HYBRID EXTERNAL FIXATION OF TIBIAL PILON FRACTURES- A PROSPECTIVE STUDY
Jyothish Kavungal1, Jacob Pulikotil Joseph1, Jose Francis3

1Assistant Professor, Department of Orthopaedics, Government Medical College, Thrissur.
2Additional Professor, Department of Orthopaedics, Government Medical College, Thrissur.
3Professor, Department of Orthopaedics, Government Medical College, Thrissur.

ABSTRACT

BACKGROUND
Significant wound complications and ankle stiffness in patients with tibial pilon fractures treated by internal fixation or ankle spanning external fixation. Ankle sparing external fixation reduces these complications to a greater extent.

MATERIALS AND METHODS
15 patients with tibial pilon fractures treated by hybrid external fixation were followed up for a period of 40 weeks.

RESULTS
The average union time was 24-40 wks. in 94% of patients. The functional score was good to excellent in 73% of patients. The radiological alignment was not fully acceptable though in majority of cases.

CONCLUSION
Hybrid fixation gives a satisfactory functional outcome in the management of tibial pilon fractures.

KEYWORDS
Pilon Fractures, Hybrid Fixation, Swivel Clamp, Twisted Plate, Ankle Sparing.


BACKGROUND
Fractures of the distal end of the tibia involving the articular surface and adjacent metaphysis are difficult to treat. Moreover, these fractures have become common nowadays. ‘Pilon’ means ‘pharmacist’s pestle’, which was coined by the French radiologist Destot. Bonin used the French word ‘plafond’ (ceiling) to describe the distal tibial articular surface. Ruedi and Allgower1,2 described a classification system for these fractures.

Following are the factors contributing to the uncertain outcome of these injuries-
1. Impaction into the supra-articular metaphysis.
2. Instability.
3. Comminution.
4. Primary articular cartilage damage.
5. Joint surface incongruity.

30-50% of the fractures are associated with other organ injuries due to the high energy nature. 10-30% are open injuries with degloving and crushing. They account for 3-10% of all tibial fractures and less than 1% of all lower limb fractures.

AIMS AND OBJECTIVES
1. To evaluate the functional outcome of tibial pilon fractures treated by hybrid external fixation sparing the ankle joint.4,5
2. To analyse the advantages and disadvantages of ankle sparing device.
3. To evaluate the relation between anatomical and functional outcomes.

MATERIALS AND METHODS
A prospective study of tibial pilon fractures admitted at Government Medical College, Thrissur, during 2010-11. Total number of cases = 15, number of male patients = 11, number of female patients = 4. Number of closed fractures = 6, Number of compound fractures = 9.

All the cases were managed by hybrid external fixation sparing the ankle joint.6

Inclusion Criteria
All cases of pilon fractures treated by hybrid ankle sparing external fixator.

Exclusion Criteria
Pilon fractures treated conservatively or operated by different modes of fixation.

Selection of Cases- Cases selected were AO types A1, A2, A3, B1, B2, C1, C2, C3 types were omitted.
DISCUSSION
Preliminary Treatment
Closed fractures are either immobilised in a long leg slab or calcaneal pin traction from the emergency room itself. Compound fractures are thoroughly debrided and lavaged with normal saline, tetanus immunoglobulin, tetanus toxoid and antibiotic prophylaxis (IV cephalosporin/aminoglycoside) given and subsequent immobilisation done accordingly. In the ward, the limb is elevated to prevent soft tissue swelling.

Preoperative Evaluation
A thorough history of the mode of injury (high velocity/low velocity), personal habits like smoking or alcoholism, comorbidities like diabetes, hypertension, COPD, occupation and functional demands of the patient is taken. A detailed physical examination to detect the associated injuries (orthopaedic as well as non-orthopaedic), co-morbidities (anaemia, hypertension), distal neurovascular status, etc. is undertaken. The patient is thoroughly evaluated for the haemoglobin, blood sugar, renal parameters, blood group, hepatitis and HIV and AP and lateral x-rays regarding the AO fracture type, the amount of comminution, soft tissue damage (external/internal degloving). Additional views like lateral/medial oblique views, additional investigations like CT scan were sometimes mandatory for the definite interpretation of the fracture pattern and the comminution in certain cases.

Operative Procedure
The selected cases were managed by hybrid external fixation.

Anaesthesia
Spinal anaesthesia was used in four cases. Regional lower limb blockade using the nerve stimulator (Stimuplex) was employed in ten cases. One case was abandoned during the first attempt under nerve block and spinal anaesthesia was given in the second attempt.

Position of the Patient
Supine position.

Procedure
The affected limb is painted from the lower thigh down including the foot and toes. The toes are always kept exposed to know the alignment of the limb while reducing the fracture. Three Schanz pins are put in a row on the proximal fragment of the tibia at right angles to the shaft slightly medial to the margin of the shin. The nearest Schanz pin is within 5 cm of the fracture, the farthest being within 15 cm distance. The fracture is now reduced by giving traction and the limb is held in proper alignment without any valgus or varus by looking at the positions of the patella and the second toe. The long K-wires are now put percutaneously through the safe zone from the lateral to the medial aspect of the limb, i.e. 70°–260° and 90°–280°, the former just anterior to the fibula and the latter through the fibula. The wires are connected by an Ilizarov half ring using wire fixation clamps. The proximal and the distal constructs are connected by universal external fixator rods using universal clamps on the Schanz pins and swivel clamp or twisted plate on the Ilizarov ring. The stability of the frame is accentuated by a second universal ex-fix rod attached in a triangular fashion. The reduction and the pin/wire placements are checked by the C-arm peroperatively. The distal vascularity of the limb is checked before shifting the patient from the anaesthesia table.

Fibular Fixation
In our study, we preferred not to fix the fibula mainly because of wound complications. We could obtain reasonably good alignment and fracture healing even without fibular fixation.

Postoperative Management
Postoperatively, the limb is well elevated, pin tract properly cleaned every day, appropriate antibiotics given. If the wound healing is satisfactory and limb is not much oedematous, the patient is discharged on the 6th or 7th postoperative day. The hybrid fixator is retained for 4-6 weeks depending on the stability, clinical and radiological progress of healing and pin tract infection. A long leg cast is given further for a period of 3-4 weeks followed by patellar tendon bearing cast. The time to bear weight is determined by clinical and radiological indicators of fracture healing.

Postoperative Complications
1. Wound Infection
There were infections of the compound wound in 3 of our patients out of the fifteen cases (20%). One case was managed by vacuum suction technique. The other two cases could be managed by thorough debridement, proper antibiotics and supportive measures.

2. Pin-Tract Infection
Pin-tract infection developed in 2 of our patients (13.33%). They were managed by proper pin-tract care and supportive measures. In the second patient, the pins had to be removed a little earlier than usual.

3. Pin Loosening
One patient had loosening of the pins due to osteoporosis (6.66%). The loose pins were removed.

4. Osteomyelitis
One patient developed osteomyelitis of the lower end of the tibia and fibula (6.66%). It was a grade 2 open fracture, which got infected and was managed by temporary external fixation. Hybrid fixation was done only after the infection settled. But, there was a flare up of infection after 12 weeks when the patient was in the PTB cast. The patient has intermittent relapses and remissions of infection even if the fracture has malunited and he is able to walk.
5. **Limb Oedema**
   One patient had severe oedema of the lower limb even after union of the fracture and weight bearing (6.66%). It was managed by physiotherapy, anti-oedema medications, crepe bandage and other supports.

6. **Fibular Wound Dehiscence**
   In our study, fibular fixation was done in only one patient, which led to wound dehiscence (6.66%). It was managed by regular wound care along with other supportive measures. We did not attempt fibular fixation in the rest of our patients in the study.

7. **Non-Union**
   One of the fractures did not unite even after 36 weeks and was taken as non-union (6.66%). It was managed by ORIF and bone grafting using locking hybrid plates for the lower end of the tibia.
   5 patients out of 15 (33.33%) in our study did not develop any complications whatsoever.

**RESULTS**

**Tibial Pilon Fractures**
1. In this study of tibial pilon fractures, 80% (12 out of 15) of patients belonged to the age group of 30-60 yrs.
2. Males predominated the study population with 73% compared to the females 27%.
3. 53% of patients hailed from poor socioeconomic strata and an equal % of patients were manual labourers.
4. Road traffic accidents comprised the commonest mode of injury, 73% of tibial pilon fractures in this study.
5. 60% of the fractures were compound in the study. The rate of complications were high among compound fractures, 89% as against 33% among closed fractures.
6. 74% of the fractures were right sided.
7. AO type-A fractures constituted 60% of the cases out of which 44.5% were type A2.

**Ankle Sparing Hybrid Fixation**
1. All the 15 patients in the study were operated within a time period of 1-3 weeks of the injury.
2. Regional nerve blockade of the lower limb was used in 66.7% of cases and spinal anaesthesia was used in 26.7%.
3. The average operating time was less than 1 hour in all the cases.
4. In 73% of cases, a good fracture alignment could be obtained with this technique.
5. The articular congruity was good in all the 15 cases, which could be one of the reasons for a good ankle score in this technique.
6. The functional ankle score (Mazur score) was excellent in 13% of cases, good in 60% of cases and fair in 27% of cases. None of the patients in the study were having a poor Mazur score.
7. The average time to union of the tibial pilon fracture with this technique was 24-40 weeks in this study.
8. 33% of patients did not have any complications with this particular technique. The rest of the patients had complications like pin-tract infection, wound infection, osteomyelitis, pin loosening, wound dehiscence, oedema and nonunion.

**CONCLUSION**

Hybrid external fixation is an excellent treatment option for types A1 to C2 of tibial pilon fractures with respect to the functional outcomes. It is not a good technique for type C3 pilon fractures.

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