ORIGINAL ARTICLE

A Comparison of Functional Outcome of Intra Articular Distal Tibial Pilon Fracture Treated by One Stage vs Two Stage Surgically

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ABSTRACT

Introduction: The study was conducted to evaluate clinical and functional outcomes of comminuted pilon of distal tibial fractures after surgical management and fixation by modalities available ranging from temporary external fixation, simple distal tibial plates to moderate plating system and intra medullary nails for fibula.

Methodology: Total 24 cases with intraarticular distal tibial pilon fracture were randomly divided in to two group. One group was managed by one stage procedure and second group was operated by two stage procedure.

Results: From this study we infer that patient who had undergone one stage procedure had shorter hospital stay. In present study we observed that arthrosis, superficial infection and arthritis was higher in two stage procedure. Assessed by Ovadia Beals Evaluation Score - Objective Evaluation as well as subjective evaluation. Furthermore, the rate of complications was also identical. However, functional outcome assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score revealed that the patients underwent one stage procedure had better functional outcome.

Conclusion: Considering the better functional outcome and the shorter hospital stay, we preferred using one stage operative procedure in better skin condition, less soft tissue damage, closed fracture of type b and C AO/OTA Pilon fractures.

Keywords: Tibial Pilon Fracture, Ovadia Beals Evaluation Score, AO/OTA, AOFAS

INTRODUCTION

These are one of the most complex injuries involving the ankle joint, accounting for approximately 1% - 10% of all lower extremity fracture As the energy of injuries increases, so does the number of these complex fractures. Avoiding the numerous soft-tissue complications that may be encountered during treatment is critical to a good result. Wound problems, osteomyelitis, malunion, nonunion, pintract infections, and hardware failure are typical obstacles that must be avoided to obtain a satisfactory outcome. Treatment goals include anatomical reconstruction of the joint surface and maintenance of mechanical alignment. Proper length and rotation are critical, as are preserving and maximizing ankle and subtalar motion.[1,2] Even when these goals are met, there is no guarantee that patients will have an acceptable result.

Modern lifestyle and increase in high speed road traffic accidents especially two wheelers has led to an increased incidence of complex fractures of the distal tibia which has made their treatment more difficult. Conventionally the treatment of these fractures is considered to be a challenging task because of Less soft tissue coverage over the bone, Comminution of weight bearing articular surface of distal tibia, High chances of nonunion. (5% to 6.6 %), Difficulties in reduction and internal fixation and Possibility of ankle arthrosis.[2,3,4]

The surgical management of distal tibial fractures has evolved over the past 35 years in a large part due to an improved understanding of the importance of the soft tissue envelope. Although multiple treatment approaches and protocols have been described, there is no consensus regarding the optimal treatment of these challenging injuries. Similarly, long-term outcome data from randomized comparative treatment methods remains lacking.[5]

So we are doing this study to evaluate clinical and functional outcomes of comminuted pilon of distal tibial fractures after surgical management and fixation by modalities available ranging from temporary external fixation, simple distal tibial plates to moderate plating system and intera medullary nails for fibula.

The purpose of the study is to analyze and observe the results of management of pilon fractures in respect to operative technique and method, implants used according to the fracture morphology & clinical and functional outcome.

METHODOLOGY

This study was conducted among patients reporting with distal tibial pilon fractures in OPD or casualty and operated in the Department of Orthopaedics, Krishna Institute of Medical Sciences, Deemed University, Karad

(Maharashtra). This study was conducted during Dec 2019 to June 2021. This was a prospective randomised comparative study conducted among cases with Pilon fracture.

Sample size: Sample size was calculated using equation $n = (Z_{\alpha/2}+Z_{\beta})^2 *2*\sigma^2 / (s_1-s_2)^2$, where $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84), σ^2 is the population variance, and (s1-s2) is the difference would like to be detected. Here S1 was taken as AOFAS score 81.6 for first group and 89.9 for second group.[6] The calculated sample size was 12 for each group. Total sample size was 24.

Eligibility Criteria: All age and both gender patients having intraarticular distal tibial pilon fracture AO classification in type B and type C were included in the study. Cases with Surgical Indication of Articular fracture displacement of >2mm, Unstable fracture of tibial metaphysis and open Pilon fracture(Gustilo-Anderson type -1) and closed pilon fracture were included. Patient with co morbid conditions and not fit for surgery or anaesthesia like those patient who had extensive soft tissue injury (blister/huge swelling)which couldn't be treated with single stage, local surgery, previous soft tissue transfer, peripheral vascular disease, pathological fracture or Gustilo-Anderson type 2 and tape 3 (open fracture) were excluded from the study.

Randomization: Each eligible cases based on above inclusion and exclusion criteria was assigned to group A or group B using random number allocation table.

Intervention: Patients were admitted to trauma ward and those who were fulfilling the selection criteria were taken for the study. Pre-operative assessment was done. Pre-operative x-rays and ct scan were taken almost all patient. Operative procedure was decided as per the fracture and soft tissue condition.

Pre-Op Preparation and Assessment: Patient`s name, I.p.d. number, date of admission and operation, demographic data and history was collected; Routine blood and systemic examination; Pre operative xray (ankle ap/lateral/mortise and full length of tibia fibula) and ct scan was done; In our study we follow protocol of SPAN-SCAN-PLAN in two stage group; Information regarding mode of injury, side and site of injury, open/closed injury, distal neurovascular status, any associated injury and associated illness was taken; Evaluation of skin status is important. The ankle should be inspected circumferentially for open wounds, soft tissue contusion and bruises. Limb edema, palpation of the local skin temperature, development of skin blisters should be looked for. Capillary refill of the involved extremity is monitored periodically in the initial period of injury; Functions of the extensor tendons crossing ankle are assessed; Primary management in form of i.v. fluids, antibiotics, immobilization, traction, elevation, debridement, blood transfusion was given.

Surgical Modalities of Treatment:

Group A) One stage Procedure - ORIF with plates and screw fixation; and MIPPO (Minimal Invasive Percutaneous Plate Osteosynthesis)

Group B) Two stage procedure - External Fixation to tibia with or without fibula fixation Followed by Internal Fixation to tibia

Surgical Approaches: Skin incisions and surgical approaches to tibial pilon are many and they have been tested and modified over many decades in an attempt to decrease the incidence of wound complications. Extensile incisions are avoided in the distal tibia because of the precarious vascular supply and risk of wound dehiscence Although the indications to fix the fibula internally have been modified in recent years, it is still an integral part of fixing tibial plafond fractures, so that length and axial alignment can be maintained.

Tibia: Surgical approaches were either Anterolateral, Anteromedial, Modified anteromedial, Posteromedial or Posterolateral.

Surgical technique: Positioning: 1) Regional Anaesthesia, 2) Supine position on an operating table with a radiolucent extension. A small soft rolled towel is placed beneath the ipsilateral buttock to decrease the tendency to externally rotate, and 3) Operated limb painted knee to foot.

Surgical exposure: Fibula fixation was performed primarily to restore length and achieve indirect reduction of tibia fracture. Fibula fractured is fixed by the following steps:

Fibula (Posterio lateral approach of Henry): A longitudinal skin incision was taken from the posterior lateral boarder of lateral malleolus, extending proximally for 10-15 cm along the posterio lateral aspect of fibula. careful the incision sural nerve is superficial. Peroneal muscle are retracted medially and full thickness superficial flap should be minted to reduce the risk of skin necrosis.

Fibula Fixation: Proximal and distal fracture ends was seen and hematoma was cleaned. Reduction of fracture was achived by traction and manipulation. Reduction was confirmed by using image intensifier. One-third/Semi tubular plate was placed to lateral surface of fibula using two plate bone holding forceps. After confirming fracture reduction again and ruling out plate offset to bone, 3.5mm conventional cortical screws distally and proximally are inserted. Wound wash given with betadine and normal saline mixture. Wound closed in layers.

This posterolateral incision provides a larger skin bridge between this incision and the tibial incision. A 7 cm skin bridge was routinely recommended. Howard recently demonstrated minimal soft tissue complications with skin incision bridges between 5 and 6 cm when treating tibial plafond fractures.

Tibia fixation: Incision: A longitudinal incision was taken from tip of medial malleolus, extending proximally for 7-10 cm along the medial boarder of tibia

Step 1: Fluoroscopy imaging done to check the anteroposterior and medial lateral axis alignment

Step 2: Articular fragment and main fracture fragments identified, reduced and fixed with > posteromedial > central > anterior > anterolateral.

Step 3: Articular fragments reduced to proximal metaphyseal fragment and locking compression plate is slid and positioned over the medial surface of tibia. Length of the plate is three times the span of fractured segment.

Step 4: Plate position and offset checked using fluoroscopy and then definitive fixation carried out. First screw being 3.5mm conventional cortical screw predrilled with 2.7mm drill bit proximally followed by locking 3.5mm cortical screws proximally and distally.

Mippo: In mippo technique distal part of the approach used ,the fracture was reduced indirectly and plate was inserted distal to proximally through the incision. Separate incison was taken proximally and proximal screw inserted in this incision. Final position of plate, screw and reduction was seen under image intensifier. Wound wash given with mixture of normal saline and betadine, wound was closed with layers and sterile dressing was done.

External fixation

Position of patient: The patient is positioned supine on a radiolucent operating table extension with the foot brought to the end of the table. The injured leg is elevated on folded linen or a molded foam cushion. A bump consisting of a single rolled blanket is placed beneath the ipsilateral hip. The image intensifier is on the side opposite the injured limb.

Technique: Stab incision was taken at 5-7 cm above the proximal facture line (schanz pin was not inserted at fracture site, usually minimal distance maintain between schanz pin insertion and fracture line), Two stab incision was taken and distance between to stab incision was 3-5 cm, Schanz pin was inserted anterior to posterior in direction and just 1-2 cm medial to tibia crest, 6.5 mm schanz pin was used after drilling with 3.5 mm drill bit, Position of schanz pin was confermed under image intensifier in both view, Two schanz pin was connect with connecting road with help of clamp.

One stainman pin was paased to calcaneum in medial to lateral Tibiocalcaneal connection, Both end of calcaneum satinmain pin was connect with tibial schanz pin with help of connecting rod and clamp, Reduction by manipulating the calcaneal pin, Reduction was achieved by the traction and manipulating the calcaneal pin and reduction was confirmed under image intensifier, Connecting the rods, Rods was connected with schanz pin and stainman pin with help of clamp, Medial end of stainman pin was connected with proximal schanz pin and lateral end of stainman pin was connected with distal schanz pin .

Tibiotarsal trans-fixation: To keep the midfoot in a neutral position, one or two small schanz pins (3.5 mm) should be inserted in one of the cuneiforms or cuboid, in the first metatarsal or in the first and in the fifth metatarsal and connected directly to tibial frame with help of connecting road.

Fixation of a fibular fracture: Fixation of an associated fibular fracture adds stability and contributes to overall reconstruction.

Post Operative and Follow Up Protocol: Belove knee slab and elevation was given immediate post operative. Toe movement and knee exercises were started after post of day 3 in external fixation and ankle movement and knee exercise were started after post of day 3 in definitive internal fixation. After definite fixation Suture were removed after post of day 12-15. Patient were discharged after suture removal. Follow up was done at 6 weeks, 3month and 6 months, at 6 months follow up, the functional outcome was assessed by the using Ovadia-Beals and AOAFS ankle hindfoot scoring system and evidence of union was analyzed from radiograph of the ankle with distal 2/3rd tibia-fibula in AP and Lateral views. When Sign of radiological union appeared, patient was made to do partial weight-bearing walking with help of a walker. Full weight-bearing was allowed after fracture union.

Assessment of Outcome: Assessment of outcome after surgical procedure were assessed using **Ovadia-Beals clinical scoring system**[7] and AOFAS ankle hindfoot score[8] in both the groups.

Ethical Consideration The study was conducted after taking approval from Institutional Ethical Committee. After that informed written consent was taken from each participant who agreed to participate.

Statistical Testing: Data was analyzed using SPSS statistical software ver.16. While comparing both the intervention groups, qualitative variables were presented in form of frequency and percentage while quantitative variables were presented by mean and standard deviation. To compare both the group chi square test used for comparison of qualitative variables and unpaired t test was used for comparison of quantitative variables

RESULTS

This study was conducted among 24 to compare functional outcome of intra articular distal tibial pilon fracture treated by one stage vs two stage method surgically. Observations of the study were presented in the following tables and graphs.

Age distribution of patients was almost similar in both the groups. Mean age of patients in group one was 44.08 years and it was 45.16 years in group two. There was no significance difference in age distribution in both the groups.

Gender distribution of patients was almost similar in both the groups. P value was 0.537 calculated using chi-square test at 1 df and 95% CI. There was no significance difference in gender distribution in both the groups.

There was no significance difference in mechanism of injury among patients in both the groups. P value was 0.615 calculated using chi-square test at 1 df and 95% CI.

In this study 11 out of 12 patients were found closed type one stage procedure whereas 8 out of 12 patients were found closed type two stage procedure. P value was 0.131 calculated using chi-square test at 1 df and 95% CI. There was no significance difference in type of injury among patients in both the groups. In one stage procedure, 11 out of 12 patients were found fibula fracture and in two-stage procedure, 9 out of 12 patients were found fibula fracture. There was no significance difference found in fibula fracture in both the groups. P value was 0.131 calculated using chi-square test at 1 df and 95% CI.

In one stage procedure 3 (25%), 3 (25%) were found in C1 and C2 type respectively. In two stage procedure 6 (50%), 2 (16.7%) were found in C1 and C2 type respectively. There was no significance difference found in both the groups. P value was 0.867 calculated using chi-square test at 5 df and 95% CI.

Table 1: Demographic Profile of Study cases

Demographic Characteristics	One-Stage Procedure (n=12)	Two-stage Procedure (n=12)	*P value*
Age (y)			
<30	1 (8.3%)	1 (8.3%)	
30-40	3 (25%)	3 (25%)	
40-50	5 (41.7%)	4 (33.3%)	
>50	3 (25%)	4 (33.3%)	
Mean±SD (yrs)	44.08±10.83	45.16±10.98	0.964
Gender			
Male	10 (83.3%)	11 (91.7%)	0.537
female	2 (16.7%)	1 (8.3%)	

Table 2: Description of injury in study cases

Injury profile	One-Stage Procedure (n=12)	Two-stage Procedure (n=12)	*P value*
Mechanism of Injury			
Vehicle accident	9 (75%)	8 (66.7%)	0.615
Sport injury	3 (25%)	4 (33.3%)	
Type of injury			
Closed type	9 (75%)	10 (83.3%)	0.131
Open type	3 (25%)	2 (16.7%)	
Fibula fracture			
Present	11 (91.7%)	9 (75%)	0.142
Absent	1 (8.3%)	3 (25%)	
Co-morbidities/Risk factor			
Smoking	5 (41.7%)	7 (58.3%)	0.414
alcoholism	8 (66.7%)	6 (50%)	0.407
DM	3 (25%)	4 (33.3%)	0.653
HT	3 (25%)	2 (16.7%)	0.615

Table 3: Classification of injury in study cases

Characteristics	One-Stage Procedure (n=12)	Two-stage Procedure (n=12)	*P value*
AO/ OTA type Classification			
B1	2 (16.7%)	1 (8.3%)	*0.867*
B2	1 (8.3%)	1 (8.3%)	
B3	1 (8.3%)	1 (8.3%)	
C1	3 (25%)	6 (50%)	
C2	3 (25%)	2 (16.7%)	
C3	2 (16.7%)	1 (8.3%)	
Time period between injury &treatment			
<6 hrs	4 (33.3%)	3 (25%)	0.788
6–24 hrs	7 (58.3%)	7 (58.3%)	
>24 hrs	1 (8.3%)	2 (16.7%)	
Time period between injury & operation			
<1 days	4 (33.3%)	3 (25%)	0.842
1-7 days	6 (50%)	6 (50%)	
>7 days	2 (16.7%)	3 (25%)	
Pain (VAS)			
1-4	6 (50%)	4 (33.3%)	
5-7	6 (50%)	6 (50%)	
8-10	0	2 (16.7%)	
Mean±SD	4.8±1.2	6.3±1.5	0.012
Satisfaction (VAS)			
1-4	2 (16.7%)	2 (16.7%)	
5-7	6 (50%)	4 (33.3%)	
8-10	4 (33.3%)	6 (50%)	
Mean±SD	7.0±1.34	5.6±1.57	0.028

The highest 8 (66.7%) patients were found alcoholism in one stage procedure whereas smoking was the highest 7 (58.3%) patients were found in two stage procedure. There was no significance difference found in co-morbidities or risk factor in both the groups. P value was calculated using chi-square test at 2 df and 95% CI.

Time period distribution between injury and treatment of patients was almost similar in both the groups. There was no significance difference in time period distribution in both the groups. P value was 0.788 calculated using chisquare test at 2 df and 95% CI. Poor skin condition and swelling was less in one stage procedure while poor skin condition and swelling were more in two stages procedure.

Time period distribution between injury and operation of patients in one stage procedure was high in between 2-7 days whereas in final fixation of two stage procedure it was more than 14 days. There was no significance difference in time period distribution in both the groups. P value was 0.842 calculated using chi-square test at 3 df and 95% CI.

Mean of pain after surgery of patient's in-group one was 4.8 and it was 6.3 in-group two. There was significance difference in pain found in both the groups. P value was 0.012 calculated using unpaired t test at 95% CI. This indicated that pain after surgery using VAS was significantly less in one stage procedure.

Mean of satisfaction after surgery of patient's in-group one was 7.0 and it was 5.6 in-group two. There was significance difference found in satisfaction after the completion of the surgery. P value was 0.028 calculated using unpaired t test at 95% CI. This indicated that patients underwent stage one procedure were more satisfied than patients underwent two stage procedure.

There was excellent Ovadia beals evaluation score found in-group one compare to group two. There was no significance difference found in Ovadia Beals evaluation score. P value was 0.108 calculated using chisquare test at 3 df and 95% CI. There was good Ovadia beals evaluation score found in-group one compare to group two. There was no significance difference found in Ovadia Beals evaluation score. P value was 0.548 calculated using chisquare test at 3 df and 95% CI.

Mean and SD of AOFAS of patients' in-group one was 86.8±14.1 and it was 75.4±11.9 in-group two. There was significance difference found in both the groups. P value 0.043 calculated using unpaired t test at 95% CI. This indicated that functional out (assessed by AOFAS) were better in patients underwent stage one procedure compared to patients underwent stage two procedure.

Mean and SD of hospital stay of patients' in-group one was 7.9±1.7 and it was 19.8±2.8 in-group two. There was significance difference found in both the groups. P value <0.01 calculated using unpaired t test at 95% CI. This indicated that hospital stay was significantly less in patients underwent stage one procedure compared to patients underwent stage two procedure.

There was no significance difference found in complication in both the groups. P values were calculated using chi-square test at 2 df and 95% CI.

Table 4: Outcome Assessment in study cases

Outcome Assessment	One-Stage Procedure (n=12)	Two-stage Procedure (n=12)	*P value*
Ovadia Beals Evaluation Score – Objective Evaluation			
Excellent	5 (41.7%)	1 (8.3%)	0.108
Good	5 (41.7%)	4 (33.3%)	
Fair	2 (16.7%)	5 (41.7%)	
Poor	0	2 (16.7%)	
Ovadia Beals Evaluation Score – Subjective Evaluation			
Excellent	2 (16.7%)	1 (8.3%)	0.548
Good	5 (41.7%)	3 (25%)	
Fair	3 (25%)	3 (25%)	
Poor	2 (16.7%)	5 (41.7%)	
AOFAS			
61-70	1 (8.3%)	0	
71-80	5 (41.7%)	5 (41.7%)	
81-90	6 (50%)	6 (50%)	
91-100	0	1 (8.3%)	
Mean±SD	86.8±14.1	75.4±11.9	0.043
Hospital stay (days)			
6-9 days	8 (66.7%)	2 (16.7%)	
10-12 days	4 (33.3%)	3 (25%)	
13-16 days	0	7 (58.3%)	
Mean±SD	7.9±1.7	13.8±2.8	0.00001
Complications			
Superficial infection	1 (8.3%)	2 (16.7%)	0.537
Deep infection	1 (8.3%)	1 (8.3%)	0.999
Arthrosis	4 (33.4%)	8 (66.8%)	0.102
Arthritis	2 (16.7%)	3 (25 %)	0.615
Union time			
16 to 24 weeks	8 (66.67%)	7 (58.33%)	0.673
> 24 weeks	4 (33.33%)	5 (41.66%)	
ROM of Ankle joint			
Planter Flexion (in degree)	42 ± 3	41 ± 9	0.843
Dorsi Flexion (in degree)	17 ± 2	18 ± 1	0.417
Eversion (in degree)	10 ± 1	9 ± 2	0.135
Inversion (in degree)	19 ± 3	18 ± 2	0.347

DISCUSSION

Pilon fractures are one of the most difficult orthopaedic injuries to treat. Treatments for these injuries are difficult, and they are frequently linked with poor outcomes. Because these fractures are frequently caused by significant trauma and are linked with articular surface involvement, many patients will not obtain the desired results, and many will have to live with the pain and discomfort of this disease for the rest of their lives.

The best treatment strategy and time for a Pilon fracture are still unknown. The injured and swollen soft tissue in these fractures is thought to be the cause of high levels of infection and wound healing issues following surgery.[9] As a result, a two-stage approach was commonly adopted, which included retaining the primary fibular length and external fixation of the tibia, followed by delayed ORIF while the soft tissue improved.[10]

Baseline Characteristics: In the present study age distribution of patients was almost similar in both the groups. Mean age of patients in group one was 44.08 years and it was 45.16 years in group two. There was no significance difference in age distribution in both the groups. Gender distribution of patients was almost similar in both the groups. P value was 0.537 calculated using chi-square test at 1 df and 95% CI. There was no significance difference in gender distribution in both the groups. There was no significance difference in mechanism of injury among patients in both the groups. P value was 0.615 calculated using chi-square test at 1 df and 95% CI.

In the present study There was no significance difference in type of injury among patients in both the groups. In one stage procedure, 11 out of 12 patients were found fibula fracture and in two-stage procedure, 9 out of 12 patients were found fibula fracture.

In one stage procedure 3 (25%), 3 (25%) were found in C1 and C2 type respectively. In two stage procedure 6 (50%), 2 (16.7%) were found in C1 and C2 type respectively. There was no significance difference found in both the groups. P value was 0.867 calculated using chi-square test at 5 df and 95% CI.

Minator Sajjid M et al[11] conducted a study to compare two major methods of treatment (one-stage open reduction internal fixation (ORIF) and two-stage treatment (primary external fixation and secondary ORIF)) among 41 cases. In this study patients of both groups had no significant difference in terms of age, gender, mechanism of fracture and follow-up time.

In the present study there was no significance difference found in co-morbidities or risk factor in both the groups. Time period distribution between injury and treatment of patients was almost similar in both the groups.

Pilon fractures are of the most challenging injuries in orthopedic surgery. Treatments of these injuries are very challenging which are often associated with less favourable results. Since these fractures are usually caused by severe trauma and are associated with involvement of the articular surface, the desired results are not achieved in many patients and many of them will have life-long struggle with pain and discomfort of this problem.[11]

VAS Pain, Satisfaction and AOFAS score: In the present study VAS pain score after surgery in one stage group was 4.8 and it was 6.3 in two stage procedure group. Pain after surgery was significantly less in one stage procedure. Satisfaction after surgery, as measured using VAS, in one stage procedure group one was 7.0 and it was 5.6 in two stage procedure group. Patients underwent stage one procedure were significantly more satisfied than patients underwent two stage procedure.

In the present study AOFAS of patients in one stage procedure group was 86.8±14.1 and it was 75.4±11.9 in two stage group. Functional out (assessed by AOFAS - American Orthopaedic Foot and Ankle Society) were significantly better in patients underwent stage one procedure compared to patients underwent stage two procedure ($p<0.05$).

In a study by Minator Sajjid M et al[11] found that pain intensity, satisfaction, and AOFAS were not significantly different in both groups.

Recently Lavini et al[12] have revealed that employing an external fixator and ORIF to improve soft tissue might be highly beneficial. However, it is claimed that keeping the external fixator in place following plate fixation helped to reduce problems.

Patterson et al.[13] treated 22 Pilon fractures with a one-stage procedure and found that 77% of patients had good outcome.

Ovadia Beals evaluation score: In the present study there was excellent Ovadia beals evaluation score found in 5 cases in group one compare to only one case in two stage procedure group. However, there was no significance difference found in Ovadia Beals objective evaluation score. There were 7 cases having excellent or good Ovadia beals subjective evaluation score in one stage procedure group compared to 4 cases in two stage procedure group. However, there was no significance difference found in Ovadia Beals subjective evaluation score.

In a retrospective study by Dickson et al[10] it was discovered that patients treated with a two-step technique achieved excellent articular reduction and anatomical joint alignment in 81 percent and 96 percent of cases, respectively. According to radiographic tests, 28% of individuals experienced degenerative alterations. In 35% of patients, postoperative complications included loss of reduction (11%), which necessitated arthrodesis (11%), and amputation below the knee due to unsuccessful arthrodesis (3%).

A two-stage method was used by Sirkin et al[14] to treat open and closed Pilon fractures. They came to the conclusion that the high rate of infection and soft tissue problems in patients was caused by ORIF performed too soon after the soft tissue had been damaged. Sirkin and colleagues found that 17% of patients with near Pilon fractures had partial-thickness skin necrosis, and one patient (3.4%) developed a persistent draining sinus due to osteomyelitis. These patients received excellent care. In the open fracture group, 10.5 percent had partial-thickness skin necrosis and 10.5 percent developed osteomyelitis, which resulted in amputation below the knee in one case.

Richards et al[15] evaluated ORIF with external fixation in the treatment of Pilon fractures and found that both methods resulted in fracture union, adequate articular reduction, and the same infection rate. However, participants in the ORIF group appeared to have better early outcomes. In a retrospective analysis, Blauth et al[16]. evaluated clinical and radiological results of 51 Pilon fractures treated with a) primary ORIF, b) minimally invasive osteosynthesis for articular surface reconstruction and transarticular external fixation for four weeks, and c) the two-stage approach. They discovered that none of the patients in the two-stage group needed an arthrodesis. Furthermore, the range of ankle motion and rate of return to normal activities were higher in the two-stage group. In addition, this group's pain intensity and limits in leisure activities were lower. For the outcomes mentioned, however, the differences were not significant.

Union time: In the present study in the one stage procedure group 66.67% cases had union time between 16 to 24 weeks while in two stage procedure group 58.33% had union time between 16 to 24 weeks. Remaining cases in both groups had union time more than 24 weeks. There was no significance difference in union time categories in both the groups ($p>0.05$).

Richards et al. evaluated the one-stage (ORIF) and two-stage (ORIF) approaches in the treatment of Pilon fractures and found that both procedures were associated with identical fracture union times.[15]

Bacon and his colleagues compared the outcomes of the two-stage approach to the results of definitive external fixation. The period of fracture union was found to be prolonged in the two-stage group (1.39 to 5.24 weeks). However, the differences between the two groups were not statistically significant.[17]

Tang et al. found that the rate of union was the same in the PORIF and delayed ORIF groups in a recent study.[18]

Hospital Stay: In the present study hospital stay of patients in one stage group was 7.9±1.7 days and in two stage group was 19.8±2.8 days. This indicated that hospital stay was significantly less in patients underwent stage one procedure compared to patients underwent stage two procedure. In a study by Minator Sajjid M et al[11] hospital stay of PORIF group (one stage) was 8.3±1.8 days versus 13.4±2.6 days in Two-stage group. It was significantly shorter in PORIF group (*P=0.027*)

Blauth et al. determined that the two-stage strategy of treating Pilon fractures was superior to other methods.[16] Tang et al. found that the incidence of superficial and deep infection, rate of union, and mean of AOFAS in the PORIF and delayed ORIF groups were all the same. The PORIF group, on the other hand, had a much shorter time to fracture union, surgical time, and inpatient time.[18]

Post-Surgical Complications: In the present study superficial infection was reported in 3 cases, one case in one stage procedure group and two cases in two stage procedure group. Non-union, Malunion was no reported in one stage procedure and two stage procedure. There was no significance difference found in complications found in both the groups. PORIF was used by White and his colleagues[19] to treat 95 individuals with Pilon fractures. Within the first 48 hours after the injury, 88 percent of patients had surgery. In 90% of the cases, the reduction was anatomical. In six individuals, deep infection or dehiscence necessitated debridement.

Paluvadi et al[20] employed the MIPO technique in another trial and found that while it increased union time, it had a significant impact in reducing nonunion and infection rates. In 10% and 2% of the patients, respectively, superficial and deep infections occurred. The LCP plate with MIPO technique was utilised in the study by Li and his colleagues[21] to treat Pilon fractures, and the results were excellent. Only one patient was found to have a superficial infection.

Bacon and his colleagues[17] compared the outcomes of the two-stage approach to the results of definitive external fixation. The two-stage group had a longer length of fracture union (1.39 to 5.24 weeks), but the external fixator group had a greater rate of non-union (16 percent vs. 8.30 percent), malunion (8 percent vs. 1.23 percent), and infection (12 percent vs. 5.38 percent). However, the differences between the two groups were not statistically significant. The authors stated that they were unable to remark on the superiority of any of these approaches and that additional clinical trials are required.

Arthrosis: A pilon fracture can lead to tibiotalar (ankle) joint arthrosis, while a depressed calcaneal fracture can lead to subtalar arthritis. Arthrosis can also occur as a result of less serious injuries, particularly if the injuries create misalignment.[98] The ankle joint, unlike the knee and hip, is a very unusual location for primary osteoarthritis to occur. The present study reported arthrosis was reported in 8 cases in two stage group (66.8%) and 4 cases in one stage

(33.4%). In a study by J. De-las-Heras-Romero et al[22] reported arthrosis in 44.7% cases in cases with pilon fracture. Because loss of mobility to reduce discomfort is easier tolerated in the ankle and hindfoot, arthrosis of the ankle is treated with procedures that would not be employed in the knee or hip. As a result, bracing and (in more severe instances) surgical fusion are standard treatments, while surgical procedures to correct tiny cartilage abnormalities or maintain mobility through joint replacement are also employed.

CONCLUSION

From the present study we conclude that Surgical management of type b and C AO/OTA Pilon fractures in patients using one stage (internal fixation) or two-stage method including initial external fixation followed by internal fixation is associated with the similar clinical, radiological, functional and subjective outcomes. In our study we found that the union time in the both the group was similar. In our study distal tibial pilon fracture with low grade soft tissue injury, minimal edema and no blister we found one stage procedure (internal fixation) better because of less chance of infection. In present study we observed that two stage procedure was done in cases were compound wounds and skin condition was poor,in these cases by doing external fixation we could preserve soft tissue and also give better wound care.

From this study we infer that patient who had undergone one stage procedure had shorter hospital stay. In present study we observed that arthrosis, superficial infection and arthritis was higher in two stage procedure. Assessed by Ovadia Beals Evaluation Score - Objective Evaluation as well as subjective evaluation. Furthermore, the rate of complications was also identical. However, functional outcome assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score revealed that the patients under went one stage procedure had better functional outcome. Perceived pain after surgery is also significantly less and patients are better satisfied in one stage procedure compared to two stage procedure.

Considering the better functional outcome and the shorter hospital stay, we preferred using one stage operative procedure in better skin condition, less soft tissue damage, closed fracture of type b and C AO/OTA Pilon fractures.

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