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Functional Outcome of Proximal Tibial Fractures Managed by Locking Compression Plate

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Abstract

Background: *Proximal tibial fractures are complex intra-articular injuries that can significantly affect knee function. Locking compression plate (LCP) fixation provides stable fixation and allows early mobilization, but data on functional outcomes in Bangladeshi patients remain limited. This study aimed to evaluate the functional outcome of proximal tibial fractures managed with LCP at a tertiary care center in Bangladesh.*

Methods: *This prospective observational study was conducted in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from January 2019 to December 2019. A total of 45 adult patients with closed proximal tibial fractures who met the inclusion criteria were enrolled. All patients underwent open reduction and internal fixation with LCP, followed by structured postoperative rehabilitation. Demographic data, mode of injury and fracture characteristics were recorded. Functional outcome at final follow-up was assessed using the Rasmussen functional knee score and analyzed with SPSS version 23.0.*

Results: *The majority of patients were aged 31–40 years (31.1%) and male (71.1%). Road traffic accidents were the most common mode of injury (57.8%), followed by fall from height (24.4%). At final follow-up, 18 patients (40.0%) achieved excellent functional outcomes, 17 (37.8%) had good outcomes, 7 (15.6%) fair and 3 (6.7%) poor. Overall, 77.8% of patients demonstrated satisfactory (excellent or good) functional recovery.*

Conclusion: *Locking compression plate fixation is an effective method for managing proximal tibial fractures in adult Bangladeshi patients, providing stable fixation, early mobilization and good functional recovery. Careful surgical technique and structured rehabilitation are essential to optimize outcomes.*

Keywords: *Proximal tibial fracture, Locking compression plate, Functional outcome, Knee function.*

1. Introduction

Proximal tibial fractures are significant intra-articular injuries that commonly involve the knee joint and pose substantial challenges in orthopedic trauma care [1]. These fractures account for approximately 1% of all fractures and are frequently associated with high-energy trauma in younger individuals and low-energy osteoporotic injuries in older patients [2].

The primary goals of treatment are restoration of the articular surface, maintenance of mechanical alignment, stable fixation and early mobilization to achieve optimal functional recovery of the knee joint [3]. Failure to achieve these objectives may result in complications such as malunion, knee stiffness, post-traumatic osteoarthritis and long-term functional impairment [4].

In Bangladesh, rapid urbanization, increased motorization and occupational hazards contribute to a rising incidence of road traffic accidents and fall-related injuries, making proximal tibial fractures a relatively common presentation in tertiary care hospitals [5]. Patients often present with complex fracture patterns due to high-energy trauma, delayed hospital attendance and varying soft-tissue conditions, which complicate management and affect outcomes [6]. Therefore, selecting an appropriate fixation method that provides stable construct and allows early rehabilitation is essential in the local clinical context [7]. Locking compression plate (LCP) fixation has gained popularity in the management

of proximal tibial fractures because of its biomechanical advantages, including angular stability, preservation of periosteal blood supply and improved fixation in metaphyseal and osteoporotic bone [8]. The locking mechanism creates a fixed-angle construct that acts as an internal fixator, reducing the risk of implant failure and secondary displacement while permitting early knee mobilization [9]. Several international studies have reported favorable clinical and functional outcomes with proximal tibial LCP fixation, particularly in comminuted and intra-articular fractures. However, outcomes may vary depending on fracture pattern, surgical technique, patient factors and postoperative rehabilitation [10].

Despite the increasing use of locking compression plates in Bangladesh, there is limited local evidence evaluating functional outcomes following this technique, especially in patients treated at tertiary referral centers [11]. Differences in injury mechanism, healthcare access, surgical expertise and follow-up compliance may influence treatment results compared with other settings. Assessing functional outcome in the Bangladeshi population is therefore important to determine the effectiveness of this fixation method in routine clinical practice and to guide treatment protocols [12].

The present study was undertaken at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, in 2019 to evaluate the functional outcome of proximal tibial fractures managed by locking compression plate fixation. The study aimed to assess postoperative knee function and overall clinical recovery following surgical stabilization of these fractures in adult Bangladeshi patients.

2. Methodology & Materials

This prospective observational study was conducted in the Department of Orthopaedic Surgery at Bangabandhu Sheikh Mujib Medical. University (BSMMU), Dhaka, Bangladesh, from January 2019 to December 2019 to evaluate the functional outcome of proximal tibial fractures managed by locking compression plate fixation.

A total of 45 patients with radiologically confirmed proximal tibial fractures who fulfilled the selection criteria were enrolled consecutively after obtaining informed written consent. All patients underwent open reduction and internal fixation with proximal tibial locking compression plate following standard surgical principles and postoperative rehabilitation protocol. Patients were followed up regularly in the outpatient department for clinical and radiological assessment until fracture union and functional recovery.

Inclusion criteria comprised adult patients aged ≥18 years of either sex with closed proximal tibial fractures (Schatzker types I–VI) presenting within three weeks of injury and treated with locking compression plate fixation, who consented to participate and completed follow-up. Exclusion criteria included open fractures with severe soft-tissue loss (Gustilo–Anderson grade III), pathological fractures, associated neurovascular injury, polytrauma requiring prolonged immobilization, previous ipsilateral knee pathology or surgery and patients lost to follow-up before functional evaluation.

Demographic variables, injury characteristics, fracture type, operative details and postoperative complications were recorded in a structured data sheet. Functional outcome at final follow-up was assessed using the Rasmussen functional knee score and graded as excellent, good, fair, or poor. Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics such as mean, standard deviation, frequency and percentage were calculated.

3. Results

Table 1. *Age Distribution of the Study Patients (n = 45)*

Age group (years)	Number of patients	Percentage (%)
18–30	12	26.7
31–40	14	31.1
41–50	10	22.2
>50	9	20
Total	45	100

Table 1 shows the age distribution of the study patients, where the majority belonged to the 31–40 years age group (31.1%), followed by 18–30 years (26.7%). Patients aged 41–50 years constituted 22.2%, while 20% were older than 50 years.

Table 2. *Sex Distribution of the Study Patients (n = 45)*

Sex	Number of patients	Percentage (%)
Male	32	71.1
Female	13	28.9
Total	45	100

Table 2 shows the sex distribution of the study patients, where the majority were male (71.1%), while females constituted 28.9% of the total 45 cases.

Table 3. *Mode of Injury of the Study Patients (n = 45)*

Mode of injury	Number of patients	Percentage (%)
Road traffic accident	26	57.8
Fall from height	11	24.4
Slip/fall on ground	6	13.3
Assault/sports injury	2	4.4
Total	45	100

Table 3 shows the mode of injury of the study patients, where road traffic accidents were the most common cause (57.8%), followed by fall from height (24.4%) and slip/fall on ground (13.3%). Assault or sports-related injuries accounted for 4.4% of cases.

Table 4. *Functional Outcome at Final Follow-up (n = 45)*

Functional outcome	Number of patients	Percentage (%)
Excellent	18	40
Good	17	37.8
Fair	7	15.6
Poor	3	6.7
Total	45	100

Table 4 shows the functional outcome at final follow-up, where the majority of patients had excellent (40.0%) and good (37.8%) results. Fair outcomes were observed in 15.6% of cases, while only 6.7% had poor functional outcome.

4. Discussion

Proximal tibial fractures are complex peri-articular injuries that significantly affect knee function and their successful management depends on stable fixation and early mobilization. Locking compression plate (LCP) fixation has increasingly become the preferred method due to its angular stability and biological fixation principles. The present study evaluated the functional outcome of proximal tibial fractures treated with LCP in 45 adult patients at a tertiary care center in Bangladesh and the findings are comparable with previously published literature.

In the present study, the majority of patients were young to middle-aged adults, with the highest proportion in the 31–40 years age group (31.1%), followed by 18–30 years (26.7%). Similar age distribution has been reported by Chalasani et al. and Shiva et al., who observed that proximal tibial fractures commonly affect economically active adults due to high-energy trauma [13, 14]. The male predominance observed in our series (71.1%) is also consistent with reports by Kale et al., reflecting greater exposure of males to outdoor activities, occupational hazards and road traffic accidents in developing countries [15].

Road traffic accident was the leading mode of injury in our study (57.8%), followed by fall from height (24.4%). Comparable findings were noted by Naik et al. and Nikolaou et al., who also reported road traffic trauma as the most frequent cause of proximal tibial fractures [16, 17]. This pattern reflects increasing vehicular movement and inadequate road safety measures in low- and middle-income countries, including Bangladesh. Such high-energy mechanisms often result in comminuted and intra-articular fractures requiring stable fixation methods like locking plates.

Functional outcome in the present study was encouraging, with excellent results in 40.0% and good in 37.8% of patients, giving an overall

satisfactory (excellent + good) outcome of 77.8%. These findings are comparable with Chalasani et al., who reported 80% excellent-to-good outcomes with proximal tibial LCP fixation and Arumugam et al., who also demonstrated predominantly good functional recovery following minimally invasive locking plate osteosynthesis [13, 18]. Similarly, Shiva et al. observed favorable functional results in the majority of patients treated with locking compression plates around the knee joint [14]. The relatively low proportion of poor outcomes in our study (6.7%) further supports the effectiveness of LCP fixation.

The favorable outcomes observed may be attributed to the biomechanical advantages of locking plates, which provide angular stability and act as an internal fixator while preserving periosteal blood supply. Raschke et al. emphasized that stable fixation and restoration of articular congruity are key determinants of good knee function after proximal tibial fractures [19]. Moreover, minimally invasive or biological plating techniques associated with locking plates reduce soft-tissue disruption and promote fracture healing, as noted by Ronga et al. and Ahmad et al [20, 21]. These principles likely contributed to the high proportion of satisfactory functional outcomes in our series.

Comparative studies have also demonstrated the superiority or equivalence of locking plates over conventional fixation methods. Bastias et al. similarly concluded that locking plates provide improved stability in metaphyseal fractures, particularly in osteoporotic or comminuted bone. Such evidence supports the choice of LCP fixation in the present study population [22].

The demographic and injury characteristics of our patients—young male predominance and road traffic–related trauma—reflect the epidemiological pattern reported in regional orthopedic literature. The high rate of satisfactory functional outcome (77.8%) observed in this Bangladeshi cohort indicates that locking compression plate fixation is an effective method for managing proximal tibial fractures in a tertiary care setting. These results align with multiple international and regional studies, confirming that LCP fixation allows stable fixation, early mobilization and good knee function.

However, a small proportion of fair (15.6%) and poor (6.7%) outcomes in our study suggests that factors such as fracture severity, soft-tissue injury and rehabilitation compliance may influence final results, as also highlighted by Naik et al. and Nikolaou et al. Careful patient selection, meticulous surgical technique and structured postoperative physiotherapy remain essential to optimize outcomes [16, 17].

5. Limitations Of The Study

This study has a few limitations. The sample size was relatively small (n = 45) and the follow-up period was limited to one year, which may not capture long-term complications such as post-traumatic osteoarthritis. Additionally, being a single-center study from BSMMU, Dhaka, the findings may not be fully generalizable to other populations or settings in Bangladesh. Variations in fracture pattern, patient compliance with physiotherapy and surgeon experience could also have influenced the outcomes.

6. Conclusion

Locking compression plate fixation provides stable and reliable management for proximal tibial fractures, allowing early mobilization and good functional recovery. In our study, the majority of patients (77.8%) achieved excellent to good functional outcomes, supporting the use of LCP as an effective treatment option in adult Bangladeshi patients. Careful surgical technique and structured rehabilitation remain essential to optimize results and minimize complications.

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Conflicts Of Interest

There are no conflicts of interest.

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