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ORIGINAL ARTICLE

Outcome of Two Ring Hybrid Ilizarov Fixator in the Management of Proximal Tibial Fractures in Adults

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ABSTRACT

Objective: The aim of this study is to determine the outcomes of using two ring hybrid ilizarov fixator for the management of proximal tibial fractures in adult patients.
Study Design: Descriptive Study
Place and Duration:
Methods: There were 60 patients of both genders were presented in this study. Patients were aged between 25-65 years. Informed written consent was taken from all the patients for detailed demographics age, sex, body mass index and cause of fracture. All the patients had proximal tibial fractures were included, type of fractures were assessed by schatzker technique. Outcomes were assessed by using Rasmussen score in terms of excellent, good and fair. Radiological outcome was measured by fracture healing on radiography. Student t-test and chi square test was used. SPSS 24.0 was used to analyze all of the data.
Results: There were 45 (75%) patients were males and 15 (25%) were female patients. Mean age of the patients was 42.3±7.43 years with mean BMI 25.07±6.29 kg/m^2. Falling was the most common cause of fracture found in 33 (55%), followed by road traffic accidents in 17 (28.3%) and 10 (16.7%) fractures by assault. Majority of the patients were schatzker type VI fractures 34 (56.7%) followed by schatzker type V fractures in 11 (18.3%), metaphyseal fractures found in 8 (13.3%) cases and proximalone third shaft fractures in 7 (11.7%) cases. Mean surgery time was 4.2±6.17 hours and mean union time of fractures was 19.8±6.61 weeks. According to Rasmussen score 39 (65%) cases showed excellent results with knee flexion more than 90 degree, good results found in 17 (28.3%) patients and fair results in 4 (6.7%) cases. Pin tract infection was the most common complication found in 12 (20%) cases, followed by compartment syndrome in 4 (6.7%) and delayed union in 3 (5%). No any poor outcome was assessed in this study.
Conclusion: We concluded in this study that the use of two ring hybrid ilizarov fixator in the management of proximal tibial fractures were effective and useful in terms of excellent and good outcomes of knee flexion. The ilizarov approach allowed for early definitive treatment with a low rate of complications and a favourable clinical outcome.
Keywords: Proximal Tibial fracture, Ilizarov Fixator, Shatzker, Rasmussen score, Outcomes

INTRODUCTION

It is estimated that one percent of all tibia fractures occur in adults [1]. It is extremely difficult to treat complex or high-energy fractures (Schatzker V, VI) because of possible knee joint dysfunction. Skin problems and infection rates can reach 87.5 percent when using a single incision for dual-plate fixation [2]. There were further developments that were less damaging to the soft tissues, such as two plates inserted through two minimally invasive incisions and locking plates fixed in combination with screws, a hybrid external fixator, or Ilizarov fixation. We have used hybrid fixators in our surgical department for many years because they allow us to keep the soft tissues that are so critical in treating these fractures.If you have a proximal metaphyseal tibia fracture that is not osteoporotic, open reduction and internal fixation (ORIF) is the preferred treatment method. [4] The Ilizarov circular fixator has recently become a recognised therapeutic option for fractures of the Schatzker V-VI and AO C2 and C3 types.[5]

Articular surface tibia fractures are most commonly caused by direct strikes with significant energy, regardless of the extent of joint extension.[6] There is a high complication rate, independent of therapy, because of the type of trauma and the relatively high frequency of serious soft-tissue injuries. Soft-tissue complications can arise from extensive surgical incisions required for internal fixation [7, 8].

The fracture fragments can be minimised and mended with minimal soft-tissue exposure or blood loss if the classic Ilizarov treatment is conducted in accordance with the original instructions [9]. This method is used to remove screws and plates after a fracture has healed.. After surgery, the fixator allows for modifications in alignment and compression/distraction. Weight-bearing can begin as early as six weeks after Ilizarov surgery since the fixation is strong enough. Therefore, the Ilizarov treatment is utilised to treat unicondylar fractures [10]. In communal bicondylar high-energy fractures, the reasoning is the same and there is no requirement for a staged approach.

In spite of the fact that extra-articular fractures are regarded to have a lesser chance of treatment difficulties than intra-articular fractures, their proximity to ankles and vulnerable soft-tissue in their distal regions elevates the risk of complications [11].There is a 2.4 percent union rate and 14.3 percent malunion rate for these fractures regardless of the treatment method. When choosing a method of fixation, it is critical to take into account the possibility of soft-tissue problems and fracture malalignment [12,13].

A joint-bridging fixator has been used to treat intra-articular distal tibial fractures, which has been shown to have a lower complication rate than internal fixation [14]. In these fractures, primary circular fixators (following Ilizarov principles) with or without significant internal osteo-synthesis have been demonstrated to reduce complication rates [15].

It is usually possible to treat patients utilising the Ilizarov method with a one-stage therapy since reduction is less invasive, with minimal soft-tissue exposure and blood loss. Allows for post-surgical modification of alignment and compression/distraction if necessary. Additionally, the fixation is secure enough to allow for early weight-bearing.

A two-ring hybrid Ilizarov fixator for the treatment of proximal tibial fractures in adults was our primary goal in this study.

MATERIAL AND METHODS

This descriptive study was conducted at the orthopaedics department of Ayub Teaching hospital Abbottabad for duration of one year from July 2020 to June 2021. It was composed of sixty patients of both genders. Informed written consent was taken from all the patients for detailed demographics age, sex, body mass index and cause of fracture. Patients had vascular injury, pathological fracture, history of previous surgery for the fracture,

poly-trauma patients, compartment syndrome and requiring surgical intervention by other specialties were excluded from this study.

Patients were aged between 25-65 years. All the patients who had proximal tibial fractures were included, type of fractures were assessed by shatzker technique. All patients had a complete medical history, baseline tests, and AP and lateral x-rays of the tibia with the knee joint. To examine intra-articular extension and stepping, a 3DCT scan was performed. Patients were operated on as part of a planned procedure.

The procedure was performed in a supine position under general or spinal anaesthetic with strict aseptic measures in place. An Ilizarov plain wire was inserted at condylar level in the distal femur with reference to the centre of the patella, and a second wire was inserted in the calcaneus or distal tibia. These wires were coupled to a distraction/hanging frame, and distraction was used to produce and maintain reduction at the fracture site via ligamentotaxis in order to restore normal length, rotation and alignment of a portion of the articular surface. Image intensifier was used to evaluate the reduction. A percutaneous wire/Schanz pin or tiny Bristow incision was used to decrease the medial or lateral condyle if necessary. Percutaneous pointed reduction clamp and pelvic ball tip reduction rod (Matta) were also utilised to reduce the fracture in some situations. Beaded wires were used to fix the depressed articular surface after elevation and reduction. The reduction was verified with an image intensifier. Four or five wires in the proximal tibia and one or two wires through the second ring in the tibia distal to the fracture site, combined with an oblique Schanz pin in the distal ring, completed the treatment (usually of 5mm thickness). Pin tract care and early range of motion were emphasised on all patients. For the first month, follow-up visits were held weekly, then monthly. If clinical and radiological symptoms of union were observed, toe touch walking with a walker was initiated at 4-6 weeks, cane use at 12 weeks, and full weight bearing at 28 weeks. Radiological union, knee range of motion, and the Rasmussen functional knee score were all used to assess the outcome.

Rasmussen score was used in terms of excellent, good and fair functional outcomes. Radiological outcome was measured by fracture healing on radiography. Student t-test and chi square test was used. SPSS 24.0 was used to analyze all of the data.

RESULTS

There were 45 (75%) patients were males and 15 (25%) were female patients. Mean age of the patients was 42.3±7.43 years with mean BMI 25.07±6.29 kg/m^2. Falling was the most common cause of fracture found in 33 (55%), followed by road traffic accidents in 17 (28.3%) and 10 (16.7%) fractures by assault. Majority of the patients were schatzker type VI fractures 34 (56.7%) followed by schatzker type V fractures in 11 (18.3%), metaphyseal fractures found in 8 (13.3%) cases and proximal one third shaft fractures in 7 (11.7%) cases.(Table 1)

Table 1: Baseline detailed demographics of enrolled cases

Variables	Frequency	Percentage
Mean age (years)	42.3±7.43	
Mean BMI (kg/m^2)	25.07±6.29	
Gender		
Male	45	75
Female	16	25
Cause of Fracture		
Fall	33	55
RTA	17	28.3
Assault	10	16.3
Type of Fracture		
schatzker type VI fracture	34	56.7
schatzker type V fracture	11	18.3
metaphyseal fractures	8	13.3
and proximal one third shaft fractures	7	11.7

Mean surgery time was 4.2±6.17 hours and mean union time of fractures was 19.8±6.61 weeks.(Table 2)

Table 2: Time for surgery and union of fracture

Variables	Mean	Standard Deviation
surgery time (hours)	4.2	6.17
union time of fractures (weeks)	19.8	6.61

According to Rasmussen score 39 (65%) cases showed excellent results with knee flexion more than 90 degree, good results found in 17 (28.3%) patients with knee flexion more than 45 degree and fair results in 4 (6.7%) cases with knee flexion less than 45 degree.(Table 3)

Table 3: Post-operatively functional outcomes among cases

Functional Outcomes	Frequency	Percentage
Excellent	39	65
Good	17	28.3
Fair	4	6.7
Total	60	100

Pin tract infection was the most common complication found in 12 (20%) cases, followed by compartment syndrome in 4 (6.7%) and delayed union in 3 (5%). No any poor outcome was assessed in this study.(Table 4)

Table 4: Association of complications among cases

Variables	Frequency	Percentage
Complications		
Pin tract infection	12	20
compartment syndrome	4	6.7
delayed union	3	5
No Complication	41	68.3
Total	60	100

DISCUSSION

Treatment of proximal tibia fractures is always a challenge due to skin and soft tissue problems, fracture comminution and resulting knee joint stiffness.[16]The Ilizarov fixator although used primarily for non-unions and deformity correction,13 is a valid choice for complex proximal tibia fractures as well and adding a Schanz screw (half pin)increases the stability of frame14and hence improves the outcome of treatment.[17] Kumar and Paige differentiated conventional Ilizarov fixator from hybrid Ilizarov fixator by the addition of a Schanz screw into the frame.[18]

In this descriptive study sixty patients of both genders had proximal tibial fractures were presented. There were 45 (75%) patients were males and 15 (25%) were female patients. Mean age of the patients was 42.3±7.43 years with mean BMI 25.07±6.29 kg/m^2. Findings of current research was comparable to the previous study.[19] Falling was the most common cause of fracture found in 33 (55%), followed by road traffic accidents in 17 (28.3%) and 10 (16.7%) fractures by assault. Majority of the patients were shatzker type VI fractures 34 (56.7%) followed by shatzker type V fractures in 11 (18.3%), metaphyseal fractures found in 8 (13.3%) cases and proximal one third shaft fractures in 7 (11.7%) cases. These results showed comparable results to the past studies.[20.21]

In our study Mean surgery time was 4.2±6.17 hours and mean union time of fractures was 19.8±6.61 weeks. The operating time was longer for the more complicated fractures, as expected. Despite this, the operating time in this study compares favourably to that of Lee et al. [22], who used the less invasive stabilisation system (LISS) to operate on 36 tibial plateau fractures, with a mean operation time of 150 minutes. When compared to open plating of the tibial plateau, pre-assembling the frame could save time in the operating theatre, but one key advantage of the Ilizarov technique is that it is virtually closed, and if the surgical duration is extended, the danger of wound infection is low [23]. According to Rasmussen score 39 (65%) cases showed excellent results with

knee flexion more than 90 degree, good results found in 17 (28.3%) patients with knee flexion more than 45 degree and fair results in 4 (6.7%) cases with knee flexion less than 45 degree.[19] According to the Rasmussen knee score, Ariffin and Mahdi [24] repaired Schatzker type V and VI fractures with a modified hybrid fixator and reported excellent outcomes in 15 (48 percent), good in 13 (42 percent), and fair in 3 (10 percent) patients. In their study, the average knee flexion was 120 degrees (range 90 to 140 degrees). However, Wu and colleagues[25] found that proximal tibial fractures treated with external fixation and internal fixation had identical short-term functional outcomes.

Pin tract infection was the most common complication found in 12 (20%) cases, followed by compartment syndrome in 4 (6.7%) and delayed union in 3 (5%). No any poor outcome was assessed in this study. The risk of skin-penetrating infections is a common problem with external fixators of all kinds, according to previous study (pin site and pin tract infections). In the literature, the incidence of pin site infections ranges from 4.5 percent to 71 percent, while the incidence of pin tract infections ranges from 10 percent to 50 percent [27]. Parameswaran et al. [28] found that ring fixators had the lowest rate of infection when compared to unilateral and hybrid fixators.

Sarad used hybrid Ilizarov to treat 30 proximal tibia fractures and reported excellent bone outcomes in 21 (70%) cases, good in 6 (20%) cases, fair in 2 (6.6%) cases, and poor in 1 (3.3%) cases, according to the ASAMI scoring system. The functional outcome was excellent in 17 cases (56.6%), good in 9 cases (30%), and fair in four cases (46.6%). (13.3 percent). In every way, Sarad found, hybrid Ilizarov was superior than traditional Ilizarov. In one local study, Nawaz and Afghan treated 90 proximal tibial fractures with hybrid Ilizarov, and 84 (93.3 percent) of the patients were able to heal. 18 patients (20%) had an excellent functional outcome, 49 (54.4%) had a good functional outcome, and 23 (25.5%) had a fair functional outcome. [29,30]

CONCLUSION

We concluded in this study that the use of two ring hybrid ilizarov fixator in the management of proximal tibial fractures were effective and useful in terms of excellent and good outcomes of knee flexion. The ilizarov approach allowed for early definitive treatment with a low rate of complications and a favourable clinical outcome.

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