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Original Research Article

FUNCTIONAL OUTCOME OF FIXATION OF TIBIA SCHATZKER TYPE II AND TYPE III FRACTURES UNDER ARTHROSCOPIC GUIDANCE

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Abstract: *The tibial plateau fracture is a common type of orthopaedic fracture. An alternative to open reduction and internal fixation (ORIF) is arthroscopic-assisted reduction and internal fixation, which provides direct visualisation of the articular surface of the plateau, evaluation of the reduction of the articular surface, and management of any intra-articular pathology that may be associated with the reduction of the articular surface. This study aimed to determine the functional outcome of patients who received tibial fixation under arthroscopic supervision for Schatzker's Type II and III tibial fractures. The research was conducted over six months in the Orthopaedic Surgical Department at Jinnah Hospital in Lahore from November 17, 2022, to May 17, 2023. Sixty patients met the inclusion criteria were recruited after obtaining written informed permission. A clinical and historical examination of each patient's knees was conducted, followed by arthroscopy-guided internal reduction and repair of the tibial fracture under general anaesthesia. All patients received a post-operative rehabilitation regimen. At the three-month follow-up, standing AP radiographs were taken to examine the general alignment of the limbs, and Rasmussen score results were recorded. The average age of the patients was 46 years, and 63.3% were men and 36.7% were women. Schatzker grades II and III tibial plateau fractures were present in 53.3% and 46.7% of the patients, respectively. The mean Rasmussen clinical score was 27.33, indicating that 50 out of 60 patients had excellent recovery, nine out of 60 patients had good recovery, and one out of 60 patients had fair recovery. The mean Rasmussen radiological score was 7.36, indicating that 48 out of 60 patients had outstanding recovery, 11 out of 60 patients had good recovery, and one out of 60 patients had fair recovery. In conclusion, arthroscopic-assisted reduction and internal fixation is a good technique for treating young patients with Schatzker grades II-III tibial plateau fractures, and it enables control of co-existing injuries of intra-articular soft tissues, leading to faster recovery and greater patient satisfaction. However, having expertise in trauma and arthroscopic methods is important to carry out the procedure correctly.*

Keywords: Tibial Fracture, Rasmussen Score, Arthroscopic Guidance

Introduction

Even though tibial plateau fractures are relatively infrequent, accounting for around one percent of all fractures, they can cause significant impairments in joint function if not treated effectively. Tibial plateau fractures are classified into six different categories according to Schatzker's classification, which is the most frequent classification of tibial fractures. These groups are determined by the injured compartment and the articular depression. In the case of such fractures, immediate surgical intervention is essential to provide joint stability and mobility, appropriate alignment of the limb, and minimal dysfunction of the joint and arthritic concerns over the long term (Le Baron et al., 2019; Wang et al., 2018).

The level of damage to the soft tissue and the patterns of fracture are the primary factors that decide the suitable strategy needed, such as the type and quantity of implants used and the postoperative protocols for the mobilization procedure. According to Schatzker's categorization system, low-energy injuries in the lateral tibial plateau are classified as type I through type III fractures. Open reduction internal fixation (ORIF) is the treatment of choice for displaced tibia plateau fractures, and this is the case even in Schatzker's type I to III fractures. As a result of the significant dissection of soft tissue that occurs during ORIF, it is impossible to exclude the occurrence of complications such as infections, the formation of hematomas, surgical wound dehiscence, and surgical wound edge necrosis (Dhillon et al., 2021; Safy, 2022; Verona et al., 2019).

More and more, patients with type II and III fractures are opting for arthroscopy-assisted reduction and internal fixation (ARIF). By eliminating the need for a capsulotomy or arthrotomy and using a tiny skin incision, arthroscopic reduction and internal fixation (ARIF) have become the standard method for treating articular abnormalities and associated meniscal or ligamentous disorders (Chase et al., 2019; Leigheb et al., 2020). In their evaluation of the clinical results of ARIF vs. ORIF, Le Baron et al. found that 84% of patients in the ARIF group achieved adequate reduction quality, compared to 80% in the ORIF group, and that the mean Hospital for Special Surgery (HSS) score was 74 in the ARIF group compared to 70 in the ORIF group ($p<0.01$) (Le Baron et al., 2019).

Radical Rasmussen scores were 8.42 in the ARIF group compared to ORIF, while clinical Rasmussen scores were 92.37 vs. 86.29 and 7.33 in the ARIF group compared to ORIF, respectively ($p=0.104$), according to Verona et al. (Verona et al., 2019). When looking at patients who had ARIF, Leighab et al. found that the average Rasmussen Clinical score was 27.2 (14 out of 18 patients had a remarkable recovery, 3 out of 18 had a good recovery, and

1 had fair recovery), and the average Rasmussen Radiological score was 9.1 (15 out of 3 had good recovery) (Leigheb et al., 2020).

Arthroscopic aided stabilization of tibial fractures has been the subject of many investigations conducted on a global scale. However, there is a lack of data from the area. Thus, this research sought to investigate the functional result after arthroscopic tibial stabilization in patients with Type II and III Schatzker's tibial fractures as measured by the mean Rasmussen score. This research will help plan surgical procedures for patients with Schatzker's II-III tibial plateau fractures, linked to more excellent functional recovery, fewer morbidity, and higher patient satisfaction.

Methodology

From November 17, 2022, until May 17, 2023, researchers at Jinnah Hospital Lahore's Orthopaedic Surgical Department monitored patients for six months. After obtaining written informed permission, sixty patients who met the inclusion criteria were recruited for the research. A sample size of 60 patients was calculated, keeping a 95% confidence level and 6% absolute precision and taking the expected mean Rasmussen radiological score of tibial fracture under arthroscopic guidance as 8.42±2.24 (Verona et al., 2019).

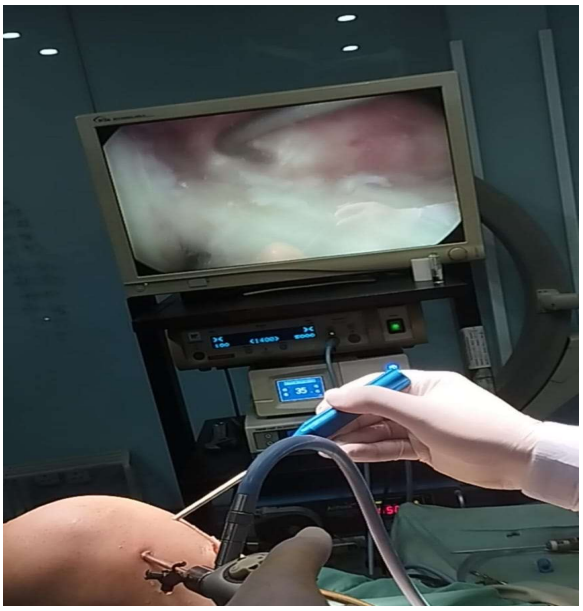

Fig 01 Scope positioning and reduction of fracture

In this investigation, we included male and female patients aged 20–40 who met the following criteria: a Schatzker's type 2 or 3 fracture according to the operational definition; presentation within two weeks after trauma; articular depression more than 5 mm; and a varus or valgus of the knee greater than 10 degrees. Exclusion criteria for this research were individuals with pathological fractures, concomitant knee dislocations, poly-trauma, smoking, comorbid illnesses (such as metabolic disorders, smoking, drug misuse, or ischemic heart disease), and open fractures. All patients had a thorough evaluation of their knees, including taking their medical history. To determine whether the tibial fracture was of Schatzker's type II or III, we took anterior-posterior and lateral digital X-rays of the injured knee. Then, we ran a 3D computed tomography (CT) scan of the joint. Before surgical surgery, we ensured that all individuals were anesthetized. Patients had their tibial fractures treated with arthroscopically guided internal reduction and fixation after being given general anesthesia. All of the patients were provided with the same post-operative rehabilitation regimen.

Prompt passive knee mobility was initiated on the first post-operative day, with flexion up to 90 degrees. Seven days after surgery, all groups could engage in active knee mobility, which progressively improved during the first eight weeks. After four weeks of non-weight bearing with crutches and eight weeks of full weight bearing, the patient was cleared to return to normal activities based on radiological healing of the fracture and pain improvement. We took new lateral and anteroposterior (AP) radiographs on the first day after surgery, as well as after one month and three months.

Standing AP radiographs were taken during the most recent follow-up appointment three months ago to assess the patient's total limb alignment. The results were recorded using the Rasmussen score. When X-rays of the knees (both anterior and posterior) reveal a cleavage and compression fracture of the lateral tibial plateau, we know that the patient has a Schatzker's type II fracture. The articular surface of the tibial plateau is compressed and forced into the lateral tibial metaphysis by axial forces, as proven on X-ray (anteroposterior and lateral) of the knees, in a pure compression fracture of the lateral tibial plateau, which is known as a Schatzker's type III fracture. We evaluated the functional outcome at three months using the mean Rasmussen clinical and radiological score.

A version of SPSS 25.0 was used for data analysis. Age, Rasmussen clinical ratings, and radiological results are all examples of quantitative data presented as means and standard deviations. Gender, fracture type, and result grading were some qualitative factors shown as percentages and frequencies. Fracture type, age, and gender were the dividing lines in the data set. For the mean score and outcome grading, we used a post-stratification t-test and a Chi-square test; a p-value of 0.05 was deemed significant.

Results

A total of 60 patients fulfilling inclusion and exclusion criteria were selected to determine the functional outcome in patients with type II and III Schatzker's tibial fractures who had tibial fixation under arthroscopic guidance. The mean age was calculated as 35.46± 4.01 years. Age distribution of the patients was done, and it showed that out of 60 patients, 9(15.0%) were in the age group of 20-30 years, and 51(85.0%) were in the age group of 31-40 years.Gender distribution of the patients was done, it showed that 38(63.3%) were males and 22(36.7%) were females. Distribution of the type of fracture was done, and it showed that 32(53.3%) had type II fracture and 28(46.7%) had type III fracture (Table 1). The mean Rasmussen clinical score was 27.33±1.69. The mean Rasmussen radiological score was 17.36±1.48.

Table 2 presents the frequency distribution of the grading of Rasmussen clinical and radiological scores in a study population. The Rasmussen clinical score is categorized into four grades: Excellent, Good, Fair, and Poor, while the Rasmussen radiological score follows the same grading

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system. The data indicates that among the 60 participants, 50 (83.3%) achieved an Excellent clinical score, 9 (15.0%) received a Good score, and 1 (1.7%) was rated as Fair. Importantly, no participants were classified as Poor. The distribution of Rasmussen radiological scores shows a similar trend, with 48 (80.0%) participants achieving an excellent score, 11 (18.3%) receiving a Good score, and 1 (1.7%) rated as Fair. (Table 2)

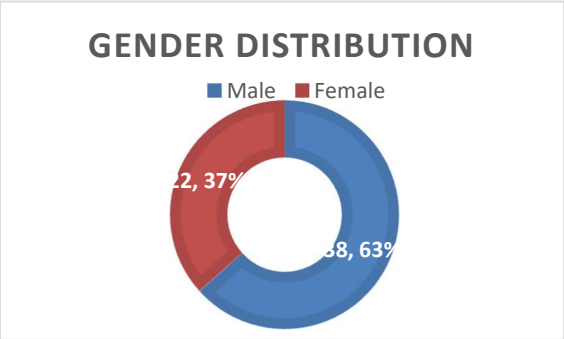

Fig 2: Distribution of gender in the study population

Table 3 further stratifies the grading of Rasmussen clinical scores based on different variables: age group, gender, and fracture type. Participants aged 20-30 years had 9 (100.0%) Excellent scores for the age group variable. In the 31-40 age group, 41 (80.4%) participants received an Excellent score, 9 (17.6%) were rated as Good, and 1 (2.0%) was Fair. The gender-wise distribution shows that among males, 33 (86.8%) achieved an Excellent score, 5 (13.2%) received a Good score, and none were rated as Fair. Females had 17 (77.3%) with an Excellent score, 4 (18.2%) with a Good score, and 1 (4.5%) with a Fair score. Lastly, regarding the type of fracture, participants with Type II fractures had 28 (87.5%) Excellent scores, 4 (12.5%) Good scores, and none with a Fair score. Those with Type III fractures had 22 (78.6%) Excellent scores, 5 (17.9%) Good scores, and 1 (3.6%) Fair score. The p-values indicate the statistical significance of the distribution across subgroups for age group, gender, and fracture type.

Fig 3 Pre-op X-ray

Table 1: Demographics of the study population

Age groups	Frequency	Percent
20-30 years	9	15.0
31-40 years	51	85.0
Total	60	100.0
Gender		
Male	38	63.3
Female	22	36.7
Total	60	100.0
Type of fracture		
Type-II	32	53.3
Type-III	28	46.7
Total	60	100.0

Table 2: Frequency distribution of grading of Rasmussen clinical and radiological score

Grading of Rasmussen clinical score	Frequency	Percent
Excellent	50	83.3
Good	9	15.0
Fair	1	1.7
Poor	0	0.0
Total	60	100.0
Grading of Rasmussen radiological score		
Excellent	48	80.0
Good	11	18.3
Fair	1	1.7
Poor	0	0.0
Total	60	100.0

Table-3: Stratification for grading of Rasmussen clinical score concerning age group, gender, and type of fracture

Variables	Sub-groups	Grading of Rasmussen clinical score			Total	p-value
		Excellent	Good	Fair		
Age group	20-30 years	9	0	0	9	0.347
		100.0%	0.0%	0.0%	100.0%	
	31-40 years	41	9	1	51	
		80.4%	17.6%	2.0%	100.0%	
	Total	50	9	1	60	
		83.3%	15.0%	1.7%	100.0%	
Gender	Male	33	5	0	38	0.415
		86.8%	13.2%	0.0%	100.0%	
	Female	17	4	1	22	
		77.3%	18.2%	4.5%	100.0%	
	Total	50	9	1	60	
		83.3%	15.0%	1.7%	100.0%	
Type of fracture	Type II	28	4	0	32	0.456
		87.5%	12.5%	0.0%	100.0%	
	Type III	22	5	1	28	
		78.6%	17.9%	3.6%	100.0%	

Fig 4 (a

Fig (b

Postoperative X-ray

Discussion

Tibial plateau fractures that are displaced or unstable are caused by high-energy trauma and need prompt and suitable surgical procedures to attain stable and mobile joints with satisfactory limb alignment and minimum long-term sequelae of joint dysfunction and arthritis. The selection and quantity of implants and the post-operative mobilization regimens are contingent upon the nature of the soft tissue injuries and the patterns of the fractures. The Schatzker classification has traditionally been the predominant method to standardize the therapeutic approach. However, more recent classifications based on computed tomography (CT) have also been documented (Kumar et al., 2019; Trikha et al., 2019; Zhu et al., 2012)

The surgical techniques used for treating fractures range from closed reduction with percutaneous screw fixation to open reduction and internal fixation (ORIF) with anatomical

plates. Treatment choice depends on the fracture fragments' position and typically requires one or more approaches. However, it is essential to note that these procedures might cause damage to the soft tissues (Singh et al., 2009).

Anatomical reduction necessitates visualizing the articular surface, which typically requires extensive dissection into the damaged soft tissue. Arthroscopy is an alternative technique used to view the articular border. It has been shown that arthroscopy and arthroscopy-assisted techniques may be used for certain fractures of the tibial plateau. The most often documented fractures for these aided operations are categories I-III (Chen et al., 2015; Dhillon et al., 2020). Arthroscopy allows the surgeon to see the articular border directly using a less intrusive technique. There have been claims of superior results, quicker recovery, and fewer problems with this procedure than traditional open surgery. Furthermore, arthroscopy allows the surgeon to address concurrent soft tissue damage to the ligaments and menisci (Fowble et al., 1993; Verona et al., 2019). In the current study, we determined the functional outcome in patients with Schatzker's type II and III tibial fractures with tibial fixation under arthroscopic guidance.

In this study, the mean age was calculated as 35.46± 4.01 years. Age distribution of the patients was done, and it showed that out of 60 patients, 9(15.0%) were in the age group of 20-30 years, and 51(85.0%) were in the age group of 31-40 years. Gender distribution of the patients was done, it showed that 38(63.3%) were males and 22(36.7%) were females. Distribution of the fracture type was done; it showed that 32(53.3%) had type II and 28(46.7%) had type III fracture. The mean Rasmussen clinical score was 27.33. The mean Rasmussen radiological score was 17.36.

Regarding gender disparity, Chen et al. discovered that these fractures are more prevalent among men, as shown by 7 out of 12 studies with a male majority of over 50%. The current series consisted of 63.3% males. At the same time, Malla et al. documented a ratio of 5:2. The higher representation of men in this context may likely be attributed to the traditional gender roles in Pakistan, where females often assume the role of homemakers. In contrast, males are more likely to engage in work-related travel and thus experience a higher incidence of roadside accidents (Chen et al., 2015; Dhillon et al., 2021; Kumar et al., 2020). ARIF is often recommended for Schatzker's kinds I to III, while several studies have also included types IV and V, with varying results. Duan et al. performed surgical procedures on 39 patients classified as categories I to V. Out of them, 36 patients had good outcomes, with 90% reporting no discomfort when walking. Approximately 77% of individuals had a full recovery, exhibiting no limitations in their range of motion and no development of osteoarthritis. Nevertheless, in a research conducted by Chan et al., which only focused on kinds IV and V fractures, it was shown that 16.7% of the participants developed osteoarthritis. Additionally, only 22% of the patients had good clinical Rasmussen ratings (Chan et al., 2003; Duan et al., 2008).

Regarding the overall results, our research found that the average Rasmussen clinical score was 27.33 out of 30, which is considered outstanding. This score is comparable to the findings of Zawam et al. (26 out of 30) in a prior series. Their research observed superior outcomes in 19 out of 25 patients and good outcomes in the other six patients. In contrast, our study found that 14 out of 15 patients had exceptional scores, with just one type II fracture scoring in the excellent range (Zawam and Gad, 2019).

Shankar et al. documented the case of a 41-year-old woman with a type III central depressed lateral plateau fracture, which was treated with ARIF. An aimer was used to guide the procedure, while serial dilators were employed to push the cancellous bone of the tunnel toward the depressed fragment. This action raised the fragment, which was then secured using a 6.5 mm PTCS. The patient exhibited complete mobility at the 6-month and resumed her normal daily activities with evidence of bone union on radiographic images (Dhillon et al., 2021). The outcomes of previous trials have consistently shown excellent or good results in over 80% of patients, confirming that ARIF is a well-established tool for trauma surgeons (Chen et al., 2015).

Complications were not included in our analysis. Zawam et al. only reported one superficial infection and another articular depression during early weight bearing. Wang et al. conducted a review where they found that peri-operative problems occurred in 1 out of 239 cases across seven trials. In their study, Malla et colleagues. They documented a total of 7 problems among their cohort of 28 patients. These complications included 3 cases of infection, 2 cases of wound dehiscence, and 2 cases of malunion (Dhillon et al., 2021; Wang et al., 2018; Zawam and Gad, 2019).

Consequently, when considering the potential difficulties, ARIF proves to be a secure and efficient treatment for treating these fractures. The research provides variable reports on whether the beneficial outcomes and low problems of ARIF have an overall influence on its functional superiority compared to ORIF. Verona et al. conducted a comparison research between ARIF and ORIF. While both techniques yielded promising results, the former had superior clinical outcomes, as shown by higher scores on the Knee Society score and Rasmussen radiological score after one year (Verona et al., 2019).

Nevertheless, Wang et al.'s evaluation concluded that there was no significant benefit in functional outcomes between ARIF and ORIF, mostly due to the limited quality of evidence provided by the studies included. Nevertheless, the ORIF group exhibited a notable increase in problems, with 13 reported cases out of 238 patients, which was much worse than the ARIF patients (Wang et al., 2018). The current study has documented exceptional results in the patients involved. Nevertheless, the limitations of this study include a smaller patient sample size and a shorter duration of follow-up. Furthermore, further data in the form of high-quality randomized trials is required to assess the superiority of the approach compared to ORIF.

Conclusion

Our study, focusing only on Schatzker's types II-III tibial plateau fractures, has shown that ARIF (Arthroscopic Reduction and Internal Fixation) is a very effective technique for young patients. Furthermore, it offers the added benefit of addressing any accompanying injuries to the intra-articular soft tissues. It enables rapid recovery and enhances patient contentment. Proficiency in both trauma and arthroscopic methods is necessary for optimal performance.

Declarations

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Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
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Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MUHAMMAD TAHIR KARIM (Medical officer)
Coordination of collaborative efforts.
JAVED HASSAN (Associate professor)
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript
MUHAMMAD SAJID (Senior Registrar)
Manuscript revisions, critical input.
Coordination of collaborative efforts.
Data acquisition, analysis.
Data entry and Data analysis, drafting article

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