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# The management of tibial pilon fractures with the Ilizarov fixator: The role of ankle arthroscopy

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## HIGHLIGHTS

- Ankle spanning using the Ilizarov technique is a useful tool in reducing pilon fractures without excessive soft tissue damage.
- Ankle distraction using Ilizaov allows for a good environment for healing of the articular surface by increasing the blood supply and by distraction that will relief the compression on the articular surface making sure it will heal without the risk of collapse and accordingly will decrease the incidence of osteoarthritis.
- Although the use of arthroscopy was helpful in assessing the articular surface, reducing any depressed fragments after closed reduction and washing all the debris inside the ankle, it did not have any statistical positive effect on our results.
- The added value of using arthroscopy needs more investigation with longer follow up and larger number of cases.

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## ABSTRACT

*Background:* Pilon fractures usually result from high energy trauma, and are commonly associated with extensive soft tissue damage which prevents the use of open reduction and internal fixation.
*Purpose:* This study was designed to evaluate the use of the Ilizarov external fixator in the treatment of pilon fractures of the ankle, and to determine whether arthroscopy of the ankle could improve the outcome.
*Methods:* From February 2011 to May 2013 a total of 23 patients with unilateral closed pilon fractures were divided into two groups treated with and without arthroscopy during fixation with the Ilizarov external fixator. The fractures were classified according to the AO Rüdi and Allgöwer classification. Follow up ranged from 10 to 37 months with a mean of 18 months.
*Results:* All cases were evaluated at follow up by the AOFAS and the Bone et al. grading system. According to Bone et al. there were 3 cases excellent, 4 cases good, 2 cases fair, and 2 cases poor in Group A (without arthroscopy), whereas there were 4 cases excellent, 6 cases good, 2 cases fair in Group B (with arthroscopy). The AOFAS score for Group A was $77.8 \pm 5.8$, and for Group B was $78.4 \pm 6.9$.
*Conclusion:* We concluded that the Ilizarov external fixator is an excellent method in treating pilon fractures as it minimizes the need for extensive surgery. We also conclude that the use of arthroscopy during pilon fracture fixation did not add statistically significant improvement to our results and it needs longer term investigation to assess its advantage – if any – to the final outcome.
Level of evidence: level 2.



## 1. Introduction

Pilon or tibial plafond fracture is considered one of the most difficult injuries to treat [3,4,6,15]. The French word pilon was used by Destout who noticed the similarity in shape between the articular surface of the distal tibia and a pharmacist's pestle (pilon) [9]. Pilon fractures result from high energy trauma in the form of an axial loading force which is sometimes accompanied by a rotational element [11]. The pilon fracture is often an open injury, and when closed it is usually associated with extensive soft tissue damage [8,24].

There is no consensus in the current literature regarding the optimal treatment for pilon fracture [3].

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Although open reduction and anatomical reconstruction of the articular surface is advised in the management of any intra-articular fracture, it is difficult to apply in high-energy tibial pilon fractures. Co-existing extensive soft tissue injury may preclude open reduction and internal fixation (ORIF) due to the high risk of wound problems or infection. The pattern of the vascular supply of the region of the distal tibia makes nonunion a common outcome of ORIF [2,13,24].

The use of the Ilizarov external fixator in treating pilon fractures is beneficial in preserving the endosteal and periosteal blood supply. It also assists in the reduction of fracture fragments by ligamentotaxis. Compression of fracture fragments is possible by the use of olive wires. The Ilizarov technique also has the advantage that the rigidity of fixation can be adjusted to suit the stage of fracture healing [5].

In an attempt to improve the results of the Ilizarov external fixator in treating pilon fractures ankle arthroscopy has been recently utilized [15]. The use of arthroscopy during fracture fixation increases the cost and duration of surgery as well as being technically demanding. We have compared using the Ilizarov external fixator alone (Group A) with the use of the Ilizarov fixator assisted by ankle arthroscopy (Group B). The results of a prospective randomized trial of these two methods in treating pilon fractures is reported.

## 2. Material and methods

Our hospital review board approved the study protocol. In the period between February 2011 and May 2013 a total of 23 patients with unilateral closed pilon fractures were recruited into the trial. The patients were prospectively randomized into two groups, the first group (Group A) of eleven patients were treated using the Ilizarov external fixator alone and the second group of 12 patients (Group B) were treated by the Ilizarov technique assisted by ankle arthroscopy.

Cases aged above fifty and below eighteen years, cases with open fractures, pathological fractures, prolonged steroid use, renal failure, diabetes mellitus, and pre-existing symptomatic ankle arthritis were excluded from this study.

## 3. Surgical technique

In both Groups the tibial part of the frame was applied as the first step. It consisted of three rings, the proximal two rings being fixed according to the principles of the Ilizarov technique. The foot frame was applied with two wires in the calcaneus and one wire on the talus. The calcaneal and talar wires were held by a 5/8 ring around the hindfoot. The calcaneal 5/8 ring was connected to the tibial part by 2 threaded rods (Fig. 1). Reduction of the fracture was achieved by distraction between the tibial part of the frame and the foot part through the threaded rods. A transfixing wire from lateral malleolus to the tibia was inserted and held over the third ring. An olive wire was inserted to compress the bone fragment. The position of all wires and the reduction of the fracture were checked by fluoroscopy.

In Group B using standard medial and lateral arthroscopic portals were used employing a 4.0-mm 70° arthroscope. The fracture surfaces and joint space were debrided of hematoma, and soft tissue debris. Reduction of the fracture was assessed and any displaced fragment was elevated under arthroscopic control (Fig. 2). Under fluoroscopic guidance a wire was then inserted to hold the fragment in the third ring.

**Fig. 1.** Photo showing the limb after application of the basic Ilizarov frame.

## 4. Follow up

Follow up continued for a mean of 18 months (10–37 months). On the second day after surgery all patients had radiographs (antero-posterior, lateral, and mortise views) (Figs. 3–5).

Partial weight bearing was allowed six weeks postoperative and was gradually increased according to clinical and radiological evidence of union (Fig. 6) up to full weight bearing after complete union (Fig. 7) at a mean of 12 weeks (10–16 weeks).

X-ray examination was repeated every month for a period of six month to evaluate bone union and fracture consolidation and then every three month for the next 18 months to assess early arthritis.

Removal of the ring fixator was done for all cases after complete union at a mean period of 14 weeks (12–17 weeks). Removal of the fixator was followed by muscle strengthening exercises and physiotherapy.

## 5. Data

The patients' demographics including age, sex, side and the AO fracture classification according to Rüedi and Allgőwer (Fig. 8) were recorded.

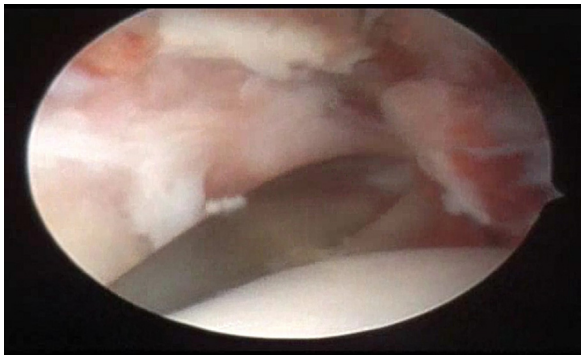

**Fig. 2.** Ankle arthroscopy snap shot showing manipulation of fracture fragments using a blunt instrument.