DOI: https://doi.org/10.54393/pjhs.v6i4.2958

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 04 (April 2025)

Original Article

OPEN ACCESS

Comparison of Functional Outcome of Locking Plate versus External Fixation in Management of Comminuted Intra Articular Fracture of Proximal Tibia

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ARTICLE INFO

Keywords:
Proximal Tibia Fracture, Locking Plate Outcomes, External Fixation Comparison, Functional Knee Recovery

How to Cite:
Shah, S. U., Saud, A. M., Rashid, M., Napar, A. R., Zia, O. B., & Abidi, S. A. R. (2025). Comparison of Functional Outcome of Locking Plate versus External Fixation in Management of Comminuted Intra Articular Fracture of Proximal Tibia: Locking Plate versus External Fixator. Pakistan Journal of Health Sciences, 6(4), 233-237.https://doi.org/10.54393/pjhs. v6i4.2958

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Received date: 7th March, 2025
Revised date: 17th April, 2025
Acceptance date: 24th April, 2025
Published date: 30th April, 2025

ABSTRACT

The surgical management of Schatzker type V or VI tibial plateau fractures can be challenging, and complications may include compartment syndrome, soft-tissue and ligament damage, and neurovascular injury. A successful course of treatment necessitates articular cartilage regeneration, biological integrity preservation, mechanical axis realignment, joint stabilization, and mobility preservation. **Objective:** To compare the outcomes of locking plate vs. external fixation in management of comminuted intra articular fracture of proximal tibia. **Methods:** In this quasi experimental study 82 patients of proximal tibia fracture were presented. Patients were admitted to orthopedic department and were included after getting informed written consent. Two groups were created, in group I 41 patients received locking plate and 41 patients of group II received external fixation. Outcomes among both groups were compared after treatment. SPSS version 23.0 was used to analyze all data. **Results:** There were majority males in both groups. Patients of group I had mean age of 36.13 ± 10.63 years and in group II mean age was 34.8 ± 7.49 years. Postoperative functional outcome was significantly better in group I as compared to group II with p value <0.05. As per Rasmussen's clinical functional knee score, group I had higher score 23.61 ± 6.154 as compared to group II 21.45 ± 6.187 with p value <0.03. Post-operative frequency of infection was lower in group I as compared to group II with p value <0.02. **Conclusion:** It was concluded that in this study that internal locking plate showed better outcomes in terms of functional results while had higher blood loss and longer operative time as compared to external fixation.

INTRODUCTION

Tibial plateau fractures caused by Schatzker type V or VI pose difficult surgical problems and are associated with possible side effects include compartment syndrome, soft-tissue and ligament damage, and neurovascular injury [1, 2]. Important factors affecting the long-term prognosis are ligamentous instability and the lack of articular congruity repair [3]. A successful course of treatment requires articular cartilage restoration, biological integrity preservation, mechanical axis realignment, joint stabilization, and mobility preservation [4]. In the case of tibial plateau fractures, Schatzker types V and VI present a number of significant surgical challenges, including neurovascular injury, compartment syndrome, damage to soft tissues and ligaments, and other sequelae. These

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complications are characteristics of the complicated surgical problems [5]. In the long run, the prognosis is significantly impacted by a number of variables, including the presence of ligamentous instability and the inability to restore articular congruity.3) Biological integrity, stability of the joint, preservation of mobility, realignment of the mechanical axis, and repair of articular cartilage are all essential components for the successful completion of therapeutic procedures. The use of a lateral locking plate in conventional Open Reduction and Internal Fixation (ORIF) procedures to realign the osseous tissues has a high risk of surgical complications. This risk is especially high when the procedures are performed in conjunction with one another. Nevertheless, this strategy proved to be successful. The Ilizarov treatment, which allows for closed reduction and fixation, is a suitable alternative that does not create substantial complications with the soft tissues [6]. There is a correlation between high-energy trauma and complex and open tibial fractures; nevertheless, it is important to note that both forms of trauma have the potential to induce this injury. Open fractures are connected with a higher risk of complications and permanent disability than closed fractures. For patients who have suffered a fracture of the tibial plateau, there are a number of therapy options open to them, including both non-operative and surgical procedures [7]. Non-operative therapy, such as the Sarmiento program, may be beneficial for patients with submeniscal fractures, stable fractures that are not displaced, and certain patient demographics, such as the elderly [8].

Surgical treatment is necessary for certain kinds of fractures, fractures that have been displaced, and fractures that have been associated with vascular or compartment syndrome. The surgical treatments encompass a broad variety of fixation techniques, ranging from those that are performed internally, such as arthroscopic fixation and biologic fixation, to those that are performed externally, such as the Ilizarov device and hybrid fixators. It has not yet been demonstrated that balloon tibioplasty is successful in the long run, despite the early confidence that was expressed. When it comes to the functional outcome of Rasmussen's knee, the results of research that compared the hybrid Ilizarov treatment with the locking plate technique have been inconsistent [9, 10]. Treatment for tibial plateau fractures is difficult, and non-operative and surgical methods are available. Non-operative treatment, like the Sarmiento program, is appropriate for sub-meniscal fractures, stable, non-displaced fractures, and specific patient groups, such as the elderly [11]. Certain fracture types, displaced fractures, and fractures involving vascular or compartment syndrome necessitate surgical treatment. Surgical procedures include both exterior fixation techniques, such as the use of devices like the Ilizarov instrument or hybrid fixators, and internal fixation techniques, such as arthroscopic fixation, biologic fixation, and traditional double plating. Although balloon tibioplasty shows promise, its long-term effectiveness is not proven. Different outcomes are obtained using the hybrid Ilizarov technique and locking plate approach in studies assessing Rasmussen's knee functional outcome [11, 12]. With a complication incidence of 12% (re-fracture after implants were withdrawn), the findings demonstrated that 85 percent of the patients achieved full clinical and radiological union [12]. All of the cases were successful in achieving full union. According to the findings of another study, all 32 femoral fractures that were treated with locking plates in children and adolescents healed fully radiologically, demonstrating that the treatment was successful in every single instance [13, 14]. As a result of the increased likelihood of angular deformity, an increasing percentage of fractures that occur in children are being treated surgically. In juvenile femoral fractures, angular deformities cannot exceed 10 degrees forward/backward or 5 degrees medial/lateral. This is because there is a strong association between angulations of the femur and arthritis of the knee joint. In order to advance current understanding, this study compared the functional results of patients treated for comminuted intra-articular fractures of the proximal tibia using the locking plate technique against external fixation.

METHODS

This quasi experimental study was conducted at orthopedic department of Sahiwal Medical College /Sahiwal Teaching Hospital from 10/05/2024-30/11/2024 and comprised of 82 patients with proximal tibia fracture. The approved IRB reference number is 158/IRB/SLMC/SWL. Patients were included after getting informed written consent. Non- consecutive sampling technique was used. The formula for sample size calculation for comparing two independent means was: $n=(Z\alpha/2+Z\beta)2\times2\times\sigma2d2$. With an effect size of 0.67, two followed alpha values (0.05), and beta value (0.1), 41 patients in each group were sufficient to identify a significant difference. So total sample size taken was 82 patients. 41 patients received locking plate in group I and 41 patients of group II received external fixation. Following the patient's pre-operative measurements and fitness evaluation, they were placed in a supine posture on a traction table and, following spinal anaesthesia, their knees were flexed to 90 degrees. In order to limit blood flow during the locking compression plate fixation, a tourniquet was utilized. The fracture has healed, according to C-arm imaging. The appropriate incision was used to apply lateral or medial plating. The wound was cleaned using normal saline, which has a pH of 0.9%. In order to stabilize the skeleton, patients were prepared and then back-slab was put above the knee.

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Under general anaesthesia, a single surgical team operated on all patients. Injectable first-generation cephalosporins were administered following pre- and post-operative sensitivity testing and continued for a minimum of seven days. There was radiologic evidence of callus at six weeks, which allowed for partial weight bearing. When it was deemed appropriate, full weight bearing was initiated and documented. For an average of one year, patients were monitored. All infection occurrences have been documented and contrasted. The non-union incidence was reported, and the time for unionisation in the two categories was compared. Association of infection and its severity was observed. SPSS version 23.0 was to analyze the data. A significant result was defined as a p-value less than 0.05. Age and other quantitative factors were defined as means with standard for normality test. The chi-square test was used to compare the two groups' functional outcomes at six months. The threshold for significance was p-value <0.05.

RESULTS

In group I 34 (82.9%) were males and 7 (17.1%) females while in group II 31 (75.6%) males and 10 (24.4%) female patients. Patients of group I had mean age 36.13 ± 10.63 years and in group II mean age was 34.8 ± 7.49 years. Road traffic accidents were the most common cause of injury followed by fall from the height. In group I 28 (68.3%) cases had fracture type VI and in group II 25 (60.97%) cases had fracture type VI (table 1).

Table 1: Demographics of the Presented Cases (n=82)

Variables	Mean ± SD/Frequency (%)	
	Group I	Group II
Mean Age (Years)	36.13 ± 10.63	34.8 ± 7.49
Gender		
Male	34 (82.9%)	31 (75.6%)
Female	7 (17.1%)	10 (24.4%)
Cause of Injury		
RTA	30 (73.2%)	28 (68.3%)
Fall from Height	11 (26.8%)	13 (31.7%)
Fracture Type		
V	13 (31.7%)	16 (39.03%)
VI	28 (68.3%)	25 (60.97%)

In group I intra-operative blood loss was 121.12 ± 5.37 ml and 25.7 ± 6.38 ml in group II. Mean operative time in group I was higher 86.17 ± 14.88 as compared to group II 41.8 ± 5.44 minutes with p value < 0.004 (table 2).

Table 2: Comparison of Intra-Operative Parameters among both Groups

Variables	Mean ± SD		p-Value
	Group I	Group II	
Blood Loss	121.12 ± 5.37	25.7 ± 6.38	<0.003
Operative Time	86.17 ± 14.88	41.8 ± 5.44	<0.004

Postoperative functional outcome was significantly better in group I 53.7% good, 39.02% fair and 7.3% poor as compared to group II 24.4% good, 41.5% fair and 34.4% poor with p value <0.05 (table 3).

Table 3: Post-Operative Comparison of Functional Outcomes (n=82)

Variables	Frequency (%)		p-Value
	Group I	Group II	
Good	22 (53.7%)	10 (24.4%)	<0.05
Fair	16 (39.02%)	17 (41.5%)	
Poor	3 (7.3%)	14 (34.4%)	

As per Rasmussen's clinical functional knee score, group I had higher score 23.61 ± 6.154 as compared to group II 21.45 ± 6.187 with p value <0.03 (table 4).

Table 4: Comparison of Knee Score

Variables	Mean ± SD		p-Value
	Group I	Group II	
Rasmussen's Clinical Functional Knee Score	23.61 ± 6.154	21.45 ± 6.187	<0.003

Post-operative frequency of infection n was lower in group I 4.9% as compared to group II 21.9% with p value <0.02 (figure 1).

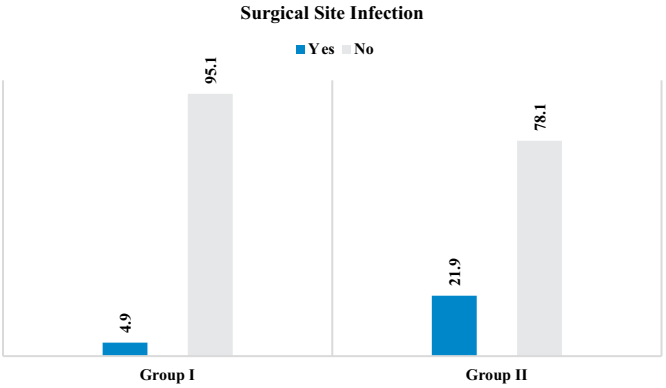

Figure 1: Post-Operative Comparison of Infection

DISCUSSION

There is evidence that locking plate fixation increases the union rate for femur shaft fractures, which is useful for reduced cortical blood flow, increased endosteal necrosis, elevated intra-compartment pressures, and infection risk are all possible outcomes of a locked plate after high-energy trauma or an open fracture [15, 16]. When fixing a fracture, it might be technically challenging to keep the section in an unstable position, necessitating the use of locking screws, extra plates, or even the open insertion of a bone reduction clamp or bone holding [17]. Regardless of the fixation technique used, a shorter healing period is directly related to proper initial anatomical reduction. Scarring and an abundance of callus production make secondary reduction impossible in this age bracket. Following the appropriate removal of necrosed or dead tissue and bone, the reduction is accomplished using a

DOI: https://doi.org/10.54393/pjhs.v6i4.2958

closed, minimally invasive technique that minimized soft tissue stripping through the tiny incision or traumatic wound. The exact method relies on the protocol. Under image intensification, screws can be used to stabilize fractures if needed [18]. In current study, Postoperative functional outcome was significantly better in group I as compared to group II with p value <0.05. Researchers Smith PN et al., found that "definitive external fixation and staged ORIF" result in similar rates of union, time to union, and complications when it comes to treating tibial plafond fractures. They suggested larger randomized prospective studies to evaluate the reliability and practical implications of the results over the long term [19]. The functional result of the knee was rated as outstanding in 25% of participants, good in 60%, fair in 10%, and bad in 5% of those who underwent the hybrid Ilizarov operation, according to studies done by Raza A et al [20]. As per Rasmussen's clinical functional knee score, group I had higher score 23.61 ± 6.154 as compared to group II 21.45 ± 6.187 with p value <0.03. Using Rasmussen's knee functional outcome, the study found that 50% of participants rated the locking plate technique as exceptional, 35% as good, 15% as fair, and 0% as bad. Based on Rasmussen's knee functional result, 35% of participants rated the locking plate technique as exceptional, 42% as good, 15% as fair, and 8% as poor, according to a research by Karunakaran A et al [21]. This all-inclusive review is on the complex elements to think about while managing a tibial plateau fracture, with an emphasis on individualized strategies according to the fracture features, patient variables, and soft tissue pathologies.

CONCLUSIONS

It was concluded that in this study the internal locking plate showed better outcomes in terms of functional results while had higher blood loss and longer operative time as compared to external fixation.

Authors Contribution

Conceptualization: SUS
Methodology: AMS, MR
Formal analysis: SUS
Writing, review and editing: SUS, AMS, ARN, OBZ, SARA
All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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