however there is a limitation of accessibility in each approach. Despite the extensive soft tissue release, soft tissue complications are kept to minimum with meticulous handling.

Conclusion: Extensile approach to high-energy pilon fractures allows good visualization and access of fracture site, without significant soft tissue complication.

Keywords: Extensile Approach; Pilon Fracture; Surgical Exposure; Surgical Outcome; Soft Tissue Complication

Introduction

In foot and ankle procedures, just like other orthopaedic surgeries, minimally invasive surgery (MIS) is rapidly gaining popularity as it reduces soft tissue violation, induces less pain and discomfort, as well as reduces hospital stay and recovery time. Having said that, it is not applicable to every injury. High energy pilon fractures involving multiple columns is one of those examples.

Pilon fractures are distal tibia fractures with high energy rotation and/or axial compression injuries that involve the articular surface. In this anatomical region, soft tissue coverage and blood supply are generally poor therefore great care must be taken when treating this fracture.

Besides delayed primary surgery and spanning external fixation for soft tissue care, selection of appropriate surgical approach plays an important role to allow adequate exposures and visualization of operative site, proper fracture reduction and implant placements to ensure good surgical outcome. Various surgical approaches to Pilon fractures have been described [1-8], but not a single one is ideal or perfect and each surgical approach carries their pros and cons. Assal., *et al*. has introduced an extensile approach for handling high energy pilon fractures involving multiple columns [9]. This surgical approach allows complete visualization of the articular surface and offers the ability for implant placement medially, laterally and anteriorly, as required. Many showed concerns regarding the soft tissue complication in view of the extent of soft tissue dissection in this particular anatomical region.

This is a retrospective study of twelve patients with the extensile approach to high energy pilon fractures, and the aim is to assess the soft tissue outcome and associated complications.

Materials and Methods

Total of twelve patients with high energy pilon fractures with articular and metaphyseal-diaphyseal junction involvement, underwent surgery for open reduction and internal fixation (ORIF) by utilizing the extensile approach, from April 2021 to March 2022 were included in this study as in (Table 1). Demographic data obtained included pre- and postoperative radiographs, treatment methods, intraoperative photos and complications encountered. There were 10 male and 2 female patients. Mean age of 38.6 years (range of 17-75 years). All patients underwent staged surgery, spanning external fixators were applied for soft tissue care prior to the definitive surgery, except 1 patient who presented late to our center. This patient's fractured limb was elevated and immobilized with backs lab for soft tissue care. Four were open fractures and the open wounds were debrided. All associated fibular fractures were not fixed in the initial surgery, they were fixed after the tibia during the definitive surgery. For the definitive surgeries, the extensile approach was used in all patients for the tibia while the fibula was approached via a separate lateral approach and both were stabilized with locking plates.

No.	Age	Sex	Open fracture	Spanning external fixator	Wound complication	Delayed union
1	38	F	Yes	Yes	No	Yes
2	36	M	Yes	Yes	Superficial wound edge necrosis	Yes
3	22	M	Yes	Yes	Superficial wound edge necrosis	No
4	17	M	No	Yes	No	No
5	41	M	No	Yes	Superficial wound edge necrosis with superficial infection	No
6	58	M	No	No	Superficial wound edge necrosis	Yes
7	24	M	No	Yes	Superficial wound edge necrosis	Yes
8	75	F	No	Yes	Superficial wound edge necrosis with superficial infection	Yes
9*	48	M	No	Yes	Superficial wound edge necrosis	No
10	45	M	No	Yes	No	No
11	25	M	No	Yes	No	No
12	34	M	Yes	Yes	Superficial wound edge necrosis	No

Table 1: Patient demography, treatments and complications.

To illustrate the surgical technique and intra-operative photos, patient No.9 is used as an example. Patient No.9 is a 48-year-old man who had a motor vehicle accident and sustained a confused high energy closed right pilon fracture. Spanning external fixator was applied for fracture immobilization and soft tissue care. External fixator pins applied away from the definitive surgical zone to reduce the risk of infection. Repeated radiograph and CT scan showed comminuted pilon fracture involving the medial malleolus, anterolateral and posterolateral columns, and severely impacted tibial plafond as in (Figure 1). (Figure 1a and 1b) are the coronal plane CT scan from anterior to posterior, showing the superiorly displaced talus in relation to fibula and impacted tibial plafond with lateral column split. (Figure 1c and 1d) are the sagittal plane showing the depth of the impacted tibial plafond from lateral to medial. The fibula was intact in this injury. Patient underwent definitive surgery 10 days after injury, when the soft tissue condition was optimal. Intraoperative skin marking as shown in (Figure 2a and 2b) is the illustrated diagram. The incision starts 10 mm distal to tip of medial malleolus and extends laterally across the ankle to a point just lateral to midline, and then turns at about 110 degrees angle, extending proximally 10 mm lateral to tibial crest. The distal lateral corner turning angle should not be acute to avoid skin necrosis. Assal., *et al*. had described the surgical technique in a very detailed and comprehensive manner [9]. After meticulous deep dissection and care taken to maintain full thickness flap, the impacted articular surface, medial and lateral columns were visualized as shown in (Figure 3). (Figure 3a) shows the lateral column is well visualized and the disimpacted plafond which is temporarily held by a Kirschner wire. The talar dome is for inspection of the cartilage condition. (Figure 3b) shows the accessibility to the medial column, the medial Kirschner wire is for soft tissue retraction. (Figure 4a) shows the impacted tibial plafond and the talar dome before disimpaction, and (Figure 4b) is the intraoperative radiograph showing the disimpaction of the tibial plafond done via the lateral column fracture site. After reduction, bone grafting and fixation, intraoperative imaging were done, (Figure 5a) showing the AP view and (Figure 5b) showing the lateral. (Figure 6a) showing the medial end of the wound, (Figure 6b) showing the center

and (Figure 6c) shows wound edge necrosis over the distal lateral corner postoperatively, however there was no infection involved. The wound healed well within the standard duration with no complication.

Figure 1: Figure 1a and 1b are the coronal plane CT scan from anterior to posterior, showing the superiorly displaced talus in relation to fibula and impacted tibial plafond with lateral column split. Figure 1c and 1d are the sagittal plane showing the depth of the impacted tibial plafond from lateral to medial.

Figure 2: Intraoperative marking for skin incision is done as shown in Figure 2a, and Figure 2b is the illustrated diagram.

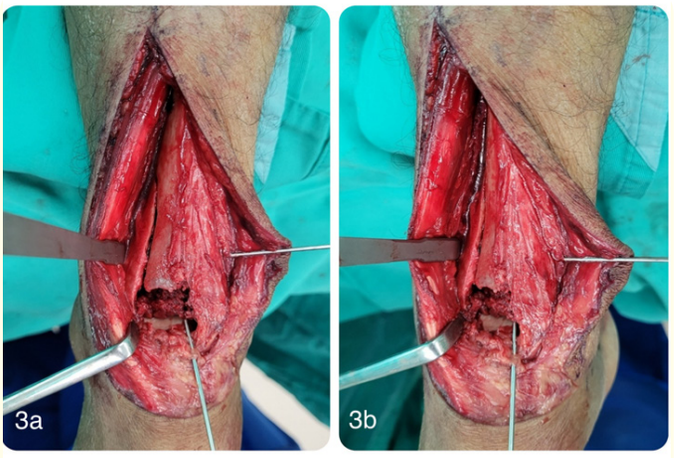

Figure 3: Figure 3a shows the lateral column is well visualized and the disimpacted plafond which is temporarily held by a Kirschner wire. The talar dome is visible for inspection of the cartilage condition. Figure 3b shows the accessibility to the medial column, the medial Kirschner wire is for soft tissue retraction.

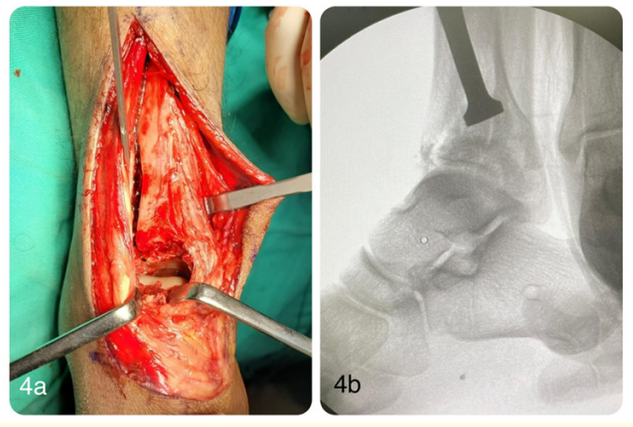

Figure 4: Figure 4a shows the impacted tibial plafond and the talar dome before disimpaction, and Figure 4b is the intraoperative radiograph showing the disimpaction of the tibial plafond done via the lateral column fracture site.

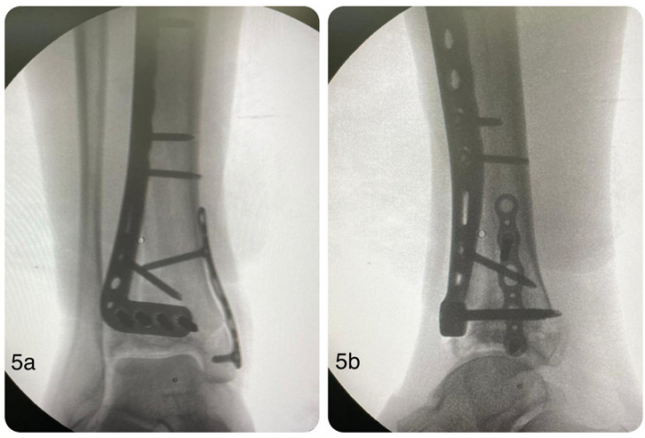

Figure 5: Figure 5a showing the intraoperative imaging of AP view and Figure 5b showing the lateral view after fracture reduction, bone grafting and fixation.

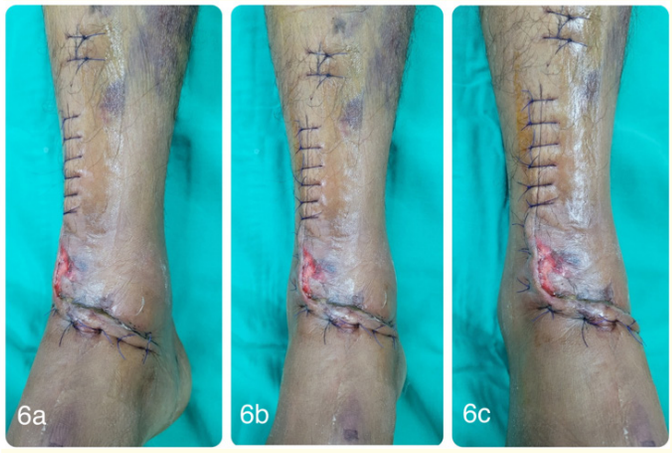

Figure 6: Figure 6a showing the medial end of the wound, Figure 6b showing the center and Figure 6c shows wound edge necrosis over the distal lateral corner postoperatively.

Results and Discussion

With this approach, the surgical field is well exposed for visualization, reduction and fixation. Intra-articular surface, Chaput tubercle and medial malleolus is easily accessible without much difficulties. Early complications such as wound edge necrosis was noted at the junction of the distal lateral corner of the incision in six patients. These patients did not require hospitalization or antibiotics and the wounds resolved with dressing alone. Other than those six patients, two patients were complicated by superficial infection over the wound edge necrosis, requiring oral antibiotic and dressing. No deep infection noted in all patients. The traumatic wound in the four patients with open fracture healed uneventfully. Other clinical outcome parameters were not included or described in detail in this study as our aim is to report on soft tissue complication in relation to this extensile approach.

All patients were followed up for a minimum of 6 months, all fractures united well, except for five patients who had delayed union. With the help of the post-operative physiotherapy sessions, all patients were able to achieve a minimum of 5-degree dorsiflexion, and at least 45-degree range of motion.

MIS is rapidly gaining popularity in foot and ankle surgery by using a combination of cannulated screws and external fixators as definitive fracture fixations. This technique reduces the soft tissue violation, induces less post-operative pain, as well as reduces hospital stay and recovery time. Most importantly, it reduces the risk of postoperative infection. It is very challenging to restore the articular surface well if the exposure and visibility is inadequate in pilon fractures. The key to a proper reduction and fixation of all columns comes from its surgical approach.

Among the various types of surgical approaches that have been described to date, the extensile approach as described by Assal., *et al*. is the approach that meets the criteria mentioned above. Despite that the extensile approach is the workhorse surgical approach to high energy pilon fractures, bear in mind that it is not always the most ideal. If the fracture involves more of the posterior column, and cannot be addressed from the anterior approach, then a posterior approach such as the posteromedial and the posterolateral approach should be utilized.

Despite the extensive soft tissue release, soft tissue complications are kept to minimum with meticulous handling. There are few tips to minimize the soft tissue complication rate while doing such extensile approach. Soft tissue optimization prior to definitive surgery could be done with fracture immobilization by spanning external fixation, limb elevation, ice therapy, wound dressing, and antibiotic. When applying the external fixator, avoid placing the Schanz screws in the definitive operative zones, or close to any traumatic wounds to reduce risk of infection. Regular pin site inspections and dressings, or any wound dressings should not be neglected. While the patient is on an external fixator, can proceed with the latter parts of the SPAN, SCAN, PLAN. Assal., *et al*. mentioned that, when performing the surgery, placement of the incisions must be planned and marked strategically to get the most exposure and accessibility. For example, too proximally placed transverse incision limb will have difficulty to visualize the ankle joint, too medially placed turning point from transverse to vertical incision limbs will cause difficulty to access the lateral column such as Chaput tubercle. Any deviation of these placements will result in more soft tissue traction and manipulation which might increase the risk of soft tissue complications. When making the skin incision at the junction of the transverse and the vertical limbs, must always

keep the scalpel blade perpendicular to the skin to avoid skiving, and the angle of the junction should not be less than 90 degrees. By taking these measures, risk of flap necrosis can be minimized. Be mindful, to maintain full thickness when developing the soft tissue flap, gentle retractions at all times, as well as to regularly moisten the flap and exposed tendons, joints and bones.

Conclusion

Extensile approach is the workhorse surgical approach to high energy pilon fractures. It allows good visualization and access of fracture sites involving the medial, anterior and lateral columns, as well as articular visualization and restoration. Despite the extensive soft tissue dissection, soft tissue complications can be avoided or kept to minimum with meticulous surgical techniques and soft tissue handling.

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Conflict of Interest

I hereby declare that there are no financial interests or any conflict of interest that exist in this study. The study has been conducted with complete transparency and integrity, ensuring the objectivity and credibility of the findings.

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