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## Study of outcome of pilon fracture of tibia treated with open reduction and plating

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### Abstract

**Background and Aim:** Pilon fracture of tibia are difficult to treat. Age, Skin condition, Mode of trauma, Open injury further increases obstacles in healing process. Various modalities of treatment are available but no ideal treatment has yet evolved. Casting often leads to malalignment, increased chances of non-union and also stiffness in the joints from prolonged immobilization. Hence the aim of the study was to see the effectiveness of open reduction and plating in pilon fracture of tibia in adults.

**Material and Method:** A total of 20 patients were included in the study. All the included patients had fracture of distal tibia (pilon), aged >18 during the period of 2019-2020 in our hospital. Fracture is classified according to AO-OTA Classification. All are treated by open reduction and plating. Length and type of plate was selected as per fracture pattern. Post-Operatively above knee cast with leg elevation given to decrease pain and edema. The patients are followed up at regular interval of 4,8,12 and 16 weeks and results were evaluated using AOFAS for the results of treatment.

**Results:** we had 60% excellent results, 20% good results, 10% had fair & 10% poor results

**Discussion and Conclusion:** Open reduction and plating achieves strength of distal tibial (pilon) fracture shaft in all three planes of loading- bending, compression and torsion. The rate of union compared to other modalities of treatment is excellent.

**Keywords:** tibia, fracture, pilon, plating

### Introduction

Tibial pilon fracture was described by the Etienne Destot, a French radiologist in 1911 to describe fracture occurring in distal tibia within 5 cm from the ankle joint line [1, 2]. Tibial pilon fractures account for 1% to 10% of all lower extremity injuries [6]. These are intra-articular fractures involving the ankle joint. These fractures may occur due to high or low energy injuries [3, 4, 5]. The precarious vasculature around the ankle and the subcutaneous location of tibia make these fracture one of the serious injuries challenging orthopaedic surgeons [6].

Fractures of the distal tibia can be quite challenging to manage. They are notoriously difficult to reduce, align and stabilize, and are prone to develop wound complications and infections. As these fractures involve a major weight bearing joint, they result in functional impairment [7]. To preserve normal ankle function, it is must to maintain joint congruity, preserve the normal mechanical axis, ensure joint stability and restore full range of motion especially in Indian culture where squatting and sitting cross legged is must as routine. This is a formidable task to accomplish, especially in the phase of compromised soft tissues especially in open fractures, variable bone quality and associated medical conditions of the patients

Conservative treatment by cast application lead to prolonged immobilization lead to ankle and knee stiffness affecting to quality of life of patient

Many treatment options emerged over time for treating these injuries. Early open reduction and internal fixation lost its popularity due to wound related complications and external fixation emerged as the definitive fixation which was replaced by hybrid fixators with the advantage of early mobilization of ankle and better stability [9]. Hourglass shape of medullary canal prevents the tight endosteal which compromises stability thus limiting the use of intramedullary nails [9].

Several different surgical approaches have been described for DISTAL TIBIAL fractures (medial, lateral and combined) depending on the location of the fracture. Combined extensive approaches, in particular, are associated with high complication rates, possibly due to compromised soft tissue perfusion and/or extensive soft tissue stripping from bone fragments. A review of the recent literature demonstrates a trend toward increasingly limited open reduction and internal fixation, often in association with some form of external stabilization. Minimally invasive techniques have also been described for intra-articular fractures (metaphyseal and diaphyseal metaphyseal) of the distal tibia [10, 11]. These techniques avoid the long incisions and extensive soft tissue stripping associated with conventional techniques and are best used with shorter, lower profile plates.

AO medial plating although showed promising results has its own drawbacks like wound dehiscence and implant prominence over subcutaneous border of tibia. Also in medial approach difficulty is encountered in visualization of the Chaput fragment [10, 11]. Plating on the lateral surface of tibial plafond is a new entity and the anterolateral approach is gaining popularity for the fixation of tibial pilon fractures with many studies showing better soft tissue coverage and less chance of wound dehiscence [10, 11]. Management of pilon fractures had shifted from acute to delayed fixation following the understanding that soft tissue healing is of paramount importance in treating these in injuries [12, 13]. In this study, we are evaluating the plating for distal tibia fractures.

## Materials and Methods

**A. Sample Design:** Interventional Prospective study.

**B. Sample Size:** 20

### Criteria for Patient Selection

#### • Inclusion Criteria

- 1) Adults above the age of 18 years
- 2) Fresh fracture without neurovascular deficit
- 3) Close fracture, fracture with open Grade I and II were also included.

#### • Exclusion Criteria

- 1) Adults below the age of 18 years
- 2) Fresh fracture with neurovascular deficit
- 3) Patients who don't give consent for study

### Treatment protocol

All the patients were treated according to protocol which consisted of:-

- 1) Standard A.P. & lateral plain X-ray.
- 2) Open wound were taken to operation theatre for wound debridement on emergency basis as early as possible.
- 3) Poly trauma patients were fixed as soon as their general condition allowed for surgery.
- 4) Ankle range of movement exercises started according implant used and stability of fixation of fracture, post operatively.
- 5) Patients discharged with BK slab or Ankle brace depending on stability of fixation.
- 6) Weight lifting and routine work, is allowed according to union status radiologically and clinically.
- 7) Patients follow up depended on the clinical examination as well as the x-ray findings.

## Classification

### Ao-Ota Classification

### A1 Extra-articular fracture, Metaphyseal simple

1. Spiral
2. Oblique
3. Transverse

### A2 Extra-articular, Metaphyseal wedge

1. Postero-lateral impaction
2. Antero-medial wedge
3. Extending into the diaphysis

### A3 Extra-articular fracture, Metaphyseal complex

1. Three intermediate fragments
2. More than three intermediate fragments
3. Extending into the diaphysis

### Indications

Thus the indication for surgery our study are;

- Failed conservative methods
- Unstable fracture
- Fracture in patients with polytrauma
- Bilateral distal tibia fractures
- Associated injuries in ipsilateral fibula

### Contraindications

- Pathological fractures.
- Malunited fractures.
- Infected fractures.
- Poor skin condition.
- Poor general (medical) condition of patient (where patients cannot tolerate surgery).

### Position

Patient was taken to the plain radiolucent table in supine position. The affected limb was scrubbed and prepared with savlon. Painting and draping was done under aseptic and antiseptic conditions. Draping was done in such a manner that the area from middle of the thigh to whole foot was exposed for proper recognition of anatomical landmarks. The foot was covered with either sterile pad or hand gloves. Inject able antibiotic administered prior to incision.

### Selection of implant

In tibial fractures distal tibial metaphyseal plate was considered according to the fracture geometry on antero-posterior and lateral view of the affected limb.

### Pre-operative measurement of implant size

Pre operatively on the x-ray antero-posterior view and lateral view the size of the implant was measured considering the magnification of the roentgenogram.

### Types of plates

- 1) anatomical medial distal tibia plate
- 2) condylar butress plate
- 3) anterolateral tibia plate
- 4) lc DCP

### Surgical approach

Various approaches used in our study

- 1) medial approach
- 2) anterolateral approach
- 3) anteromedial approach
- 4) posterolateral approach
- 5) posteromedial approach
- 6) operative procedure

**Surgical technique****Plate selection**

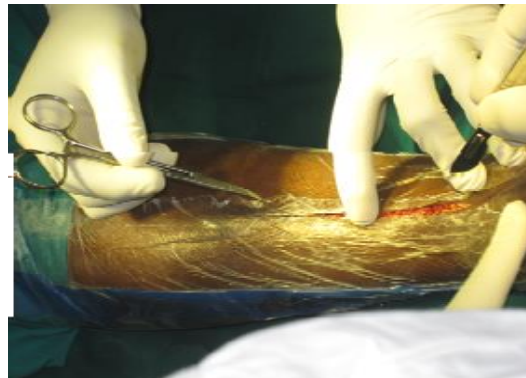
- The plates are available in various lengths and configurations, type of plate is decided according to type of fracture

**Incision and dissection**

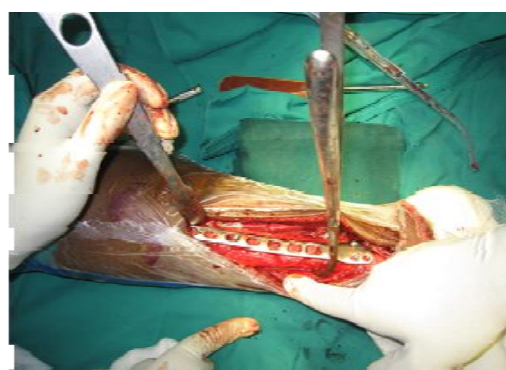
Incision is taken as per previously mentioned surgical approaches and extended distally as per site of fracture. Dissection of subcutaneous tissue is done and bone exposed, identify fracture site and margins of fracture is cleared



Incision



Extension of incision



Reduction of fracture and positioning of plate



Distal Fixation



Proximal fixation



Checking under image intensifier

**Fig 1:** Open reduction and internal fixation**Reduction of articular surface and provisional fixation**

The fracture fragments were reduced and reduction confirmed using image intensification. Reduction was stabilized using one of the following methods: The locking screw didn't provide interfragmentary compression; therefore, any desired compression was achieved with standard lag screws. The articular fractures were reduced and compressed prior to fixation of the 3.5 mm LCP Medial distal tibial plate with locking screws. If a combination of cortex and locking screws had been used, the cortex screw had been first inserted to pull the plate to the bone.

**Closure**

- The stab wounds were closed with suture. Sterile dressing with spirit applied.
- Below knee slab applied and patient was shifted to ward

with vital signs monitoring.

**Post Operative Management**

- Postoperative patients were immobilized with BK slab from next postoperative day morning.
- Postoperative analgesic is given according to patients complain.
- Intravenous antibiotics given for 1<sup>st</sup> 5 days then shifted to oral antibiotics.
- 1<sup>st</sup> dressing done on 5th post-operative day and wound condition noted.
- 2<sup>nd</sup> post-operative dressing done on 9th day.
- After that patients were discharged with oral antibiotics and analgesics and with BK slab and called on 12 to 14<sup>th</sup> post-operative day for suture removal.
- After suture removal we have given BK to patients whose



fracture fixed with LCP and other patients given BK Slab till 3 weeks followed by Ankle mobilization and was advised to come at 1 month.

**Results**

This study includes 20 patients of tibial pilon fractures treated with Distal Tibia Plate. These included closed as well as open injuries and polytrauma patients. This chapter takes into account observations of the study and effect of various factors on the results. The study includes patients operated at department of orthopaedics, medical college and SSG hospital, Vadodara.

**Table 1: mode of injury**

| Mode of injury   | Patients | Percentage (%) |
|------------------|----------|----------------|
| RTA              | 10       | 50             |
| Fall from height | 7        | 35             |
| Assault          | 3        | 15             |
| Total            | 20       | 100            |

- Most of patients had sustained fracture with road traffic accident.
- In our study it comprises 50%

**Table 2: Fracture Classification (According to OTA)**

| Fracture pattern | Patients | Percentage (%) |
|------------------|----------|----------------|
| A                | A1       | 2              |
|                  | A2       | 5              |
|                  | A3       | 8              |
| B                | B1       | 0              |
|                  | B2       | 1              |
|                  | B3       | 0              |
| C                | C1       | 1              |
|                  | C2       | 1              |
|                  | C3       | 2              |
| Total            | 20       | 100            |

- According to OTA classification.
- Type A accounted for 75% of patients.
- Type B accounted for 5% of patients.
- Type C accounted for 20% of patients.

**Table 3: Inter fragment Screw Vs Result**

| Inter fragment insertion | Excellent | Good | Fair | Poor | No. of Patients |
|--------------------------|-----------|------|------|------|-----------------|
| Yes                      | 10        | 1    | 0    | 1    | 12              |
| No                       | 2         | 3    | 2    | 1    | 8               |
| Total                    | 12        | 4    | 2    | 2    | 20              |

Patients in which inter fragment screw is inserted 10 patients out of 12 gets excellent results and 1 patient have good and 1 have poor result  
Two fair and one poor result is seen in the patients where inter fragment screw is not used

This shows inter fragment screw is used as and when needed

**Table 4: Results**

| Results   | Patients | Percentage (%) |
|-----------|----------|----------------|
| Excellent | 12       | 60             |
| Good      | 4        | 20             |
| Fair      | 2        | 10             |
| Poor      | 2        | 10             |
| Total     | 20       | 100            |

- 12(60%) were having excellent result.
- 4(20%) patients had good result.
- 2(10%) patients had fair result.
- 2(10%) patients had poor result in our study.



**Fig 2: Excellent**

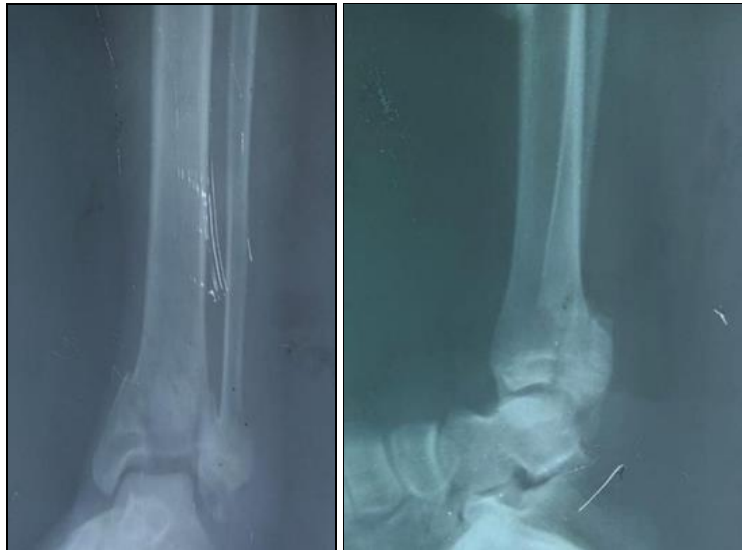


Fig 3: Preoperative



Fig 4: Final follow-up

### Discussion

- Maximum number of patients (45%) were in Middle age group of 21-40 years.
- The range of age was from 17-68 years. The mean age was 42.7years.
- Male & female patient's ratio is 3: 1(12 male, 8 female).
- 09 patients (45%) of our patients were farm labourer and manual labourer.
- There were 50% patients with injury due to RTA, 35% had injury due to fall from height and 15% had injury due to assault.
- 15(75%) patients had close fracture and 5(25%) patients had open Grade I fracture.
- Maximum number of fractures were of AO Type A (75%).
- Most patients 18 (90%) were operated within 1 week of trauma and Two patients were operated on 8<sup>th</sup> and 10<sup>th</sup> days of trauma due to other medical cause.
- In 14 patients (70%) Anatomical distal tibia plate was used, 3 patients (15%) patients were operate with Butress plate, in one patient anterolateral distal tibia plate used, in one patient LCDCP plate used and in one patient reconstruction plate used.
- In 12 (60%) patients there is inter fragment screw is used
- 10 patient got excellent results
- In 16 patients (80%) fracture is united in 4 months and 3 patients take more than 4 month for union while one patient had non-union.
- 50% of patients had injury on right side & 50% of patients had injury on left side.
- 80% of patients in our study had no problem in Ankle movement.
- 80% patients time taken for full weight bearing between 3 to 4 months
- Most of patients were able to resume their pre-trauma occupation (80%) and 20% patients change their job.
- 80% of our patients were able to walk normally without support.
- Complication were minimal in our study 80% patients have no complication. There was 1 case non-union, 3 cases of superficial infection for which two patient undergone for implant removal.
- Using the American orthopaedic foot and ankle society score, we had 60% excellent results, 20% good results, 10% had fair & 10% poor results.

### Conclusion

Pilon fracture of tibia with or without intra articular extension

is one of the difficult fractures to manage. None of the treatment options available perfectly fulfil requirements of fracture characteristics of distal tibia. The goals of treatment of a distal tibia fracture are anatomical articular reduction, restoration of axial alignment, maintenance of joint stability, achievement of fracture union, pain free weight bearing and motion, without any wound complications. The treatment plan in distal tibia fracture depends on fracture pattern, soft tissue injury, patient co-morbidity, fixation resources. Fracture pattern, concomitant articular extension, condition of soft tissue are important factors to be considered before selection of fixation method. The present case series shows that plating is an effective treatment method in terms of preserves the biological environment by preserving soft tissue with better outcome interim of union time and complications rate which is comparable to other studies.

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**Conflict of interest:** None declared.

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