

The Prevalence of Soft Tissue Injuries in Operative Schatzker Type IV Tibial Plateau Fractures, Our Hospital Results

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ABSTRACT

Objectives: The aim of this study was to investigate the prevalence of soft tissue injuries in patients with surgically treated Schatzker type IV tibial plateau fractures.

Methodology: The data of adult patients that got surgical treatment of tibial plateau fracture from July 2019 to July 2021 reviewed from the medical records of orthopedic department of Liaquat University Hospital Hyderabad Pakistan. Orthopedic Trauma Association (OTA) classification was used to classify all the fracture types. According to Wahlquist classification, twenty six patients were classified with Schatzker type IV tibial plateau fractures. Soft tissue injuries included: meniscus injuries, anterior and posterior cruciate ligament injuries, medial and lateral collateral injuries. These soft tissue injuries were diagnosed through magnetic resonance imaging (MRI) and surgical operation notes. Fisher's exact test was used to analyze the data.

Results: In Schatzker type IV tibial plateau fracture, 61.5 percent of the patients had lateral meniscus injury and 46.2 percent had medial meniscus injury. The incidence of incomplete posterior cruciate ligament injury was 69.2 percent. 92.3 percent of the patients had sustained injury of anterior cruciate ligament. The prevalence of medial collateral ligament injuries was 29.6 percent and of lateral collateral ligament was 51.9 percent. According to Wahlquist classification, these fractures were classified as: type A, 1 patients; type B, 7 patients; type C, 18 patients. The difference in the location of these injuries and the type of the fracture was not significant.

Conclusion: According to the results of this study, the prevalence of soft tissue injuries in patients with surgically treated Schatzker type IV tibial plateau fractures is high. The most frequently occurring soft tissue injuries include: anterior cruciate ligament injuries, meniscus injuries and lateral collateral ligament injuries.

Key words: Schatzker type IV, Tibial Plateau fractures, Ligament, Soft Tissue Injury

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INTRODUCTION

Schatzker classification is used to classify tibial plateau fractures. It classifies the fractures into six categories [1]. The type IV is not very common, it accounts for almost 10 percent of the total tibial plateau fractures. Mauricio Kfuri and Joseph Schatzker revisited Schatzker classification

and added two subcategories to describe the location of the fracture in relation to being anterior or posterior. This gave us two subcategories of type IV fracture: type IV A, antero-medial and type IV B, postero-medial [2]. Even though this new addition in the classification did help in describing the fracture location more accurately but did not help much in describing the related soft tissue injuries.

To predict and recognize the soft tissue injuries associated with type IV tibial plateau fractures, a new classification system was proposed [3]. This system was based on the

location of line of fracture at sagittal plane of the tibial plateau. This included three types of fractures. Type A fractures the one ones in which fracture line is medial to the intercondylar eminence, type B are the ones in which fracture line is within the intercondylar eminence and type C in which the fracture line is lateral to intercondylar eminence. As the fracture line moved towards the lateral side, the associated soft tissue injuries became severe.

Out of all lower limb fractures, tibial plateau fracture accounts for almost 1 percent [4,5]. The soft tissue injuries that could happen in type IV Schatzker fracture could be predicted by Wahl Quist classification.

The force that causes the bone fracture can also cause the soft tissue damage. These soft tissues include cruciate ligaments, collateral ligaments and meniscus injuries. These injuries can also affect the fracture management and outcomes. Magnetic resonance imaging has been used to diagnose soft tissue injuries in such cases for a long time [6].

Many studies [5,7,8] have reported soft tissue injuries in tibial plateau fractures and that MRI is used as a diagnostic and evaluation tool before the surgical procedure to help the surgeons plan a better management strategy [9].

Despite all these studies, the data on the prevalence of the soft tissue injuries in type IV Schatzker tibial plateau fracture is not enough. The features of ligament and meniscus injuries in the fracture are not known. The aim of this study was to investigate the prevalence of soft tissue injuries in patients with surgically treated Schatzker type IV tibial plateau fractures.

METHOD

The data for this study was collected from July 2019 to July 2021 reviewed from the medical records of orthopaedic department of Liaquat University Hospital Hyderabad Pakistan. Medical records of the patients were used to collect the relevant information. At first a total of 165 patients with tibial plateau fracture were identified from the records. All the patients included in the study had their fracture diagnosed through MRI, CT scan and plain radiography before any surgical procedure. The surgeons first classified the tibial plateau fractures and then preceded the surgical procedure. The diagnosis at the time of discharge was considered the final diagnosis.

All the patients included in the study had MRI examination done. The patients whose MRI was not done were excluded from the study. Finally, 26 patients were included in the study. These patients had Schatzker type IV tibial plateau fractures. All the patients suffered from blunt force trauma. The medical records of all the patients included in the study were reviewed for demographic data, injury details and surgery related data and details.

In this study, Sigma 1.5 or 3.0 T MRI use used. After the scan, the radiologist analysed the MRI report for meniscus or ligament injury. On MRI, abnormal meniscus shows changes in signal intensity. The abnormally high meniscal signal intensity changes are divided into 3 grades 5. Grade 1 and grade 2 are not considered very serious but grade 3 is considered definite or true meniscal tear. Only grade 1 and 2 signals were recorded.

The complete tearing of continuity of ligament fibres was considered complete ligament tear. But the abnormally high signals on T2 due to incomplete tearing of ligament fibres was considered partial tear 10. Avulsion fractures were also included as complete tearing of the ligament. So, the ligament injuries can be divided as partial ligament tears and complete ligament tears. It applies to both the collateral and the cruciate ligaments 11, 12.

SPSS software was used to analyse all the data. Fisher's exact test was used to find the correlation between the fracture and soft tissue injury location. P value of more than 0.05 was considered significant.

RESULTS

Out of 26 patients included in this study, 20 were females and 6 males. 9 of the fractures were of right limb and 17 of left limb. The ages of the patients ranged between 30 to 73 years, the mean age being 53.5. The results showed that according to the Orthopaedic Trauma Association classification, Schatzker type IV fracture distribution was: 41B2.3, one patient; 41B3.3, sixteen patients; 41B1.2, three patients; 41B1.3, four patients and 41B3.2, two patients. The results also showed that one patient had type A fracture, seven had type B fracture and eighteen had type C fracture according to Wahl Quist classification. All the fractures had associated soft tissue injury. Nine patients had dislocation of knee bones too. All the patients with dislocation had type C Wahl Quist fracture. All of these results are shown in Table 1. No patient was diagnosed with any kind of nerve or arterial damage.

Table 1: Patient's demographic data and soft tissue injuries.

Patient no.	Sex	Age	Side	Wahl Quist classification	AO/OTA classification	Dislocation	Meniscus injury	Ligament injury
I.	Female	37	Left	C	B3.3	Yes	Both	ACL, PCL, LCL
II.	Female	53	Right	A	B1.3	No	LM	ACL, MCL
III.	Female	63	Left	C	B3.3	No	No	ACL, PCL, LCL
IV.	Female	73	Left	B	B3.2	No	MM	ACL, PCL

V.	Male	48	Left	C	B3.3	Yes	LM	PCL, LCL
VI.	Female	70	Left	B	B3.3	No	Both	ACL
VII.	Female	62	Right	C	B3.3	No	MM	ACL, PCL, LCL, MCL
VIII.	Female	60	Left	C	B1.2	No	LM	ACL, MCL
IX.	Female	58	Left	B	B3.3	No	No	ACL, PCL, LCL
X.	Female	44	Left	C	B1.3	Yes	MM	ACL, PCL,
XI.	Female	48	Left	B	B3.3	No	LM	ACL, PCL, LCL
XII.	Male	37	Right	C	B2.3	No	Both	ACL, MCL
XIII.	Male	68	Left	B	B3.3	No	Both	ACL, PCL, LCL
XIV.	Female	39	Left	C	B1.2	No	LM	ACL, PCL, LCL
XV.	Male	50	Right	C	B3.3	Yes	No	ACL, PCL, LCL
XVI.	Female	56	Left	C	B3.3	Yes	Both	ACL, MCL
XVII.	Male	66	Right	C	B3.3	Yes	MM	ACL, PCL, LCL
XVIII.	Female	58	Right	C	B1.3	No	LM	ACL, MCL
XIX.	Female	57	Right	B	B3.3	No	No	ACL, PCL, LCL
XX.	Female	54	Left	C	B3.2	No	LM	ACL, PCL
XXI.	Female	50	Left	C	B3.3	Yes	Both	ACL, PCL, LCL
XXII.	Female	53	Right	C	B1.2	No	LM	ACL, PCL
XXIII.	Female	31	Left	B	B3.3	No	Both	ACL, PCL, LCL
XXIV.	Male	48	Left	C	B1.3	No	MM	ACL, MCL
XXV.	Female	43	Right	C	B3.3	Yes	LM	ACL, PCL, LCL
XXVI.	Female	65	Left	C	B3.3	Yes	No	ACL, MCL

Out of 26, 5 patients did not suffer from meniscus injury. 7 patients had both lateral and medial meniscus tears. 9 patients had lateral meniscus injury and 5 had medial meniscus injury. So, 16 (61.5 percent) patients had lateral meniscal tear and 12 (46.2 percent) had medial meniscal tear.

92.3 percent of the patients (24 patients) had anterior cruciate ligament injury. Out of these 24, 2 had avulsion fractures of anterior cruciate ligament while rest were partial tears. Patients with avulsion fracture were treated with wire fixation.

69.2 percent of the patients (18 patients) had partial injury of the posterior cruciate ligament, these patients recovered without any surgical treatment. 51.9 percent patients (14 patients) had partial lateral collateral ligament injury. Among these, 3 patients had bony avulsion injuries that were fixed with screws. 29.6 percent patients (8 patients) had partial medial collateral ligament tears.

The results in the Table 2 show that there is no significant difference between the type of fracture and the location of associated soft tissue injury.

Table 2: Soft tissue injuries according to Wahlquist classification.

Soft tissue pathology		A (n=1)	B (n=6)	C (n=20)	P	Wahlquist classification (No. fractures)
Meniscus	Lateral	0	3	14	0.325	
	Medial	1	3	8	0.657	
Collateral ligament	Lateral	1	5	11	0.455	
	Medial	0	1	7	0.745	
Cruciate ligament	Anterior	1	6	18	1	
	Posterior	0	4	15	0.388	

DISCUSSION

Schatzker type IV fractures are result of blunt force trauma. This type of fracture is associated with knee dislocation and soft tissue injuries. Some of the studies have reported soft tissue injuries in association with Schatzker type IV fracture. One of this study reported nine patients with this fracture, out of which 4 had anterior cruciate ligament injuries, 3 had meniscus tears and only one patient had lateral collateral ligament tear [7].

One study indicated that tibial plateau fractures due to falling from heights and vehicle accidents (high-energy injuries) had higher prevalence of soft tissue injuries [10]. This study also reported 7 posterior cruciate ligament injuries, 7 anterior cruciate ligament injuries, 5 lateral meniscus injuries and 1 medial meniscus injury in 13 type IV tibial plateau fractures.

Another study found that in 86 percent of the cases these fractures were associated with medial meniscus injuries [11]. Our study also reported 100 percent incidence of soft tissue injuries in Schatzker IV tibial plateau fractures.

Schatzker IV tibial plateau fractures have been further divided in many subtypes by different authors. One author divided it as: unicondylar, condylar, posteromedial and apinocondylar fractures. Another author divided it as type I and type II [12]. One author called Schatzker IV tibial plateau fractures, two-column fracture [13]. In the same way, some authors defined Schatzker IV tibial plateau fractures as medial unicondylar fracture or as condylar variant [14].

But a very few authors have investigated relation between the location of soft tissue injuries and the pattern of Schatzker IV tibial plateau fractures. We use Wahl Quist classification to categorize these fractures as this classification gives us hints about the mechanism of injury that caused this fracture.

The degree of knee flexion and the direction and extent of force when the injury occurred decides the type of Schatzker type IV fracture. Injury at hyperflexed knee can cause split fracture at posteromedial knee [15]. This split fracture of posteromedial knee is Schatzker type IV P fracture [2]. Continuation of force can cause anterior cruciate and lateral collateral ligament injuries. In our study, 1 Wahlquist type A fracture was found with anterior cruciate ligament, lateral collateral ligament and medial meniscus injuries.

Wahl Quist type B and C fractures can occur when force is exerted on lateral side of tibial plateau or on the intercondylar eminence. Usually meniscus injury, lateral collateral ligament, anterior cruciate ligament and posterior cruciate ligament injuries are also present in these type of fractures [16].

One study reported that if the force is high enough to cause posteromedial injury, it can also cause dislocation and damage nerves and arteries [17]. In our study, 34.6 percent (9 patients) of the patients had knee dislocation with type C Wahl Quist fracture. Also no vascular and

nerve damage was reported. These results were same as Purnell's study .

The results of our study showed 92.3 percent prevalence of ACL injuries. Another study supported our results as ACL was the most common injury reported in that study to [7].

The treatment of meniscus injury includes arthrotomy, repair and disimpaction [10, 12]. It is very important to properly treat the meniscus because it plays a very important role in stability of the knee joint [17]. One study reported that among 46 Schatzker type IV fractures, only 15 percent of the cases of meniscus injury required surgical treatment [18]. This study also stated that MRI exaggerated the meniscal injuries as not all meniscal injuries require surgical treatment.

It is still under discussion that whether the fracture related soft tissue injuries need surgical treatment or not. One of the study reported that quick repair of lateral collateral ligament is essential for the proper functioning of the knee [10]. On the other hand, another study reported that collateral ligament injury do not cause residual laxity in case of tibial plateau fracture [19]. In the same way, one study suggested knee brace for the recovery of collateral ligament injuries [20].

Further research is required to understand the prevalence of soft tissue injuries in patients with surgically treated Schatzker type IV tibial plateau fractures as the sample size of this study was small.

CONCLUSION

According to the results of this study, the prevalence of soft tissue injuries in patients with surgically treated Schatzker type IV tibial plateau fractures is high. The most frequently occurring soft tissue injuries include: Anterior cruciate ligament injuries, meniscus injuries and lateral collateral ligament injuries.

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