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Functional & Radiological Outcomes of Knee Joint After Surgical Treatment of Proximal Tibial Fractures With Hybrid External Fixator

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ABSTRACT

Objective: To determine the functional and radiological outcomes of the knee joint in Schatzker Type V and VI proximal tibial fractures treated with a hybrid external fixator.

Methodology: This prospective observational study was conducted in the Department of Orthopedic Surgery, Services Hospital Lahore, from September 2018 to April 2020, following approval from the Hospital Ethical Review Board. Adult patients aged 21 to 70 years with Schatzker Type V and VI proximal tibial fractures were included. Patients with polytrauma, associated head or spinal injuries, or previous injuries around the knee joint were excluded. A total of 60 patients (ages 18 to 70 years) with Schatzker Type V (n=40) and Type VI (n=20) fractures were enrolled. Preoperative knee joint X-rays (anteroposterior and lateral views) were performed. A two-ring hybrid external fixator was applied in all cases. Patients were followed for one year postoperatively, and functional and radiological outcomes were assessed using the Rasmussen Score.

Results: At the final follow-up, the functional Rasmussen Score was excellent in 12 patients, good in 45, and fair in 3 patients. The mean time for bony union was 14.2 weeks. Radiological Rasmussen Scores showed excellent results in 24 patients, good in 32, and fair in 4.

Conclusion: The hybrid external fixator is an effective and reliable treatment option for Schatzker Type V and VI fractures, particularly in cases with significant soft tissue damage. It provides favorable functional and radiological outcomes.

Keywords: Proximal Tibial Fractures, Schatzker Classification, Schatzker Type V & VI, Hybrid External Fixator.

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Introduction

Proximal Tibial fractures are common especially in young people and remained as challenging task to the Orthopedic Surgeons.[1] The incidence increases at two age peaks, in young people (20-30years) and in old population (60-80 years). These constitute about 1% of all fractures and frequently occur by low energy trauma in older adults, whereas high energy trauma is common in younger age groups.[2] These fractures are serious injuries because of involvement of major weight bearing joint that frequently result in functional impairment. The mechanism of injury in these types of fractures is axial loading for example a fall from height or twisting injury especially during Sports activities[3]. Young people are more sufferer than old population group. It is because of mostly the young people belong to working class and are exposed more to the road traffic accidents than old

population especially in motor cycle accidents. These complex fractures are associated with injuries to the surrounding vital structures like popliteal artery, peroneal nerve, menisci and ligaments (10%-40%) in young and in old people up to 80% of the cases are associated with these complications. There is irreversible damage to Chondrocytes and Proteoglycan substance. The management of these fractures is complex associated with lot of complications particularly decreased range of motion and compromised muscle power which is caused by damage to Extensor Retinaculum, damage to the Subchondral bone, metaphyseal impaction, arthrofibrosis and articular cartilage involvement as a consequence of trauma or surgical treatment.[4]

Schatzker Classification is the most common classification used to classify these fractures depending upon fracture pattern. Type 1 Factures are 50-70% of all proximal Tibial fractures[5]. Type 4 are 10-20% while Type 5 are 10-30% of all Schatzker injuries. Although this classification does not take into account fracture fragments that lies in the coronal plane still it is one of the most accepted classifications for explaining the fracture geometry. The Schatzker 5&6 fractures are considered as the complex fractures with associated extensive soft tissue and osseous damage with its impact on the functional outcome of the joint if not managed properly. The goal of treatment in these fractures are to maintain the axial alignment, joint stability, mobility and to correct the varus& valgus malalignment. 3-D CT scan is excellent in determination of morphology and geometry of posterolateral and posteromedial fragment in Type 5&6 injuries as compared to X-Rays.[6]

A lot of treatment options are available to treat these fractures including close reduction and POP Cast application, open reduction and internal fixation with plates either unilateral or Bilateral and Illizarov External Fixator application or Hybrid External fixation.[7] Although open reduction & internal fixation with plating system provides more stable construct but it is full of complications especially infection because of extensive soft tissue dissection[7]. Intuitively keeping in view of the result of recent literature, poor functional outcomes are related to the inadequate fracture reduction during surgery. However, implant selection is still a controversial subject for these fractures. In most of the cases, surgical treatment is chosen as fracture reduction is lost after conservative management. It has been observed that patient expectations after proximal Tibial fractures is high regardless of type of the fracture. Surgeon must discuss the realistic expectations with the patient to improve the patient apprehension. These fractures should be treated by an Experienced Orthopedic Surgeon as surgical treatment of these fractures is full of complications in the immediate and delayed postoperative period.[8]

Over the last few decades, Illizarov—an external fixator that spans the knee joint—has been used to treat intra- and peri-articular fractures. This has led to a high prevalence of sequelae, including osteoarthritis, pin tract infections, and stiffness in the knee[9]. In the recent decade the use of Hybrid External Fixator has been emphasized for surgical treatment of Proximal Tibial Fractures. It is basically a construct of two circular ring in the proximal articular region with unipolar external fixator rods in the shaft region[10]. It provides a stable construct with sparing of knee joint and early mobilization of the patient. Regaining full range of motion of Knee joint, also depends upon the aggressive rehabilitation and physiotherapy. This takes a long way to ensure functional and Radiological recovery and to ensure the patients satisfaction. Moreover, the operative duration is reduced and it is simple to apply[11]. Data regarding the Biomechanics of Hybrid External Fixator support the use of tensioned wires fixation for stabilization of Proximal Tibial Fractures[12]. It can be applied in the presence of extensive soft tissue disruption even if there is blister formation[13]. The purpose of all treatment options is anatomical reduction and rigid internal or external fixation with early Rehabilitation and good Functional outcomes of Knee Joint[14, 15]. This study would guide us choosing about the best surgical treatment, physiotherapy and Rehabilitation which would yield the excellent functional outcomes of knee joint on long term basis. This would also set a new standard for treating the specific proximal Tibial fractures.

Methodology

After approval from Ethical Review Board of the Hospital, this study was carried out from September 2018 to April 2020 at Department of Orthopaedic Surgery, Services Hospital Lahore. A total number of 60 patient fulfilling the inclusion criteria, having Schatzker Type 5 & 6 were included in the study. The sample was selected with Non-Purposive Sample Technique. There were 40 males& 20 females, all having Proximal Tibial Fractures. The age range was 21 to 70 years. All these patients were admitted through Emergency Department of this Hospital.24 patients had close fractures,20 with Gustilo

Type 1 while remaining 16 patients had Gustilo Type 2 injuries. Each patient underwent X-Rays of Knee Joint both Anteroposterior (AP) & Lateral (Lat) views. After fitness of patients for Anesthesia, either regional or general, all these patients were operated 1-5 days after admission under image intensifier. We used the two Ring Hybrid External with 1.8mm wires in all patients. All wires were tensioned in a standard manner. Two Schanz Screws of 5mm diameter were then placed at anteromedial Tibial border and these were connected to the ILLIZAROV Rings with 250 mm tubular rods with universal clamps after fracture reduction, checked under image intensifier. In 05 cases the lateral condyle was depressed, it was lifted with bone trap. 40 patients were operated on day one after the admission, 12 on the 3rd day while the remaining 08 patients were operated on the 5th post admission days. Postoperative X-rays were reviewed to assess the fracture reduction, joint congruity and alignment of the Knee joint. Quadriceps & Hamstring passive range of exercises were started on the same day after the surgery while patient was mobilized on 1st postoperative day and Knee range of movements were increased in further follow ups. I/V antibiotics were given to the patients who were having open injuries. All patients were discharged 3-10 days after the surgery. At the time of discharge each patient was guided about cleanliness of wires and fixator.

All patients were followed at 02 weeks, 06 weeks, at 03 months, at 06 months and then at the end of one year at final follow up. At each follow up functional and Radiological assessment was done by Rasmussen scoring system. Clinically Rasmussen scores are excellent (27-30), good (20-26), moderate (10-19) and poor less than 10 while Radiological outcome are excellent (18), good (12-17), moderate (6-11) and poor is less than 6. All data was assessed using SPSS Version 22. For categorical variables, Chi-Square test was used and Student t-test was used for comparison of two quantitative variables. A p value of 0.05 was considered as significant.

Results

The mean age in our patients was32+-9.2years(21-70years) with male to female ratio of 3:1, The mechanism of trauma in most of the patients (46 patients) was Road traffic injuries, f0llowed by fall from height(10patients) while remaining 04 patients had firearm injury. 24 patients had close fracture, 20 had Gustilo Type 1 while remaining 16 patients had Gustilo Type 2 injuries. 40 patients had Schatzker Type 5 fracture and 20 patients had Schatzker Type6 fracture. All patients were admitted through emergency department of the hospital and operated 1-05 days after the admission(10+-2).The mean operative duration was60+-2(50-70) while the mean hospital stay was 8+-2(3-10days).All fractures united 12+-3 days(10-16 weeks).The mean Rasmussen Functional Score was 24.3 at final follow up at the end of one year (20-28).It was excellent in 12 patients, good in 45 patients and fair in 03 patients at the final follow up. The Radiological Rasmussen Score was excellent in 24 patients, good in 32 patients and fair in04 patients.

Functional Rasmussen Score After One Year of Follow-Up.

	Excellent	Good	Fair	Poor
Number of Patients	12(20%)	45(75%)	03(5%)	0
Radiological Rasmussen Score				
Number of Patients	24 (40%)	32 53.33%)	04 (6.66%)	0

No major complications recorded in our study except 08 patients who developed pin tract infection which was treated with antibiotics and dressing while wires breakage occur in 06 patients and in them the wires were changed.

Partial weight bearing was started 5.2+-1.8 weeks (8-9 weeks) Young patients stared early weight bearing than old patients (p less than 0.03). Patients with open fractures had low Rasmussen Score than patients with close fractures (p less than 0.006).

Discussion

In our study we assessed the functional outcomes of Knee joint by using Rasmussen Score after application of Hybrid External Fixator in Schatzker Type 5&6 Proximal Tibial injuries. Despite of improvement in surgical techniques, Proximal Tibial Fractures are challenging in terms of Functional impairment and development of long-term arthritis of the Knee joint. Patients suffering from Proximal Tibial fractures are subjected to high energy trauma with combination of multiple forces like axial loading, rotational forces, varus and valgus forces resulting in articular impaction depression of Tibial chondral surface. Much research has been done in terms of Schatzker Type 5&6 injuries and reveals the favorable functional outcomes with Hybrid External Fixator.

In our study, most of the injuries were the result of Road Traffic accident. Moreover, the young patients were more sufferer than the old ones. The reason being our working class belong to young people. Our study shows relatively good functional outcomes even in severe fracture pattern

(Type 5& 6). The Functional Rasmussen Score was excellent in 12 patients, good in 45 patient and was fair in 03 patients. The average Knee movements achieved in our study was 90+-30 degree (90-130 degree), fracture union time was 16+_2 (13-18). The reason for limited movements of Knee joint in 03 patients was poor compliance of Physiotherapy protocol.

Juneja J. et al. conducted similar research on hybrid external fixators in high energy tibial plateau fractures. In their study 50 patients had excellent score, 35 with good score and 10 patients had fair score while the remaining 05 had poor score. The union time for fracture was 20 weeks. They came to the conclusion that Hybrid External Fixator provides not only the fracture stability but also protect the soft tissue to achieve the osseous union. It is easy to apply, has got the short operative time and hospital stay. It results in early mobility and has good functional outcomes regarding the Knee joint.

Our results are consistent with research conducted by Thangamani SK et al on 81 patients who had proximal tibial fractures and were treated with a hybrid external fixator. They achieved excellent to good Rasmussen Score in 88% of their patients. Their results showed that Hybrid External Fixator provides the good bony union without further damage to the soft tissue around the Knee joint. It has good functional and radiological results and permits early joint movement. In a study conducted by Raza A et al; on 26 patients with proximal Tibial fractures (Type 5&6) which were treated with Hybrid External Fixator. The range of motion of Knee joint was120 degree in their patients at the final follow-up. They came to the conclusion that Hybrid External fixator is a good device to treat proximal Tibial fractures. Their findings are consistent with our study in terms of functional & radiological outcomes.

In another study which was carried out by Subash Y et al.; from 2012 to 2015 on 30 patients with Type5 &6 Schatzker injuries. Mean Rasmussen Score was 25.4 at the final follow up. The average range of motion attained was between 0 and 100 degrees, and the mean union time was 12.06 weeks. They came to the conclusion that Hybrid External Fixator is an excellent option for treatment of Schatzker Type 5&6 fractures. It is easy to apply, has got the good Knee mobility with good functional outcomes.

The study conducted by Zafir MB et al.; on 50 patients with Proximal Tibial Fractures who were treated with Hybrid External Fixator. At the end of final Follow up, Rasmussen Functional Score was excellent in 64% (32 patients) with Knee flexion of more than 90 degree, good in 30% (16 patients) with Knee flexion up to 90 degree and fair in 03 patients. They came to the conclusion that Hybrid External Fixator is an effective technique to treat proximal Tibial Fractures & Good Radiological and Functional outcomes were achieved with this procedure in most of their patients.

Our study is consistent with other studies and suggests that Hybrid External Fixator is an exceptional option to treat Tibial plateau fractures with soft tissue compromise and has got good functional outcomes. It is minimally invasive, has a quick recovery period, is affordable, and will not interfere with soft tissue healing. Moreover, the hospital stay was also less and early rehabilitation of the patients.

Conclusion

Hybrid External Fixator is a valid option to treat Proximal tibial fractures especially Schatzker Type 5 & 6 injuries. It is cost effective, has got short operative duration, hospital stay is less and soft tissue healing is good especially in case of open fractures.

This study was conducted on small number of patients. Meanwhile the follow up of the patients was also of short duration and the risk of osteoarthritis was underestimated. It should include large number of patients with longer follow up. Moreover, no MRI was done to assess the ligamentous and meniscus injury which probably also affect the results.

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