

Original Research Article**To Compare the Minimally Invasive Plate Osteosynthesis (MIPO) with Hybrid External Fixation in the Treatment of Proximal Tibial Fracture****Asif Ahmad Khan¹, Sanjay Kumar², Ram Nandan Suman³, Kumar Anshuman⁴**¹Senior Resident, Department of Orthopaedics, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India²Senior Resident, Department of Orthopaedics, Narayan Medical College & Hospital, Jamuhar, Rohtas, Sasaram, Bihar, India³Professor and Head of Department, Department of Orthopaedics, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India⁴Professor and Head of Department, Department of Orthopaedics, Narayan Medical College & Hospital, Jamuhar, Rohtas, Sasaram, Bihar, India

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Abstract**Background:** Proximal tibial fractures can result from various causes, including direct impact or force to the knee or upper shin area, such as from a fall, sports injury, or car accident. The present study compared hybrid external fixation and MIPO in the management of proximal tibial fractures.**Materials and Methods:** 80 cases of proximal tibia fracture of both genders were divided into 2 groups of 40 each. Group I patients were treated with hybrid external fixation, and group II patients with MIPO. Parameters such as operative time, blood loss, hospital stay, healing time, etc. were recorded.**Results:** Group I had 18 males and 22 females, and Group II had 20 males and 20 females. The aetiology of fractures was road traffic accident (RTA) in 26 in group I and 30 in group II; fall in 10 in group I and 7 in group II; and violence in 4 in group I and 3 in group II. The difference was non-significant ($P > 0.05$). The mean operative time was 91.2 minutes in group I and 112.6 minutes in group II; blood loss was 128.6 ml and 204.2 ml; healing time was 8.4 weeks and 16.2 weeks; time of recovery to work was 10.6 days and 32.5 days; and hospital stay was 10.1 days and 22.4 days in groups I and II, respectively. The difference was significant ($P < 0.05$).**Conclusion:** In the treatment of proximal tibia fractures, hybrid external fixation has been demonstrated to be superior to MIPO. The mean operative time, blood loss, healing time, time of recovery to work, and hospital stay were relatively less with hybrid external fixation as compared to MIPO.**Keywords:** Hybrid external fixation, MIPO, Tibia.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

A proximal tibial fracture refers to a break or fracture that occurs in the upper part of the tibia bone, which is the larger of the two bones in the lower leg. The proximal tibia is the portion of the bone that is closer to the knee joint. These fractures can range from minor, non-displaced fractures to more severe, displaced fractures that may require surgical intervention [1]. Proximal tibial fractures can result from various causes, including direct impact or force to the knee or upper shin area, such as from a fall, sports injury, or car accident. Weakening of the bones due to conditions like osteoporosis can increase the risk of fractures, including in the proximal tibia [2]. Overuse or repetitive stress on the tibia, often seen in athletes or individuals who engage in high-impact activities,

can lead to stress fractures. Fractures that occur as a result of an underlying bone disease or condition Elderly individuals may be more susceptible to fractures due to decreased bone density and a higher risk of falls [3]. Large-scale dissection and periosteal stripping are involved in traditional open reduction and internal fixation (ORIF) procedures, which raise the risk of problems involving soft tissue. But stabilising distal tibia fractures with plate fixation is effective. The minimally invasive method of intramedullary nailing (IMN) has raised questions about the biomechanical stability of fixation and the possibility of malunion or non-union. However, intramedullary nailing (IMN) is not appropriate when the fracture line is less than 5 cm from the ankle joint [4]. In recent years, the minimally

invasive plate osteosynthesis (MIPO) approach has become more popular. Indirect reduction techniques are used in this percutaneous plating procedure to stabilise distal tibia fractures while maintaining the vascularity of the soft tissue envelope [5].

Aims and Objectives: The present study compared hybrid external fixation and MIPO in the management of proximal tibial fractures.

Materials and Methods

The present study comprised 80 cases of proximal tibia fracture in both genders attending out-patient departments (OPD), Emergency care, Department of Orthopaedic, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India, and the Department of Orthopaedic, Narayan Medical College & Hospital, Jamuhar, Rohtas, Sasaram, Bihar, India, that were operated on between September 2019 and August 2020. All were informed regarding the study, and their written

consent was obtained. The institutional ethical committee granted ethical approval.

Demographic data such as name, age, gender, etc. was recorded. Patients were divided into two groups of 40 each. Group I patients were treated with hybrid external fixation, and group II patients with MIPO. Parameters such as operative time, blood loss, hospital stay, healing time, etc. were recorded. The location and AO classification of the fractures were recorded. The results of the study were subjected to statistical analysis by chi-square test, Microsoft Excel and SPSS software version 22. A P value less than 0.05 were considered significant.

Results

There are 80 patients with proximal tibial fractures in the current study. The patients were divided into Group I and Group II at random. A total number of patients in each group were 40. The mean age was 42.50 ± 12.93 years, with a range of 20 to 60 years, and there were 38 males and 42 females.

Table 1: Demographic parameters of patients

Parameters	Group I (n=40)	Group II (n=40)
Method	Hybrid external fixation	MIPO
Gender		
Male	18	20
Female	22	20

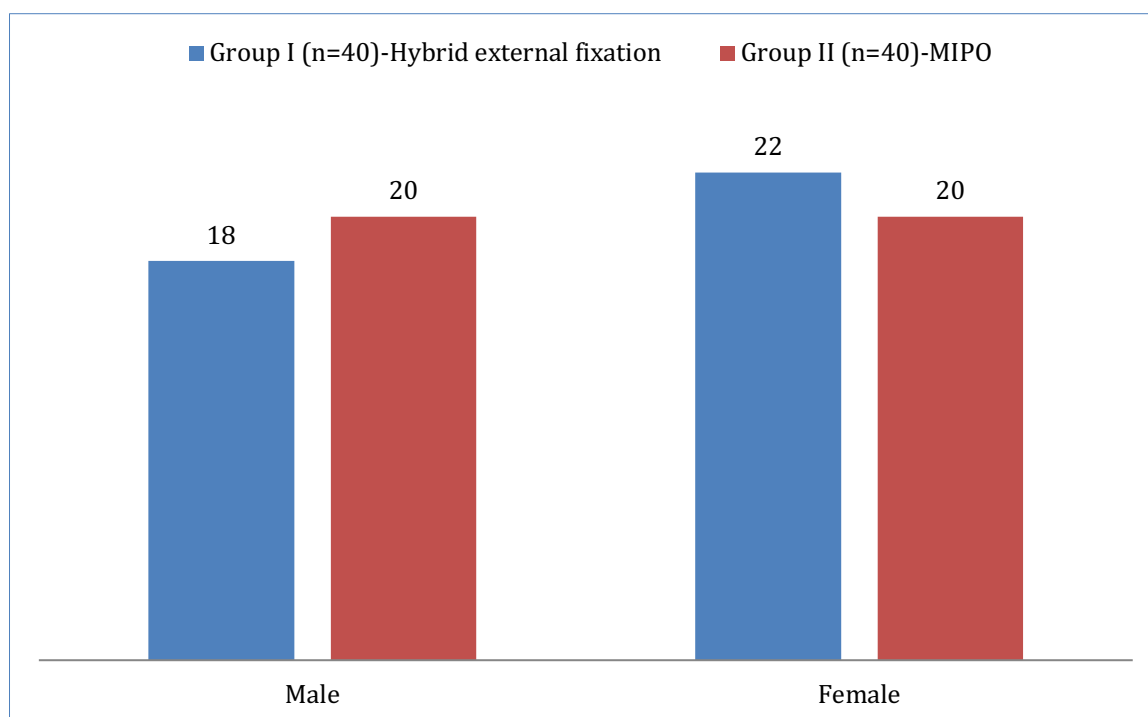


Figure 1: Gender wise distribution

Table 1 and Figure 1 shows that group I, had 18 males and 22 females and group II had 20 males and 20 females.

Table 2: Aetiology of fractures

Aetiology	Group I	Group II	P value
RTA	26	30	0.94
Fall	10	7	
Violence	4	3	

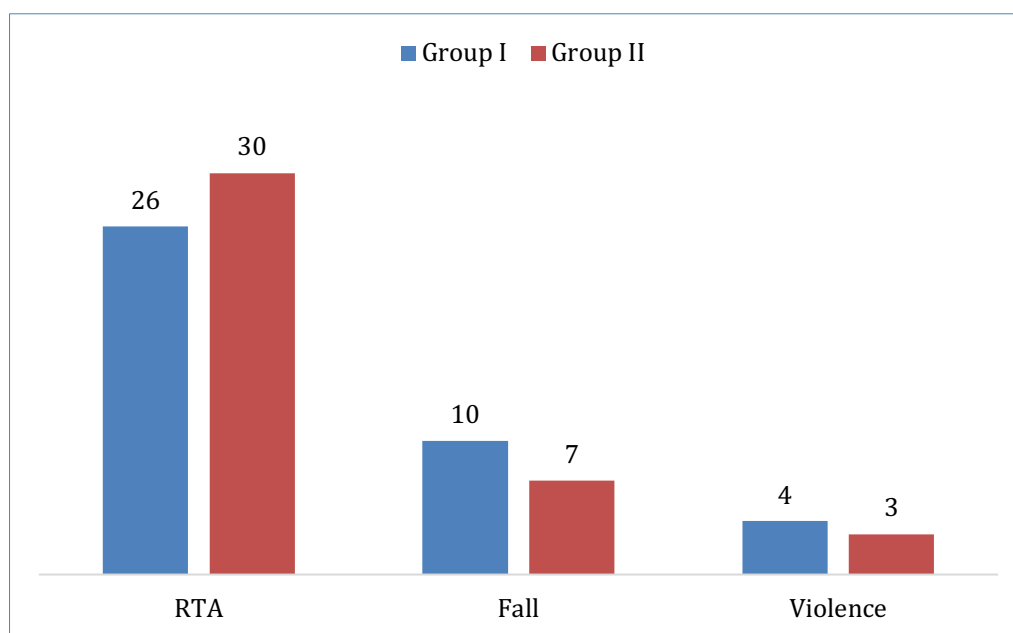
**Figure 2: Aetiology of fracture**

Table 2 and graph 2 show that the aetiology of fractures was road traffic accident (RTA) in 26 in group I and 30 in group II, fall in 10 in group I and 7 in group II, and violence in 4 in group I and 3 in group II. The difference was non-significant ($P > 0.05$).

Table 3: Assessment of parameters

Parameters	Group I	Group II	P value
Operative time (min)	91.2	112.6	0.17
Blood loss (ml)	128.6	204.2	0.04
Healing time (Weeks)	8.4	16.2	0.03
Time of recovery to work (Days)	10.6	32.5	0.02
Hospital stay (Days)	10.1	22.4	0.01

Table 3 shows that the mean operative time was 91.2 minutes in group I and 112.6 minutes in group II; blood loss was 128.6 ml and 204.2 ml; healing time was 8.4 weeks and 16.2 weeks; time of recovery to work was 10.6 days and 32.5 days; and hospital stay was 10.1 days and 22.4 days in groups I and II, respectively. The difference was significant ($P < 0.05$).

Discussion

Due to their unique anatomies, delicate soft tissue envelopes, and wound contamination, tibia fractures are extremely difficult to heal. Historically, external fixation, repeated debridement, and a delay in soft tissue recovery have been used to treat open tibial fractures while also causing persistent difficulties. How to handle unstable distal tibia fractures is still a problem for surgeons. Due to the fracture's proximity to the ankle, surgical repair is more difficult than with mid shaft tibial fractures [6]. The recommended course of treatment will depend on the fracture's distance from the plafond, its displacement, its comminution, and any soft tissue

envelope injury. The use of locking plates to fix proximal third tibia fractures has produced outstanding outcomes. Hippocrates employed a splint to treat tibial fractures, which is when external fixation first became known. In the middle of the 19th century, the first directly bone-attached external fixation devices were created. For the fixation of both open and closed fractures, external fixation is still a flexible alternative [7]. Malunion and pin track infection; however, are frequent side effects. External fixation is unique in that it is straightforward in terms of initial therapy due to the large range of reasons it treats, including polytrauma, articular dislocation, and peri-articular

fractures. Recent trends in logistics, economics, or other factors have led to an increase in the number of initial fractures treated using spanning external fixation [8,9]. The present study compared hybrid external fixation and MIPO in the management of proximal tibial fractures.

We found that group I had 18 males and 22 females, and group II had 20 males and 20 females. Savoleinanet al.[10], in their study, found that five AO/ASIF type-C intraarticular fractures had poor postoperative reduction and were thus treated with internal fixation in a second operation. Of the remaining 28 patients, local and transient pin tract infections were observed in seven patients, and one had septic arthritis of the knee. All 13 C1 and five of six C2/C3 fractures united in a mean time of 15.1 weeks, whereas three of nine type-A fractures failed to unite, albeit with an adequate reduction, and needed a second operation (odds ratio 11.4, 95% CI 1.0–143, compared with type-C fractures). For the remaining six type-A fractures, the mean healing time was 24 weeks (mean difference 8.9, 95% CI 6–12 weeks compared with type-C fractures). Age over 48 and the presence of an open fracture, but not fracture type, gender, or the level of injury energy, correlated to a poor subjective outcome.

We observed that the aetiology of fractures was road traffic accident (RTA) in 26 in group I and 30 in group II, fall in 10 in group I and 7 in group II, and violence in 4 in group I and 3 in group II. Cheng et al.[11], compared minimally invasive plate osteosynthesis (MIPO) and open reduction and internal fixation (ORIF). 30 cases of distal tibia fracture (15 pairs of ORIF and MIPO) were compared for operative time, blood loss, healing time, time of recovery to work, implant irritation symptoms, and union status. No malunion occurred, and one case of osteomyelitis developed in the ORIF group. In the ORIF group, ten cases were evaluated as excellent, three as good, one as fair, and one as poor. In the MIPO group, ten cases were excellent and five were good. The MIPO technique is not distinctively superior to ORIF in the treatment of distal tibia fractures.

We observed that the mean operative time was 91.2 minutes in group I and 112.6 minutes in group II; blood loss was 128.6 ml and 204.2 ml; healing time was 8.4 weeks and 16.2 weeks; time of recovery to work was 10.6 days and 32.5 days; and hospital stay was 10.1 days and 22.4 days in groups I and II, respectively. Jan et al. [12], carried out a study on 40 patients with proximal third tibia fractures of AO classification types 41 A2 (transverse metaphyseal) and 41 A3 (comminuted metaphyseal). Patients were divided into 2 groups depending on the surgical treatment received: the observation group, comprised of 20 patients treated by external fixation, and the control group, comprised of 20 patients treated by Open reduction internal fixation with

locking compression plate. At one week post-op, radiological assessment showed that 18 patients (93%) got anatomical reduction in the LCP group as compared to 16 patients (80%) in the external fixation group. The average duration of bone union in external fixation was 14 weeks, and that in the LCP group was 16 weeks. 2 cases in the external fixation group had pin tract infections, which were resolved with the administration of antibiotics and local pin site care; no infection was noted in the LCP group. There were 2 cases of delayed union in the LCP group, and these were reoperated using locking plates and auto-bone grafts. No deep venous thrombosis, pneumonia, or bed sores developed in any group of patients. There was one case of bed sores in the LCP group. There was initial knee stiffness in the EF group, and the mean knee range of motion was 122 degrees, compared to 126 degrees in the LCP group. The mean Rasmussen knee score was a good 25 in EF group patients and a good 24.5 in LCP group patients. The mean weight bearing time was 13 weeks postoperatively for both groups. No cases of compartment syndrome were detected in either group.

Limitations of study

The limitation of the study was the small sample size and short duration of study

Conclusion

The authors found that in the treatment of proximal tibia fractures, hybrid external fixation has been demonstrated to be superior to MIPO. The mean operative time, blood loss, healing time, time of recovery to work, and hospital stay were relatively less with hybrid external fixation as compared to MIPO.

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