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Management of Distal Tibial Pilon Fracture with MIPPO.

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ABSTRACT

Background: Aim:To evaluate the functional outcome and results of distal tibial pilon fractures by minimally invasive percutaneous plate osteosynthesis (MIPPO) technique. **Methods:** This is a prospective study conducted at the Department of Orthopaedics of our institute. 20 patients with distal tibial pilon fractures were randomly selected for the study & treated with locking compression plate using minimally invasive percutaneous plate osteosynthesis(MIPPO) technique , after obtaining ethical clearance. All cases were fresh & traumatic in nature. The patients were matched with respect to age, sex, type of injury for unbiased comparative inference. The cases were followed up for a mean duration of 6 – 10 months. **Results:** According to Olerud and Molander criteria, in our study the results are excellent (50%), good (30%), fair (10%), poor (10%) were attained in distal tibial pilon fractures. **Conclusion:** The minimally invasive percutaneous plate osteosynthesis (MIPPO) technique is a reliable fixation approach in fracture of the distal tibialpilon preserving most of the osseous vascularity and fracture heamatoma, and turns providing for a more biological repair.

Keywords: MIPPO, Locking plates.

INTRODUCTION

Pilon fractures is an important group of fractures around the Ankle, is a Fracture of the lower end of the tibia bone that forms the ankle joint by articulating with the talus. This fracture involve plafond of the Distal Tibia and extend in to the adjacent metaphysis. The fibula may or may not be intact; the Talus is Driven vertically in to the Tibial plafond. Distal tibial Pilon fractures represent a significant challenge to most of the Surgeons even today. They are only 1-10% of all lower extremity fractures.

Fracture around the Ankle one of the commonest injury occurring in day to day life, the out of this the Pilon fracture are Notorious for its Morbidity, they commonly observed in construction workers fall from Height, Motor vehicle accident with a sudden stop and High velocity injuries, They are Most commonly seen male Population, and They are more expected to injury in out side work. Industrial Revolution has led to very, fast means of Transport and an Increase in vehicular accidents, increasing the incidence of injuries around the Ankle.

In High velocity injuries the Pilon Fracture so severely distort the articular surface of the Ankle, This results Deformity, stiffness and chronic pain, resulting in secondary osteoarthritis, Further these fractures cause, severe Destruction of Anatomy in osteoporotic patient. The management is also highly difficult.

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With each individual Fracture Pattern Requiring different Type of Instrumentation for stabilization. It is very important that as orthopaedic surgeons. We understand the injuries around the Ankle thoroughly and care should be Taken by surgeon in pre-operative planning and do in the surgery and post of Rehabilitation. So that they can be managed in the best way possible. The ultimate results is not to the satisfaction of Patient many times, If we look more closely, we will find that man's increased activities and intrests are the main

contributory factors for the injuries around the Ankle.

Objective

To evaluate the functional outcome and results of distal tibialpilon (Intraarticular) fractures by minimally invasive percutaneous plate osteosynthesis (MIPPO).

MATERIALS AND METHODS

This is a prospective study from November 2014 to October 2016. 20patients with fractures of distal tibialpilonwho admitted in our institute will be taken for this study after obtaining their informed, valid written consent.

Inclusion criteria

1. Distal tibialpilon (Intra articular) fractures
2. Age >18 years

Exclusion criteria

1. Patients aged below 18 years.
2. Pathological fractures
3. Compound GR3 distal tibialpilon(intra articular) fractures according to gustiloand Anderson classification
4. Patients with co-morbid conditions and not fit for surgery.

On admission of the patient, a careful history was elicited from the patient and/or attenders to reveal the mechanism of injury and the severity of the trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. General condition was assessed with the vital signs and systemic examination. Methodical examination was done to rule out fractures at other sites.

Preoperative assessment

All the patients were explained about the surgery and appropriate and valid written consent was taken. The patient was taken for surgery after routine investigation and after obtaining fitness towards surgery. The investigations done were, Hemoglobin percentage, random blood sugar, Blood urea, Serum creatinine, HIV, HBSAg and ECG.A dose of tetanus toxoid and antibiotic was given pre-operatively. Preparation of the part was done before a day of the surgery. Instruments were checked and sterilized before hand

- Instruments and implants
- Anatomically contoured medial locking compression plate.
- 5mm locking cortical screw.
- 3.2mm locking cancellous screw and 3.5mm cortical screw.
- 4mm and 2.7 mm drill bits.
- 4.5mm and 3.2 mm drill sleeves.
- 2mm K-wires.
- 5mm and 3.2 screw drivers.
- Pneumatic/Electric/Hand drill
- T-handle
- Esmarchs tourniquet
- General instruments like retractors, number 10 surgical blade, curved and straight haemostats etc.

Operative Procedure

Type of Anesthesia- Lumbar Sub Arachnoid Block (spinal anaesthesia)

Surgical technique (MIPPO):[1]

Place the patient supine on a radiolucent operating table,administerantibiotcs preoperatively and place a tourniquet.

After spinal anesthesia, draping should be done.

Estimate the length of the plate based on preoperative films.place the plate on the skin while checking the position with fluoroscopy.

Make one anteromedial incision at the proximal end of the anticipated plate position and one at the distal end.Make a tunnel connecting these two incisions in an extraperiostealfassion by a advancing an Elevator from distal to proximal or from proximal to distal.

Reduce the fracture fragments if necessarily by indirect or direct method as miniopentechnique.Insert the plate from distal to proximal on anteromedial aspect of tibial plafond, using the threaded drill guide as a handle and check the position using fluoroscopy and secured the plate with 2mm K-wires distally and proximally.

Fix the plate with 3.5mm cortical low-profile screws. Locking screws may be used if abride plate construct is deemed necessary.

Place a nonlocking lag screw through the midportion of the plate. Because the plate is flexible, good bone-plate contact can be achieved.

Distal locking done with 3.2 mm cancellous locking screws after drilled wih 2.7mm drill bit and proximal locking done with 3.5mm cortical screw, locking or non-locking screws after drilled with 3mm drill bit with help of guide sleeve.

Finally check the adequate reduction and proper plate fixation using the fluoroscopeantero-posteriorly and laterally.

Deflate the tourniquet, and obtain hemostasis, close the woundover drains in standard layered fashion after wound wash was given.

Place a bulky cotton dressing with a posterior plaster sling to maintain the ankle in neutral position.

Figure 1: After plate insertion.

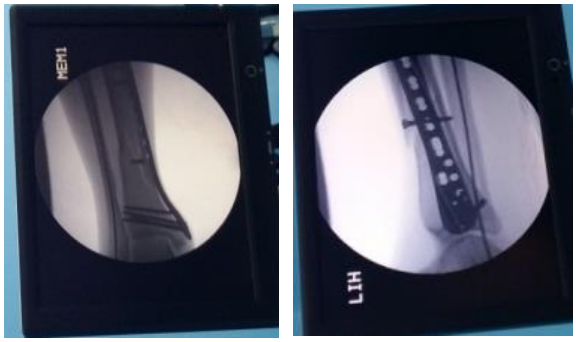

Figure 2: Antromedial plate position under C –Arm AP and lateral view.

Olerud & molander scoring system [2]

Olerud & Molander Scoring System was used in this study to assess the results.

Parameter Degree Score

1. Pain
   None-25
   While walking on uneven surface-20
   While walking on even surface outdoors-10
   While walking indoors-5,pain while walking constant and severe-0
2. Stiffness
   None-10
   Stiffness-0
3. Swelling
   None-10
   Only in evenings-5
   Constant-0
4. Stair-climbing
   No problems-10
   Impaired-5
   Impossible-0
5. Running
   Possible-5
   Impossible-0
6. Jumping Possible-5 Impossible-0
7. Squatting
   No problems-5
   Impossible-0
8. Supports
   None-10
   Taping, wrapping-5
   Stick or crutch-0
9. Work, activities of daily life
   Same as before injury-20
   Loss of tempo-15
   Change to simpler job-10
   Severely impaired work capacity-5

RESULTS

Age distribution

In present study according to inclusion criteria the age of patients ranged from 18 to 65 years and the minimum fracture age at 25 yrs. And maximum age at 65 yrs. in this study.the fracture being most common in 4th and 5th decade and an average of 47.1 years.

Sex Distribution

Out of 20 patients, in present study,15(75%) were male and5(25%) were female, the malepreponderance was because of outdoor and field work among male population.

Side Affected

There were 13 (65%) patients with right sided distal tibialpilonfractures and 7 (35%)patients with left sided tibialpilon fractures.in the present study.

Mode of Injury

In this study 12 patients (60%) sustained injury due to road traffic accidents (high velocity) and 8patients (40%) due to self fall (low velocity).

Fracture Characteristics

1. Clinical:
   Out of 20 cases in the present study, 18 cases were closed fractures and 2 cases were open fractures encountered.
2. Fracture Pattern:
   The fracture patterns were classified on the basis of Ruedi and Allgowerclassification. Out of the 20 cases studied, Type I 7 cases (35%), Type II 11 cases (55%), Type III 2 cases (10%).
3. Injury – Hopital Arrival Interval:
   The average duration in hours from the time of injury to arrival at the hospital was 27.4 with minimum as early as 4 hours to maximum of 96 hours. Age of the injury is important because of the nature of treatment instituted initially can adversely affect the treatment resulting in severe swelling, blisters and other complications via application of tight bandages, inadvertent splintage techniques etc.
4. Time Interval Between Arrival And Surgery:
   All patients were operated at an average of 5.45 days from the time of arrival tohospital ranging from 2 to 9 days.
5. Duration Of Hospital Stay.
   All patients were discharged after an average of 10 days post surgery after removal ofsutures on the 9th and 10thpost operative day. In our institution, we have been discharged the patient on the day of suture removal. The skin condition was checked on2ndpost operative day and then during suture removal. 2 patients with suspected wound problems were kept till the wound was found to be satisfactory for discharge.

Duration of Surgery

Out of the 20 cases studied 4 (20%) took 31-40 mins, 6 (30%) took 41-50 mins, 9 (45%) took 51-60 mins, 1 (5%) took 61-70 mins. In all patients in our institution we could not appliedesmarch's tourniquet bandage.

Duration of fracture union:

All the fractures united with an average of 20 weeks. There was1 case of delayedunion with 23 weeks of radiological callus formation.

Objective and subjective criteria:

Table 1: Objective Criteria.

Rating	Ankle/ Subtalar Motion	Tibiotalar Alignment	Tibial Shortening	Chronic Swelling	Pronation/ Supination	Equinus Deformity
Excellent	>75% Normal	Normal	None	None	Normal	None
Good	50-75%	Normal	None	Minimal	Normal	None
Fair	25-50%	<5 Degrees Angulation	<1cm	Moderate	Moderate Decrease	None
Poor	<25%	>5 Degrees Angulation	>1cm	Severe	Marked Decrease	Present

Table 2: subjective criteria.

Rating	Pain	Return To Work	Recreational Activity	Limited Walking	Pain Medication	Limp
Excellent	Normal	Same Work	Normal	No	None	Normal
Good	Minimal	Same Work	Mild Modification	No	None	Normal
Fair	Moderate	Modified Work	Significant Modification	Yes	Non Narcotic	Occasional
Poor	Severe	Unable	None	Yes	Narcotic	Yes

Table 3: Objective Data Table.

Rating	No. of patients	Percentage
Excellent	10	50
Good	6	30
Fair	2	10
Poor	2	10
Total	20	100

Present Study

In present study of 20 cases, 10 (50%) patients like case no 2, 3, 4, 5, 6, 9, 10, 11, 15 and 17 had excellent outcome, 6 (30%) patients like case no 1, 7, 12, 13, 18, and 19 had good outcome, 2 (10%) patients like case no 8 and 20 had fair outcome and 2(10%) patients like case no 14 and 16 had poor outcome.

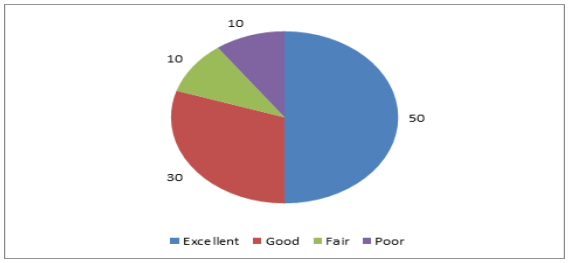

Figure 1: Objective data table.

Table 4: Subective Data Table.

Rating	No. of patients	Percentage
Excellent	10	50
Good	6	30
Fair	2	10
Poor	2	10
Total	20	100

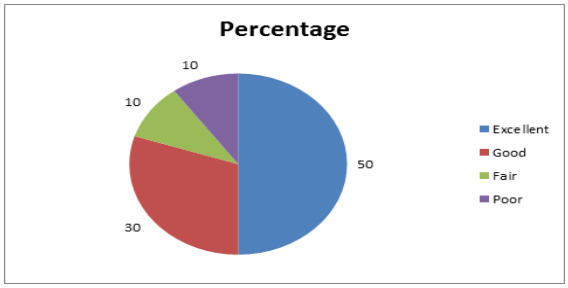

Figure 2: Subjective Data Table

Table 5: Showing Complications.

Complications	No. of patients	Percentage
Superficial skin infection	2	10
Ankle stiffness		
>75%	0	0
50-75%	0	0
25-50%	0	0
<25%	1	5
Valgus malaligment	1	5
Malleolar skin irritation	1	5

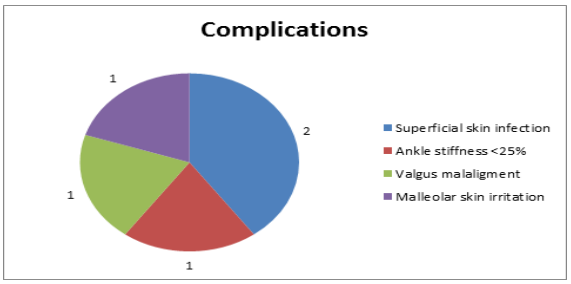

Figure 3: Complications

DISCUSSION

Management of distal tibial pilon fractures remains controversial because of limited soft tissue cover, subcutaneous location and poor vascularity.[3-5] Treatment modalities for distal tibial fractures include closed reduction and cast application.[6,7] external fixation.[8,9] open reduction and internal fixation using plates, staged open reduction,[10-13] Intramedullary nailing,[14,15] and minimally invasive percutaneous plate osteosynthesis using a locking plate.

Distal tibia has got circular cross sectional area with thinner cortex as compare to triangular diaphysis with thicker cortex. So, intramedullary nail, which is designed for tight interference fit at diaphysis, cannot provide same stability at distal fracture. Other potential complications of IMIL nailing are malunion (0-29%) and implant failure (5-39%).[16]

ORIF with conventional plate, which needs striping of periosteum, is also not an ideal treatment option because tibia is subcutaneous bone and periosteum provides 2/3 rd. of blood supply. Non-union and infection are reported with the range of 8.3-35% and 8.3-25% respectively with ORIF with plating.[17]

In fractures caused by torsional forces the articular surface is usually easier to reconstruct by internal fixation.[18] In this case, ankle instability, which is the major problem, induces postoperatively pain, while osteoarthitic lesions may appear later. Major concern in these fractures should be the restoration of the stability of the ankle joint by repair of the ligamentous elements.[19] Essential goal is to restore all structures needed in order to achieve optimal talus movement in relation to the tibia when foot dorsiflexes, the mortise is widened by a simultaneous posterolateral displacement and external rotation of the fibula. This synchronized motion performed by certain muscle activity, controlled by mechanisms of proprioception through receptors of the ligaments and of the articular capsule and requires continuity of the ligaments and anatomical reduction of the articular surface Although axial compression, rotational forces and direct blows are largely responsible, Kellam drew attention to the significant counter force from the talus which damages the articular surface of the tibia greater extent than can be appreciated radiologically.[20]

Open reduction and internal fixation is indicated intypes II and III pilon fractures. Good reduction is generally rewarded by good functional results.Non-operative management achieves good results intype I fractures; however, the good position may be lostin the plaster. Hindfoot function is negligibly affected in type Ifractures. Internal fixation is followed by recovery of hindfoot function in types II and III pilonfractures.Post-traumatic ankle arthritis is the most common complication.

Ruedi et al.[21] reported 74–90% good or excellent results in their series after open reduction and internal fixation. In Rüedi and Allgower series 74% of 84 patients were pain free and had good functional results for 9 years postoperatively. Most of the fractures in their series, however (75%) were of a low energy pattern. Mast et al.[22] using the same technique reported 78% good results on 37 patients with a minimum follow-up of 6 months. Similar good to excellent results were also reported by Groseet al.[23] On the other hand, a number of authors reported dismal results with open reduction and internal fixation.

The high complication rate with open reduction and internal fixation especially in high energy fractures can be diminished with careful selection of patients, respect of soft tissues and with the use of less invasive techniques such as limited open reduction and internal fixation and hybrid fixators.

With the development of technique of MIPPO with LCP, which preserve extra osseous blood supply, respect osteogenic fracture hematoma, biologically friendly and stable fixation method is available for distal tibiapilon fracture. Indirect reduction method and sub-cutaneous tunneling of the plate and application of locking screws with small skin incisions in MIPPO technique prevents iatrogenic injury to vascular supply of the bone. Unlike conventional plates, LCP is a friction independent self-stable construct, which provides both angular and axial stability and minimizes risk of secondary loss of reduction through a threaded interface between the screw heads and the plate body.

In spite of use of MIPPO with LCP as internal external fixators, anatomical reduction of the fracture by using indirect reduction maneuvers before applying the plate is very important surgical step.

Concomitant fibula # at the same level plays an important role in reduction. Though a few authors advocate fixation of fibula before fixation of the tibia to achieve a better alignment and to prevent valgus/varusmalaligment, no clear cut indication/ protocol exists as far as fibula fracture fixation is considered.

Some authors said that The stability of the ankle joint is not enhanced by fibula fixation because axial compression fractures are not accompanied by ligamentous damage.[24] If we reconsider that the major stabilizing element of the ankle joint is the deltoid ligament at the medial side, we can conclude that reduction and fixation of the fibula in such fractures has no significant effect in the stability of the ankle joint.

Hazarika et al, a series of 20 patient of distal tibialpilon fractures treated using locking compression plates through MIPPO technique. This approach aims to preserve bone biology and minimize surgical soft tissue trauma. This provided 87.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after stabilization with external fixators primarily.[25]

Ozkaya U, et al, a retrospective review of 22 patients with distaltibialpilon fractures were treated with titanium locking compression plates using minimally invasive technique good biological fixation of distal tibial. A totalof 81% of good to excellent outcome was assessed using American Orthopaedic Foot and Ankle Society.[26]

In the present study the results were given on the basis of Olerud and Molander scoring system, the score was analyzed by SUM points of all parameters and the interpretation as the minimum score=0 and the maximum score=100, higher the score shows the better functional ability.

The present study management of distal tibialpilon fractures with minimally invasive percutaneous

plate osteosynthesis (MIPPO) technique with locking compression plate shown the results based on Olerud and molander scoring system.in the present study the case no. 2, 3, 4, 5, 6, 9, 10, 11, 15 and 17 attained excellent results and the case no. 1, 7, 12, 13, 18, and 19 attained good results overall in the present study was attained 80% good to excellent results.

CONCLUSION

According to the study, 20 patients with fractures of the distal tibialpilon had undergone closed reduction through MIPPO techniques of application of the locking compression plates. This technique has resulted in the effective stabilization of these fractures. It does provide adequate stability and allows early motion.

The greatest advantage of the MIPPO technique is the ability to preserve the blood supply and fracture hematoma undisturbed, which helps in fracture healing and the soft tissue scaffold and to prevent the complications which is crucial for minimizing the already compromised soft tissue around the fracture

It is a simple, has a rapid and straight forward application and has areduced surgical time due to newer anatomically contoured locking compression plate for the distal tibialpilon fractures.

By the analysis of the data collected in the present study, closed reduction and internal fixation with Locking compression plate using Mippo technique for distal tibialpilon fractures is the choice of treatment where intramedullary nails are not the choice and complications rates as compared to open reduction and plating and IMIL is significantly lower.

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