Original Research Article

A study of management of Pilon fractures in by various methods

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Abstract

Tibial Pilon fractures are challenging injuries for the orthopedic surgeon to manage successfully. The main challenges in the management of these fractures are compromised skin and soft tissue envelope, comminuted fracture, displacement of fragments, metaphyseal region of fracture. In our prospective study, management of distal tibial fractures in by various methods. 32 patients with closed and open fractures of the distal tibia and were treated by various methods were selected for inclusion in the study. Male predominate the female with a ratio of 1.9:1. Out of the 32 cases, 8 (25%) cases are AO type A1, 10 (31.25%) cases were AO type A2, 13 (40.62%) cases AO type A3, and one case (3.12%) AO type B1. Out of the total 32 cases, 30 cases were followed up for 2 years.2 Cases were lost for follow-up. 30 cases were available for follow up and all cases were assessed using Karlsson and Peterson scoring system and stability, weight-bearing, swelling, and gait used in addition to subjective clinical judgment for ankle function. There were 14 (46.66%) excellent, 9 (30%) good, 3 (10%) average, 4 (13.33%) poor results. This study concludes that in distal tibial fractures taken for surgery early after an anesthetic assessment; discuss a treatment algorithm based on a staged approach to the fracture, initial spanning external fixation followed by definitive fixation.

Keywords: Pilon fracture, metaphyseal, distal tibial fractures.

Introduction

Tibial pilon fractures are relatively infrequent, accounting for 5–7% of all fractures of the tibia [1]. These fractures are caused by axial loading in which the talus is driven into the plafond, resulting in articular impaction of the distal tibia. The position of the foot at the time of impact, in conjunction with the direction and amplitude of the force, results in varying fracture patterns and amount of comminution [2]. Intra-articular distal tibia fractures can also occur from a rotational force with minimal axial load. These fractures are often low energy and therefore cause less insult to the soft tissues and less comminution and should not be considered equal to a true pilon [3, 4].The surgical treatment of pilon fractures consists of four steps: restoration of the correct length and stabilization of the fibula, reconstruction of the articular surface of the tibia, insertion of cancellous autografts, and stabilization of the medial aspect of the tibia [5]. These principles have to be modified in fractures with severe comminution and soft tissue trauma [6]. Achieving and maintaining anatomic reduction is technically difficult and sometimes impossible [7]. Because internal fixation inevitably leads to localized devitalization of bone, further damage to surrounding soft tissue may follow. The nature and timing of surgery influence soft tissue recovery [8].Traditionally, tibial pilon fractures have been classified according to the AO/OTA and Ruedi Allgower classification; however, these systems are based on plain radiographs and are not useful tools in terms of preoperative planning or prognostic indicators. Given these limitations, Leonetti and Tigani proposed a new classification system based on displacement, the number of articular fragments, the plane of the main fracture line, and the degree of comminution as seen on radiological assessment [9,10]. The research continues, with constant effort to further improve clinical outcomes in this difficult-to-treat fracture. Even with the use of advanced operative treatment options, the satisfactory outcome is not possible always in pilon fracture, and many studies' significant complication rates continuing to persist. So, in our prospective study, we have executed different modalities of treatment of closed pilon fracture with no or minimal soft tissue injury in adults and observed the final functional score and complication rates.

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Materials and Methods

Cases of tibial pilon fractures with /without associated fractures involving another region who presented to the Department of Orthopaedics, Gandhi Medical College, Telangana, History taken regarding Mode of injury, Time of injury, Personal History, and Treatment history are documented. Work up done for surgical management. Consent was taken from all the patients. This study was analyzed. This study was done after approval from the Ethical Committee of our hospital. During the study period May 2018-May 2020.

Study Design

Prospective study

Source of Data: Patients who sustained closed and open fractures of the distal tibia and were treated by various methods in the Department of Orthopaedics, Gandhi Medical College, Secunderabad were taken as the study population.

Sample Size

32 patients with closed and open fractures of the distal tibia and were treated by various methods were selected for inclusion in the study.

Among 32 patients there were 21 (65.6%) males and 11 (34.4%) females with ages ranging from 18-60 years (mean 38.8yrs).

Inclusion Criteria: Pilon fractures in the age group 18-60, Patient willing to give consent for the procedure.

Exclusion Criteria: Pediatric fractures, Associated spinal fractures, Polytrauma cases, Patients unfit for surgery.

Surgical protocols Steps

Management started as the patient was received in our trauma ward. This comprised primary assessment including airway, breathing, circulation, and screening for spinal injury, alongside simultaneous management of shock and surveying for other system injuries. The injured lower limb is splinted in Thomas's splint. Bedside imaging is done with X-rays. Blood investigations included blood sugar, urea, blood HBsAg, HIV 1, and HIV 2.

Spinal anesthesia is given followed by a prophylactic antibiotic and a pneumatic tourniquet applied and patient positioned, Painting and draping and tourniquet inflated. The fibula, if the fracture is exposed by postero-lateral approach and fixed with 1/3rd tubular plate. Closed manipulation and reduction of tibial fracture done and verified under C- arm. A small incision is made. Just below medial malleolus and the extra periosteal plane is made. Distal medial tibial locking plate with a sleeve in distal part as a handle is passed in a reduced position of the fracture. Confirm that the plate has completely crossed the fracture segment and palpated in the proximal segment preventing offset. Distal most holes are drilled with a 2.7mm drill bit and a 4mm regular cancellous screw is fixed. The position of the distal screw is verified under C-arm. A small incision is made in the proximal fracture segment correcting plate offset. It is drilled with a 3.2mm drill bit and passed with a 4.5 mm regular cortical screw, to bring the bone close to the plate. Then remaining proximal and distal holes are filled with locking screws. Position of plate and screw in the proximal segment is verified with C- arm. Entire plate with a fracture in reduction visualized under C-arm filling desired several screws. Regular screws are also replaced with locking screws. Wound closure and final wound status. The draining tube if necessary is kept on the fibular wound site.

Statistics

To obtain valid results with the small number of cases in each group the permutation test and the Karlsson and Peterson scoring

Result

32 patients with closed and open fractures of the distal tibia and were treated by various methods were selected for inclusion in the study. Male predominate the female with a ratio of 1.9:1. The average age of patients 38.8 years with a range between 18-60 years. In most of the cases, 23 (71.9%) occur due to RTA followed by fall from height 2 (6.25%) & accidental fail 7 (21.86%) cases. Right side distribution case 18 (56.25%) and lift side 14 (43.75%) cases. Out of the 32 cases, 8 (25%) cases are AO type A1, 10 (31.25%) cases were AO type A2, 13 (40.62%) cases AO type A3, and one case (3.12%) AO type B1. Out of the total 32 cases, 30 cases were followed up for 2 years.2 Cases were lost for follow-up. 30 cases were available for follow up and all cases were assessed using Karlsson and Peterson scoring system and stability, weight-bearing, swelling, and gait used in addition to subjective clinical judgment for ankle function. There were 14 (46.66%) excellent, 9 (30%) good, 3 (10%) average, 4 (13.33%) poor results. Radiological assessment is done for fracture union by taking X-rays in anteroposterior and lateral views at regular intervals. Radiological scoring, Template using the uninvolved leg with the operated leg especially valgus, varus, anterior and posterior angulation is done. Then the normal X-rays were compared with the operated side for assessing the accuracy of angulation.

CASE-1: A 63-year-old lady with a history of accidental slip and fall and sustained closed left distal tibial fracture with an associated fibula fracture. The patient was initially stabilized with a splint (Fig-1to 6).

Fig 1: Preoperative X-ray (AP and lateral views)

Fig 2: Sutured wound and immediate post-operative X-ray

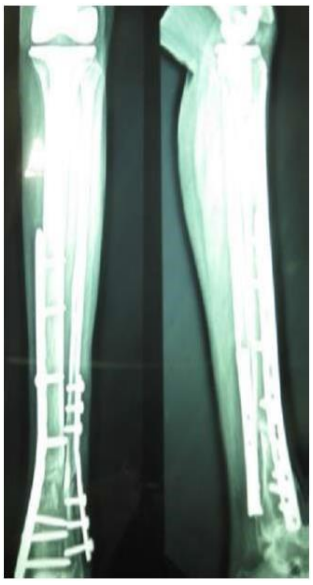

Fig 3: 20 Weeks follow up radiograph

Fig 4: Dorsiflexion

Fig 5: Plantarflexion

Fig 6: Post-surgical scar status

CASE 2: A 37 years male, with a history of road traffic accidents sustained a closed fracture left distal tibia and associate fibula. He was stabilized in the emergency room with a below-knee slab (Fig 9-12).

Fig 7: Preoperative X-ray (AP and lateral views)

Fig 8: Immediate post-operative X-ray

Fig 9: Post-operative x-ray after 6 weeks.

Fig10: Squatting position

Fig 11: Squatting with heel off

Fig 12: Post-surgical scar status

CASE 3: A 45 Years old Male, a known case of type II diabetes mellitus, with a history of a vehicular accident sustained closed left distal tibial fracture with lateral malleolus (Fig 13-18).

Fig 13: Preoperative X-ray

Fig 14: Immediate post-operative X-ray

Fig 15: 24 Weeks follow up X-ray

Fig16: Dorsiflexion

Fig 17: Plantarflexion

Fig 18: Post-surgical scar status

Discussion

Of the 32 patients enrolled in this study, twenty-one were males and the most common age group is 31 to 60 years. The most common cause is a vehicular accident in young adults and accidental fall in old ages due to the osteoporotic nature of the bone.

In 1959 Jergesen [1] reported that asserted that open reduction ad stabilization of serious tibial pilon fractures was impossible Fourquet [12] reported the overall poor result of pilon fracture after treatment. So for years, cast immobilization has been the most popular method of treatment.

In 1979 Ruedi *et al*.,[13] again reported achievement of 75% good & excellent result with ORIF. Following his principles Heim *et al*., [14] and later Ovadia and Beals [15 also subsequently reported good results. Bourne *et al*., [16] in 1983 reported 80% satisfactory result with type I &II fracture while type III has only 44% satisfactory result. Non-anatomic reduction, unstable fixation, infection, nonunion, and/or angulations were the usual causes of failure of this form of treatment. In 1986 Dillin and Slabaugh's [17] experiment reported that infection rates as high as 55% and wound sloughing rates of 36%.

In 1988 Ayeni [18] reported good results with conservative treatment in type I fracture, a poor result in type II fracture, and to type III fracture conservative treatment was not applied. Also, the post-traumatic arthritis rate was as high as 53% (10 out of 19), all being type II or III treated with plaster cast/ORIF AND ORIF only respectively.

In 1992 Mc Ferran *et al*., [19] reported a 40% rate of patients with complications following ORIF of their pilon fractures. In 1993 Teeny and Wiss [20] reported that 37% of their patients experienced deep infections and an ankle fusion rate of 26% in type III fracture after ORIF. In 1996, Wyrsch *et al*. [21] prospective study of 39 fractures found a 28% infection rate and 33% wound sloughing rate in the ORIF group compared with a 5% infection rate and a 5% wound sloughing rate in the external fixation group. Sands *et al*. [22] in 1998 performed a retrospective review of 27 out of 64 patients with plafond fractures treated with ORIF with help of SF-36 forms, which showed a decrease in all 8 Categories with significantly decreased physical function and role limitations attributed to physical health. 1999 Patterson & Michael [23] showed 77 % good results, 14 %fair results, and 9% poor results. There were no infections or soft tissue complications.

Bhattacharyya, Timothy [24]. Found in 2006 while using stage ORIF with posterolateral approach found 47% complication rate including infection, nonunion and post-traumatic arthritis. In 2009 Kline [25]. Got 19% infection rate and 16% nonunion rate in the normal group while comparing them with DM group which very high rate of infection (71%) and nonunion (43%). In 2010 Lisa [26]. Canada found 2% deep and 5% superficial infection while treating 55 pilon fractures in 43 patients. In 2012 Justin *et al*., [27]. Reported only 3.7 infection rate and 3.7% of nonunion rate with patients treated with ORIF in staged procedure compared to 11% infection and 22% nonunion in external fixation group.

In our study eight patients with AO type A1 fractures, ten patients with AO type A2, thirteen patients with AO type A3 fractures, and one patient with AO type B1 fracture. The partial articular undisplaced fracture can be considered as extra-articular fracture according to Chris Cass evens. The mean duration between injury and surgery was five days. One patient had Gustilo Anderson grade I open fracture. In this study, results of 30 patients with pilon fractures treated with fixation were analyzed radiologically and functionally with Karlsson and Peterson scoring system for ankle function. 86.6 % of patients have an acceptable outcome, and 13.4% of patients have a poor outcome. Twenty-three patients have associated distal fibula fracture on the same side. Fixing associated fibular fractures first helps us to attain limb length. But it is difficult to control angulation. K-wire or Steinmann pin can be used to manipulate the fracture fragments without opening them. Preserving fracture hematoma is the most important principle of plate osteosynthesis. Anatomical reduction and relative stability help in better callus formation and good healing. 23 cases with associated fibular fractures, though the tibia was fixed by closed. method, the fibular fracture was fixed through a posterolateral open approach with a 1/3rd tubular plate. This fixation achieved the length of the comminuted fragments.

In one patient with psychiatric illness, the fracture was treated by external fixation but stopped coming for follow-up. None of our patients demand implant removal, except the infected cases.

Having deliberated on the thickness of the plate so much, we need to consider implant removal if the patient feels such a subcutaneous implant warranting this. Though only one case came back to us after union due to changes in the skin like color change. We have removed this plate in this patient. Another patient developed a deep-seated infection that needs implant removal. The remaining twenty-eight patients which are followed till now did not have any specific skin irritation despite its subcutaneous location.

Conclusion

Distal tibial fractures pose a great challenge to an orthopedic surgeon when soft tissue conditions permit and in fractures, open reduction and internal fixation with minimally invasive

techniques are preferred. In comminution fractures, C3, a two-stage procedure of initial articular restoration and spanning external fixation followed by definitive fixation at a later stage appears to give better results. Soft tissues are the keystone of optimal treatment and a delayed surgical treatment protocol is often mandatory for optimizing the soft tissues.

In our experience in this study, our data were similar to the ones in the literature, confirming the effectiveness despite these newer surgical techniques various methods for pilon fracture achieved similar results in the long-term both clinically and radiologically advantage two-stage approach including a primary fixation with external fixation followed by definite internal fixation after soft tissue recover.

Open reduction and closed reduction through the MIPPO technique of application of locking compression plate has resulted in effective stabilization of this fracture.it provides adequate stability and allows early motion. The greatest advantage in open reduction and internal fixation with locking plate is anatomical reduction is achieved and fracture hematoma is not disturbed much external fixator is an effective method for open fracture of the distal tibia. With soft tissue compromise and open fracture

In our experience in this study, while open reduction and internal fixation remain the mainstay for treatment of the majority of these fractures, additional treatment modalities, such as external fixation and primary arthrodesis, are emerging and should be considered for more complex cases.

The overall prognosis for these injuries Additional research is needed to continue to improve results and the quality of life of patients affected by pilon fractures.

Although a larger sample of the patient and longer follow-up are required to fully evaluate pilon fracture management, we strongly encourage its consideration in the treatment of such complex fractures.

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