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Original Research Article

Knee joint stability following fixation of tibial plateau fracture by angular locking plate fixation

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ABSTRACT

Background: Injuries to the tibial plateau generally occur because of a force directed either medially or laterally an axial compressive force or both an axial force and force from the side. Tibial plateau fractures resulting frequently in functional impairment.
Methods: The total of cases included in the study was 47 in number. More than 20 years old patients of both sexes with tibial plateau fractures attended in the study. Proper informed consent was taken from the patients under the study and purpose of the study was explained. Ethical approval was obtained from the Institutional Ethics Committee. All data were processed, analyzed, and disseminated by MS Office and Statistical package for social sciences (SPSS) version 26 as per need.
Results: In this study, for majority (51%) patients <12 weeks were in needed for union. Besides these, for 23.40% and 21.28% patients, time for union were 12-14 and >14 weeks respectively. Unfortunately, in 4.26%% cases (n=2) incidence of non-union was occur. The mean period of radiological union was 12.75 weeks (12-16 weeks). Most of the patients were allowed complete weight bearing at 11 to 14 weeks. Average time gap for complete weight bearing was 13.5 weeks. In assessing the knee stability of the participants, we observed, the mean (±SD) angle of knee joints was 112.08 ±12.32 degree. The mean (±SD) Knee Society Score (KSS) was found 77.51 ± 8.16. As per the functional outcomes among all the participants, majority of them (57.45%) got 'good' results whereas 29.79% got 'Excellent' and 8.51% got 'Poor' results.
Conclusions: Satisfactory knee joint stability for patients with tibial plateau fracture angular locking plate fixation technic may be considered as an effective treatment method for orthopedic surgeons.

Keywords: Tibial plateau fractures, Knee joint, Axial, Gustilo Anderson Grade, KSS score

INTRODUCTION

Although there are various modalities for fixation of tibial plateau fractures with satisfactory results, but in this study our major concentration was in the knee joint stability following fixation of tibial plateau fracture by angular locking plate fixation. Though difficult, the treatment of these fractures aims to restore normal knee joint function by anatomical restoration of joint surfaces and maintaining the reduction by stable implants.[1] The tibial plateau is the region of proximal tibia, which comprises of the superior articular surface. It constitutes a major weight bearing portion in the body. Its fractures classically were described as bumper or fender's fractures. They gravely affect the biomechanics, stability and range of motion of the knee joint.[2] Such injuries present with a wide array of fractures, varying from minor hairline cracks with excellent functional outcomes even after conservative treatment to challenging fracture configurations requiring highly experienced surgical hands. The management of such types of injuries has for long been subject of controversies. The spectrum of treatment ranges from simple casting and

bracing to skeletal traction and early motion to open reduction and internal fixation.[3] besides these, the appropriate treatment for such injuries of different severities is unclear. A brief review of literature revealed that, different avenues are being explored for these fractures. Ali et al. reported 'a 31% fixation failure' for tibial plateau fracture in their 'elderly population'.[4] Stevens et al., noted that, only 57% of cases showed 'good functional outcome' after surgical management of tibial plateau fractures in age of more than 40 years.[5] 'Open reductio n' and 'internal fixation' has a significant complication rate.[6] So a middle path of minimally invasive technique of closed reduction by ligamentotaxis and stabilizing the fracture by limited internal fixation was developed and practiced to overcome the drawbacks of 'non-operative' and 'operative modalities'.[7] These techniques utilize percutaneous screws and Kirschner wires (K wires), external fixation frames or combination of external fixation with limited internal fixation.[8] The minimally invasive technique of closed reduction by ligamentotaxis and fixation with percutaneous screws and K wires, combines attributes to both operative and non-operative philosophies. Basically, the treatment of tibial plateau fractures is continuously evolving. Various treatment methods have emerged over the last few decades. Until the seventies, these fractures were essentially treated conservatively with a variety of modalities such as traction, cast bracing and spica casting.[9] In the eighties, as the science of internal fixation progressed rapidly, more and more tibial plateau fractures started to get operated.[10] Surgically treated fractures yielded favorable results due to the achievement of better articular congruity, higher stability and early mobilization. All the parts of this study were aimed to the proper objectives of the study.

Objectives

General objective

The objective of the study was to evaluate the knee joint stability following fixation of tibial plateau fracture by angular locking plate fixation.

Specific objective

The objective of the study was to assess the mechanism of injuries of tibial plateau fractures and to assess the time to union among the participants.

METHODS

This was a prospective observational study which was conducted in National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, Centre for Research and Rehabilitation in Endocrine Diseases, Disabilities, Infectious Diseases and Chemical Toxicities (CREDIT), Dhaka, Bangladesh, Orthopedic Hospital of Hebei Medical University, Hebei Province, China, Holy Crescent Hospital, Dhaka, Bangladesh and Dhanmondi General Hospital, Dhaka, Bangladesh during the period from January 2018 to December 2020. The total 47cases included in the study. More than 20 years old patients of both sexes with tibial plateau fractures attended to the mentioned hospital during the first six months of the study were selected as the study population. Proper informed consent was taken from the patients under the study and purpose of the study was explained. Ethical approval was obtained from the Institutional Ethics Committee. All data were processed, analyzed, and disseminated by MS Office and SPSS version 26 as per need.

RESULTS

In this study, among total 47 participants, 27 were male which was 57% and 20 were female which was 43%. Among total population, the highest 29.79% (n=14) were from 31-40 years' age group.

Figure 1: X-ray.

Table 1: Age distribution of the study participants (n=47).

Age (years)	N	%
20-30	11	23.40
31-40	14	29.79
41-50	12	25.53
51-60	7	14.89
>60	3	6.38

Table 2: Distribution of patients on basis of time to union (n=47).

Union	N	%
Less than 12 weeks	24	51.06
12 to 14 weeks	11	23.40
More than 14 weeks	10	21.28
Non union	2	4.26

Then 25.53% (n=12) were from 41-50 years' age group, 23.40% (n=11) were from 20-30 years' age group, 14.89% (n=7) were from 51-60 years' age group and only 7.38% (n=3) were from >60 years' age group. In analyzing the mechanism of injuries of the participants we found, the highest 40% injuries occurred by road traffic accidents. Then in 26% cases the mechanism was fall from height, in 19% cases it was simple falls and in 15% cases it was sports.

Table 3: Knee stability status and final outcomes at 6 months' regarding follow up (n=47).

Status	Grade	N	%
Average knee flexion	Degree	112.08 ±12.32	
Average KSS score	Point	77.51 ± 8.16	
Functional outcome (KSS)	Poor	4	8.51
	Good	27	57.45
	Excellent	14	29.79
Non-union		2	4.26

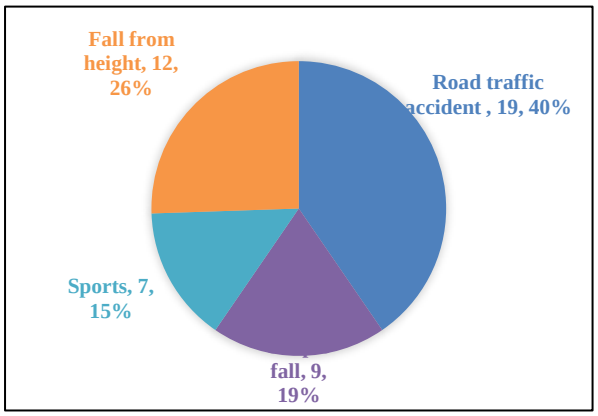

Figure 2: Distribution of type of injuries (n=47).

The average duration of hospitalization of the participants was 7.5 days (Range was: 3-8 days). In total 5 patients were managed with cancellous screws; 13 patients underwent open reduction and fixation with plating while plating supplemented with bone grafting was done in 9 patients. In total 7 patients had fixation done with dual plating. Average time gap between operation and partial weight bearing was around 9.5 weeks (8 to 13 weeks). In analyzing the time of union among the participants we observed that, for majority (51%) patients, less than 12 weeks were in needed for union. Besides these, for 23.40% and 21.28% patients, time for union were 12-14 weeks and >14 weeks respectively. Unfortunately, in 4.26% cases (n=2) incidence of non-union was occur. The mean period of radiological union was 12.75 weeks (Range: 12-16 weeks). Most of the patients were allowed complete weight bearing at 11 to 14 weeks. Average time gap for complete weight bearing was 13.5 weeks. In assessing the knee stability of the participants, we observed, the mean (±SD) angle of knee joints was 112.08 ±12.32 degree. The mean (±SD) KSS (Knee Society Score) was found 77.51 ± 8.16. As per the functional outcomes among all the participants of this study, majority of them (57.45%) got 'good' results whereas 29.79% got 'Excellent' and 8.51% got 'Poor' results.

In the Table 1 found the age segregation where 20-30 years participants were 23.40%, 31-40 years 29.79%, 41-50 years 25.53%, 51-60 years 14.89% and more than 60 years was 6.38% respectively. Figure 1 shows 26%, 40%, 15% and 19% patients were injured by fall from heights, road traffic accident, sports and simple fall accordingly. Table 2 shows the less than 12 weeks 51.06%, 12 to 14 weeks 23.40%, more than 14 weeks 21.28% and rest of 4.26%.

In the table 3 the status and final outcomes of knee stability at 6 month shown average knee flexion 112.08±12.32%, average KSS score 77.51±8.16%, Functional outcome (KSS) 8.51%, 57.45% and 29.79% others as non-union were 4.26%.

DISCUSSION

The aim of this study was to evaluate the knee joint stability following fixation of tibial plateau fracture by angular locking plate fixation. Generally tibial plateau fracture is one of the commonest intra articular fractures, are major traumatic injury occurring due to fall from height, RTA (Road traffic accidents), violence etc. Sometimes it is associated with other bony or soft tissue injuries. The treatment of upper tibial fractures with intra articular extension has become a challenge for orthopedic surgeons. We have presented the various types of tibial plateau fractures in our setup. In our study, the highest 29.79% (n=14) participants were from 31-40 years' age group. Then 25.53% (n=12) were from 41-50 years' age group, 23.40% (n=11) were from 20-30 years' age group, 14.89% (n=7) were from 51-60 years' age group and only 7.38% (n=3) were from >60 years' age group. The mean age in this study was 42.76 years. In a similar study done by Rasmussen et al the average age of patients was 55 years.[11] In this study, the majority number of patients were male (57%) and the commonest mode of injury was road traffic accident (40%). This did not correlate well with previous study by Chiax et al who in their series reported that 71% of the injuries occurred due to RTA.[12] In this series, we studied 47 cases of tibial plateau fractures treated by surgical method. Honkoenen in his series of 130 tibial plateau fractures, conducted surgery taking into consideration condylar widening of >5 mm and lateral condyle step off >3 mm.[13] The indication for surgery in these types of injuries has evolved steadily with time. Burri et al in his study, in 1979 advised that, 'Internal fixation at 1 mm of depression', and Hohl et al as well as Segal et al advocated fixation at 5 mm of depression and Honkonen et al took 3 mm of depression in consideration in his study in 1993.[14-15] In this study the indication for surgery were the same standard indications as for those tibial plateau fractures, 3 mm depression was considered as an indication for surgery in this series. In our study, in analyzing the time of union among the participants we

observed that, for majority (51%) patients, less than 12 weeks were in needed for union. Besides these, for 23.40% and 21.28% patients, time for union were 12-14 weeks and >14 weeks respectively. Unfortunately, in 4.26% cases (n=2) incidence of non-union was occur. The mean period of radiological union was 12.75 weeks (Range: 12-16 weeks). Most of the patients were allowed complete weight bearing at 11 to 14 weeks. Average time gap for complete weight bearing was 13.5 weeks. In assessing the knee stability of the participants, we observed, the mean (±SD) angle of knee joints was 112.08 ±12.32 degree. The mean (±SD) KSS (Knee Society Score) was found 77.51±8.16. As per the functional outcomes among all the participants of this study, majority of them (57.45%) got 'good' results whereas 29.79% got 'Excellent' and 8.51% got 'Poor' results. The benefits of early knee movement include reduced knee stiffness and improved cartilage regeneration. However, these benefits are to be cautiously weighted against their negative impact such as loss of fracture reduction, failure of internal fixation and compromised soft tissue healing. Schatzker et al stated that the prognosis is given by the degree of displacement, type of fracture, method of treatment and quality of post-operative care.[5] Ebraheim et al in his series of 117 tibial plateau fractures had excellent results in 68% of cases, good in 13%, fair in 11% and poor in 8% of the patients.[16] All the findings may be helpful in similar further studies.

Limitations of the study

This study was a single centered study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country.

CONCLUSION

To ensure satisfactory knee joint stability for patients with tibial plateau fracture angular locking plate fixation technic may be considered as an effective treatment method for orthopedic surgeons. The findings of this study may be helpful for the future researchers for any further research in the same issue and in the arena of the treatment of tibial plateau fracture.

Recommendations

It is to recommend for conducting more studies regarding the same issue with larger sized sample.

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