

Functional Outcome and Quality of Life After Surgical Fixation of Tibial Plateau Fracture in a Tertiary Care Center of Nepal

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ABSTRACT

Introduction

Functional outcome and quality of life (QoL) of patients will change following tibial plateau fracture fixation. There are limited studies evaluating functional and radiological outcomes following tibial plateau fixation in Nepal, and none has evaluated QoL. We aim to evaluate functional outcome and QoL in patients with tibial plateau fracture with a follow up period of more than two years.

Methods

This was a cross sectional, observational study done at Dhulikhel Hospital, from August 2021 to January 2022. Western Ontario and McMaster Universities Arthritis Index (WOMAC) functional outcome and World Health Organization QoL-8 (WHOQoL-8) questionnaire were filled by patients operated for tibial plateau fracture from 2011 to 2019. Compound fractures, untraceable patients, and those managed with casts were excluded from the study.

Results

There were 121 patients (male: female = 2.3:1) with a mean age of 37.1 years. Road traffic accidents (44.6%) were the most common mode of injury, and Schatzker type IV (30.6%) was the most common type of fracture. The average WOMAC score was 13.05 ± 12.1 and the average WHOQoL-8 score was 30.24 ± 4.1 . The average WOMAC score in high-energy and low energy trauma patients were 17.07 ± 12.29 and 8.21 ± 10 respectively. The average WHOQoL-8 in high energy and low energy trauma patients were 29.28 ± 3.59 and 31.38 ± 4.38 respectively.

Conclusions

Surgical reduction and stable internal fixation of tibial plateau fractures with long term follow up has a good functional outcome and quality of life. High energy trauma is associated with poor functional outcome and quality of life.

Keywords: functional outcome; quality of life; tibial plateau.

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INTRODUCTION

Tibial plateau fractures are usually complex intra articular injuries having long term consequences around the knee joint.¹ It represents one percentage of all the fractures and around eight percentage of the fractures in elderly.² Among the several classification systems, the Schatzker classification is the most commonly used, which divides the tibial plateau fracture into six types. Types I to IV are uni-columnar, with type V and VI being bi-columnar.³ The greater the grade and severity of injury, the poorer is the functional outcome, leading to a poor quality of life.⁴ There are many papers relating to fracture type and fixation methods, along with functional and radiological outcomes.⁵⁻⁹ The most commonly used treatment modalities are closed reduction and internal fixation of nondisplaced uni-condylar fractures and open reduction and internal fixation (ORIF) with plates and screws for displaced uni-condylar or bi-condylar fractures. The general consensus has not yet been established regarding the management of these fractures. Nevertheless, minimally invasive techniques are more commonly used for soft tissue preservation.⁵

Osteosynthesis of tibial plateau fracture has been associated with increased complications like knee stiffness, wound dehiscence requiring flap surgeries and sometimes with dreaded complications like compartment syndrome. All these are associated with poor functional outcomes, leading to a decreased quality of life. Functional outcome depends mainly on postoperative pain, stability of the joint, and range of knee motion.¹⁰ There are various literatures from our region on radiological and functional outcomes between six months to two years post-operative period.¹¹⁻¹³ However, physiological and anatomical changes around the knee joint have been observed even up

to an eight year follow up period.^{7,14,15} These changes might have affected the quality of life and functional outcome of patients on long term follow up.

There is a paucity of literature with long term follow up focusing on functional outcome and quality of life among patients who underwent surgery for tibial plateau fractures. Hence, we aim to evaluate functional outcome and quality of life in patients with surgically treated tibial plateau fractures with more than two years of follow up.

METHODS

Study Design and Recruitment of Patients

This was a single centered, cross sectional, observational study of patients conducted at a tertiary care center of Nepal, from August 2021 to January 2022. Data from the hospital's electronic medical records and physical records were collected for all patients managed operatively for tibial plateau fracture between January 2011 and December 2019.

A total of 195 cases were managed for tibial plateau fracture in the 10 year period. Out of them, 74 cases (nine were conservatively managed with a long leg cast, six cases were compound tibial plateau fractures, two cases were associated with vascular injuries, and 57 cases could not be traced) were excluded from the study. One hundred twenty one patients out of 195 (62.1%) were finally included for the study.

All patients were contacted by phone and informed about the study and were invited to participate. An interview based questionnaire was filled out for those patients who were not able to come to the hospital. This study was approved by the institutional review committee (IRC) on August 1st 2021 with IRC number 69/2021.

Data Collection

Chart reviews from operation theater records and ward records were used for data collection. Baseline characteristics including age, sex, date of injury, date of surgery, mode of injury, energy of trauma, diagnosis, associated injuries and interventions, and complications were recorded from a retrospective review of medical charts. Functional evaluation was done using a Nepali validated Western Ontario and McMaster Universities Arthritis Index (WOMAC) score and the health related quality of life was evaluated using the World Health Organization Quality of Life-8 (WHOQoL-8) questionnaire.^{16,17}

Knee function

WOMAC is a standardized patient-reported questionnaire developed to evaluate knee problems. It has been translated and culturally adapted for use among the Nepali population.¹⁶ Three subscales are included in the questionnaire: pain, stiffness, and activities of daily living (ADL). It has 24 individual components scored from zero (best) to four (worst), with a potential sum score of 0 to 96. The higher the score, the greater the amount of pain, stiffness, and a high level of functional limitations.

Quality of life

The WHOQoL-8 is a short version of the quality of life instrument developed by the WHOQoL group.¹⁸ The scale has been translated and culturally adapted for use among the Nepali population.¹⁷ It has acceptable internal consistency (Cronbach's alpha 0.74).^{17,19} (QoL WHOQoL-8 provides a comprehensive assessment of overall subjective well-being (QoL). Each item of the WHOQoL-8 is rated on a five-point scale, scored from one (worst) to five (best); the sum score has a potential range of 5 - 40. Higher scores indicate a better quality

of life.

Data analysis

Statistical Package for Social Science (SPSS) version 23.0 was used to analyze data. Continuous variables were reported as mean \pm SD or median (25th and 75th inter quartile ranges) and categorical variables as number and percentages. The data was tested for normality by the Shapiro-Wilk test. An independent-samples t test was used to compare mean values between two different energy trauma groups, where sample distribution was normal, and an appropriate non-parametric test was used for comparison of variables between the two groups where sample distribution was skewed. The Mann Whitney U test was used to calculate a difference in WHOQoL-8 and WOMAC scores between the two groups. A p value of < 0.05 was considered statistically significant.

RESULTS

Among 121 patients (male: female = 2.3:1) the mean age of the patients was 37.1 (range 16-76) years. The most common mode of injury was road traffic accidents (44.6 %, n=54), followed by fall from height (27.3%, n=33) (Table 1). The study cohort contained Schatzker type IV (30.6%) as the most common fracture type followed by type V (23.1%) (Table 1). Cannulated screw only fixation (30.57%, n=37) was the most common surgical intervention, followed by lateral column plate fixation (20.56%, n=25) and bi-columnar plate fixation (17.35%, n=21) (Table 1).

Table 1. Baseline Characteristic of 121 patients.		
		Total Cases (n,%)
Mean age		37.06 ±13.8
Sex	Male	84 (69.42%)
	Female	37 (30.57%)
Energy of Trauma	High	66 (54.54%)
	Low	55 (45.45%)
Mechanism of injury	Fall from height	33 (27.3%)
	Fall on level ground	25 (20.7%)
	Road traffic accident	54 (44.6 %)
	Twisting injury	5 (4.1%)
	Slipped from stairs	2 (1.7%)
	Hit by bull	2 (1.7%)
Fracture type (Schatzker Classification)	I	12 (9.9%)
	II	26 (21.5%)
	III	9 (7.4%)
	IV	37 (30.6%)
	V	28 (23.1%)
	VI	9 (7.4%)
Method of fixation	Cannulated Cancellous Screw (CCS) fixation	37 (30.57%)
	Medial column plate fixation	14 (11.57%)
	Lateral column plate fixation	25 (20.66%)
	Both column plate fixation	21 (17.35%)
	Lateral column plate and medial ccs	8 (6.61%)
	Medial column plate and lateral ccs	8 (6.61%)
	Posterior and medial plate fixation	2 (1.65%)
	Arthroscopic assisted fixation	5 (4.13%)
	Hybrid Illizarov	1 (0.82%)

There were 66 patients (54.54%) with high energy trauma and 55 patients (45.45%) with low energy trauma. The average WOMAC score in high energy trauma patients was 17.07 ± 12.29 and the score in low energy trauma patients was 8.21 ± 10 ($p=0.00$). The average WHOQoL-8 in high energy trauma patients was 29.28 ± 3.59 and the score in low energy trauma patients was 31.38 ± 4.38 ($p=0.003$) (Table 2).

WOMAC score		13.05±12.1
Subdivision of WOMAC	Pain	3.91±4.15
	Stiffness	0.5±0.73
	Activities of daily living	8.63±8.11
WHOQoL-8		30.24±4.1

		High Energy	Low Energy	P value
Number of patients		66	55	
Sex	Female	16	21	
	Male	50	34	
Mean age		36.68±11.86	37.52±16.03	0.73 (t test)
Fracture type (Schatzker Classification)	I	2	10	
	II	16	10	
	III	5	4	
	IV	12	25	
	V	23	5	
	VI	8	1	
WOMAC functional outcome	WOMAC	17.07±12.29	8.21±10	0.000 (Mann Whitney U test)
	Pain	5.34±4.41	2.18±3.05	0.000 (“)
	Stiffness	0.68±0.78	0.29±0.59	0.000 (“)
	ADL	11.04±8.28	5.74±6.92	0.000 (“)
WHOQoL-8		29.28±3.59	31.38±4.38	0.003 (Mann Whitney U test)
Average follow-up period		5.76±1.84 years	6.26±2.69 years	

The average WOMAC score in the total population was 13.05 ± 12.1 and the average WHOQoL-8 score was 30.24 ± 4.1 (Table 3).

Tibial plateau fractures were commonly associated with proximal fibula fracture ($n=5$, 4.1%),

followed by distal 3rd fibula fracture (n=4, 3.3%) and femoral condyle fracture (n=3, 2.4%). Two patients had compartment syndrome at the time of presentation. One patient each had dislocation of hip, ankle and subtalar joint (Figure 1).

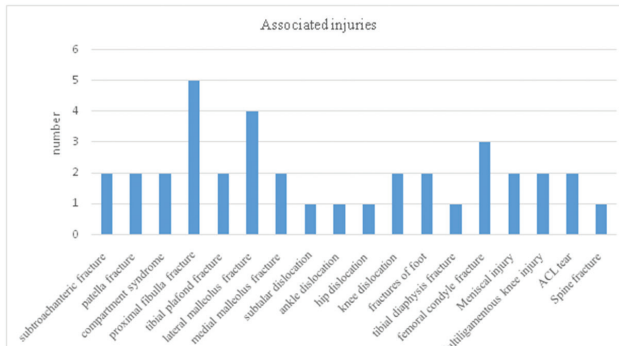


Figure 1. Associated injuries and fracture with tibial plateau fractures.

were managed by random flap surgery. There were four screw displacements out of which one was due to infection and three required screw readjustment surgery at immediate post-operative period. One patient had developed DVT and one developed varus deformity at four months after operation who was addressed with deformity correction surgery (Figure 2).

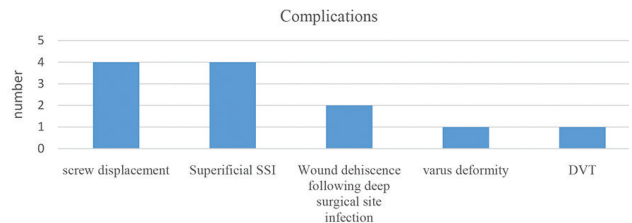


Figure 2. Complications encountered in our study.

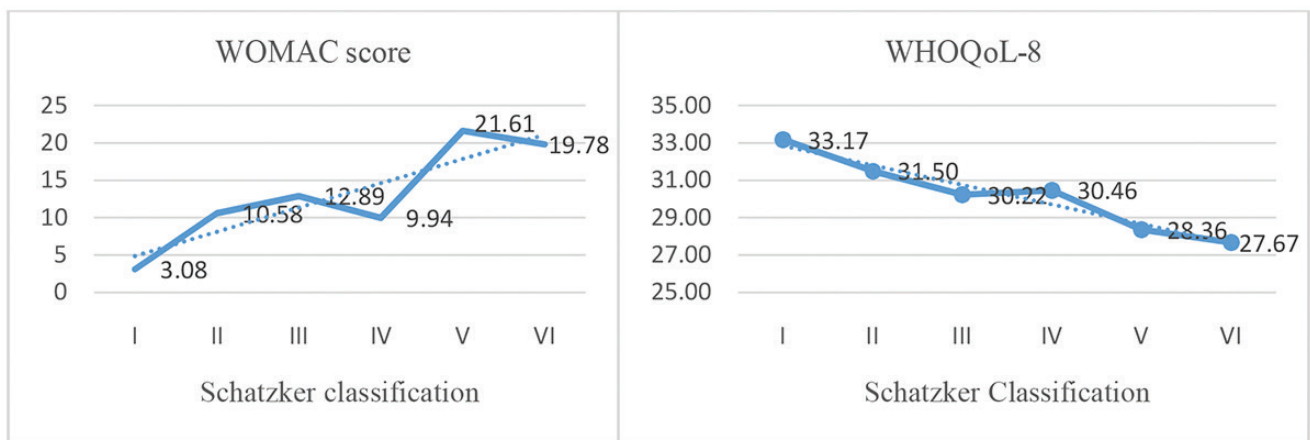


Figure 3. Trend line of average WOMAC score and average WHOQoL-8 score and type of tibial plateau fracture.

We had six (4.9%) surgical site infections, out of which, four were superficial surgical site infections and two were deep infections leading to wound dehiscence. The cases with wound dehiscence

There was an increase in WOMAC score and decrease in the WHOQoL score with an increase in the grade of tibial plateau fracture as shown in the trend line except for the type IV tibial

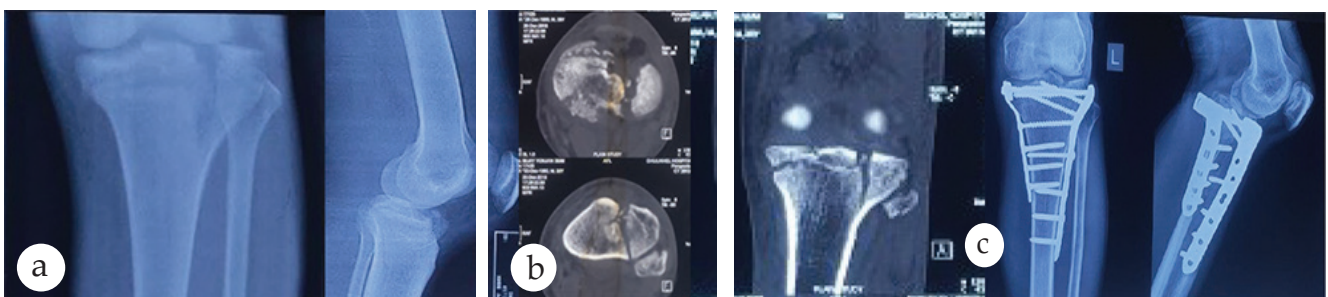


Figure 4. (a) X-ray, (b) CT scan showing type V tibial plateau fracture in a 35 years male following fall from height (c) 4 year post-operative X-ray.

plateau fracture (Figure 3).



Figure 4(d). Functional outcome of patient at 4 years post-operative period.

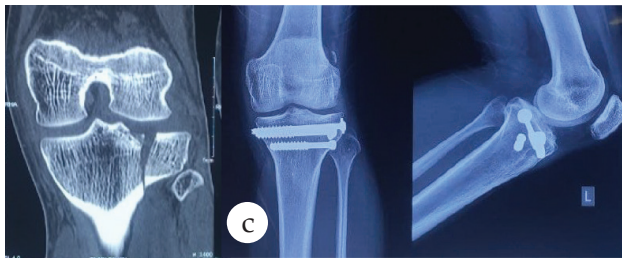
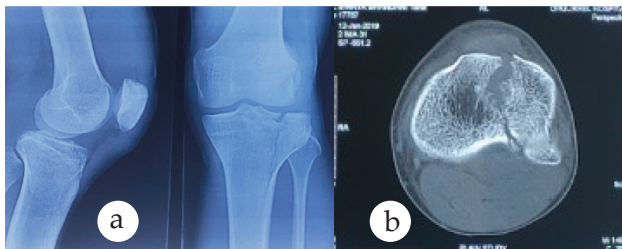


Figure 5 (a) X-ray (b) CT scan showing type I tibial plateau fracture in a 25 years male following fall on level ground (c) 3 year post-operative X-ray (d) Functional outcome of patient at 3 years post-operative period.

DISCUSSION

Our study showed that surgical fixation of tibial plateau fracture had a good functional outcome

and good quality of life in long term follow-up of a 5.9 year period. With respect to the energy of trauma, the greater the velocity of trauma, the greater the incidence of more complex tibial plateau fracture and decreased functional outcome leading to decrease in quality of life.

Males have a higher incidence of tibial plateau fracture, implying that they are more active in the outdoor activities with vehicles (two wheeler, four-wheeler) being more commonly used by this cohort, making them more prone to road traffic accidents and have such injuries.

In our study, the average age of the patients was 37.1 years. The average age of the patients reported in similar studies was 46 years and 50 years.^{7,20} Ninety-three patients (76.85%) in our study were between 25 years to 65 years and only seven patients (5.7%) were above 65 years of age which could have contributed to have average age in our study to be relatively younger than the other similar studies.^{7,20}

Road traffic accidents (44.6%) were the most common mode of injury, followed by fall from height (27.3%). This can be explained by the fact that most of our study (76.85%) cohort were in 25 years to 65 years age group. This age group is the most active, as they have to work outside for the family and hence, making them more prone to accidents. The second most common mode of injury was fall from a height. Most of our patients were from hilly regions where they have high chances of falling from trees, cliffs and difficult roads around the region. Besides, during the earthquake of 2015 in Nepal, we managed numerous cases of people suffering from tibial plateau fractures as a result of fall from a great height.

The average WOMAC score in our study was 13.05 which is higher than in the study by Hap et al.²⁰ There was an increase in the WOMAC score and a decrease in the WHOQL-8 score

with the increase in grade of the fracture except for the Schatzker type IV fracture (Figure 3). This can be explained by the fact that in our study the most common type of fracture was type IV (n = 37) and 51.35% of them were managed by CCS fixation method, and 67.6% of the type IV fractures were due to low energy trauma. This suggests that the lesser the need of complexity of surgery, the better the functional outcome and the quality of life.

The average WOMAC score and its subdivisions (pain, stiffness, and activities of daily living) showed a good prognosis in the functional outcome of the patients at the final follow up. All the three categories of WOMAC score significantly increased with the increase in the energy of trauma. High energy trauma increases the severity of fracture, leading to more extensive surgical intervention. Hence, in patients sustaining higher energy trauma, residual pain, stiffness, and difficulty in activities of daily living are seen despite fracture healing.

Our study results show that patients with low energy tibial plateau fractures had better functional outcomes than patients with high energy tibial plateau fractures when calculating the WOMAC functional score and WHOQoL score. This result coincides with the study by Hap et al.²⁰ which showed the increasing severity of tibial plateau fractures is related to the decrease in functional outcome. A similar result is shown

by Barei et al.²¹

Post-traumatic arthritis around the knee joint usually develops around six to eight years after injury, with few changes seen thereafter.¹⁴ Tim et al. have considered five years as a minimum follow up period to observe continuous functional posttraumatic improvement and delayed degenerative osteoarthritis.¹ The average follow up duration in our study was 5.98 years, ranging from 2 - 11 years. The majority of our cases (71%) had a follow up of more than five years, suggesting a long term follow up.

There are certain limitations to this study. Fifty-five patients couldn't be included in the study as we could not make telephone contact with them or trace them by any means. Declaring some of the patients' WOMAC score and WHOQoL-8 score by telephonic conversation might have some data collection bias. Quality of life has not been compared with a similar age group and in each subject before and after the surgical intervention.

CONCLUSIONS

Surgical reduction and stable internal fixation of tibial plateau fractures in our study have good functional outcomes and quality of life in long term follow up. High energy trauma and an increase in the Schatzker type of tibial plateau fracture are associated with poor functional outcome and quality of life.

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