MAGNETIC RESONANCE IMAGING (MRI) IN EVALUATING SOFT TISSUE INJURIES OF ACUTE TIBIAL PLATEAU FRACTURES

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ABSTRACT
Introduction: Complex fractures of the tibial plateau commonly occur in patients following high-energy trauma, typically accompanied by severe damage to the knee articulation and the surrounding tissues. Methods: This prospective study was undertaken at Department of Orthopaedics, Chettinad hospital and research institute from July 2018 to September 2019. Of the 34 patients, 25 (73%) were male, and 9 (27%) were female. The age of the patients ranged from 18-67 years. The mean age of the patients was 42 years. The study was conducted in the Department of Orthopaedics, Chettinad hospital and research institute, Tamil Nadu. The study population was included of a total 34 cases who were admitted to the Department of Orthopaedics for the diagnosis of fractures of the proximal tibia. Results: There was male dominance in the category with 25 patients (73 %) being male patients. In the classification, there was the majority of Type V, and type VI classification with (26%) and (23%) respectively. Conclusion: MAGNETIC RESONANCE IMAGING (MRI), which can show significant soft tissue injuries in addition to fracture configurations, should become the imaging technique of choice for evaluating tibial plateau fractures due to high energy mechanism.

KEYWORDS: Proximal tibia fractures, AO classification, Schatzker classification, Ligament injuries, MRI, ACL, PCL, PCL and Menisci

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INTRODUCTION

The fractures of tibial plateau are one of the most common intraarticular fractures accounting for 1% of all fractures. These fractures are the result of direct axial compressive or indirect coronal forces. These fractures involve many and varied fracture configurations involving medial, lateral or both plateaus with many degrees of joint depression and displacement. Generally, these fractures fall into two wide classifications, high energy fractures and low-energy fractures. Each fracture has its own unique morphology and management. It is essential to determine the strength of the injury since high-energy fractures are associated with severe soft tissue and neurovascular damage.  

During almost two decades of written experience, Tibia plateau fractures have demonstrated to be intriguing therapeutic difficulties. The tests and tribulations of treating these capricious joint fractures have been documented by thousands of papers, theses and books. After surgical stability, high-energy fractures of the tibial plateau were often correlated with bad clinical outcomes. Pain, loss of movement and instability are among the issues associated with these injuries. Good clinical examination of the knee's soft tissue structures is often hard due to pain, inflammation and bone instability. Damage to menisci and ligaments was observed in several research articles that may lead to the bad results associated with fractures of the tibial plateau. The objective of the treatment of Tibia Plateau Fracture is the precise reconstruction of the articular surfaces maintaining the mechanical axis, a stable fragment fixation allowing early mobilization and restoration of ligamentous stability by repair of all concomitant ligamentous and other soft tissue lesions, which may eventually lead to functional painless and good range of motion in the knee joint. In addition to plain X-rays and CT, MRI has become an increasingly popular imaging technique for surgical planning. However, there is a lack of detailed MRI analysis of soft tissue injuries in acute knee trauma with tibial plateau fractures. Hence this research is intended to highlight the related soft tissue injuries in acute tibial plateau fractures, in particular to determine the occurrence that would explain regular use of MRI in assessing serious knee trauma involving tibial plateau fractures.

MATERIALS AND METHODS

Study design

The study was a prospective study conducted to assess the incidence of soft tissue injuries including ACL, PCL, LCL, MCL and Menisci in acute tibial plateau fractures using MRI.
Study Setting
The study was conducted in Orthopaedics department, Chettinad Hospital and Research Institute, Kancheepuram District, Tamilnadu.

Study duration
The study was conducted from June 2018 to September 2019.

Study population
The Proximal tibia plateau fracture patients who underwent MRI along with plain X-ray and CT scan were included in the study.

Study Tools
The study tools used were

Pretested semi-structured questionnaire—two sections

Section 1: Includes demographic details of the participant—age, sex and occupation.

Section 2: Includes Mode of injury, side of involvement, SCHATZKER type of fracture and AO type of fracture based on radiology, distribution of any major ligament injury which includes ACL, PCL and PLC according to SCHATZKER ’S and AO type of fracture classification, distribution of Meniscal injuries according to SCHATZKER and AO type of fracture classification.

STANDARTIZED OPERATING PROCEDURE IN THE STUDY

Pre-operative assessment of patients:
A detailed history of the patients was taken, and their complete clinical examination was done to check for any other associated injuries. It shows that most of the patients came with the history that they got injured by road traffic accidents. Distal neurovascular status was also assessed to rule out vascular and nerve injuries.

Investigations:
Radiographs for the injured knee were taken in AP and Lateral views, after that fractures were classified based on Schatzker's classification and AO classification. CT and MRI scans were taken for evaluating the fracture configuration and associated soft tissue injuries.

Ethical consideration
Institutional Ethical Committee approval of Chettinad Hospital and Research Institute was obtained before starting the study. The participants were explained that the data collected in this study will be used only for research
purposes. The participants were explained about the freedom of withdrawal from the study at any time without penalty or loss of benefits. The confidentiality of the data collected from the enrolled participants was maintained in all the phases of the study. The participants who required medical or surgical attention were tended and treated.

Statistical analysis

The collected data was checked for completeness before entering into the Microsoft excel spreadsheet. The validation of the data was checked at regular intervals. The entered data was analysed using Statistical Package for Social Sciences (SPSS IBM) 21. The quantitative data was expressed in proportions. Chi square test was applied in which p value <0.05 was taken a significant.

DISCUSSION

Tibial Plateau fractures can greatly hinder the diagnosis of knee soft tissue injuries. Such injuries are often ignored or overlooked in the absence of MRI imaging and may potentially be a major source of pain and dysfunction in the post operative period. Recent studies have reported that high-energy tibial plateau fractures do not necessarily develop severe arthritis, yet there are major problems with pain and reduced movement. Regardless of type, the frequency of ligament and meniscal injuries is high. High-energy trends (41C or Schatzker IV, V, VI) have obviously a much higher incidence of ligament injury. The present study is aimed to determine the incidence of soft tissue injuries including ACL, PCL, LCL, MCL and Menisci in acute tibial plateau fractures using MRI. 34 patients participated in the study after obtaining consent. Gender distribution in the study showed a majority of males 73.5% compared to females who were 26.5 %. Most of the studies by Bowes and Hohl, and Duvelius and Conolly showed a male preponderance. Occupationally proximal tibial fractures in the series among the study participants, majority were (23.5%) employees travelling on 2 wheeler / 4 wheeler followed by farmers (20.5 %) shown that the major preponderance of tibial condyle fracture is seen in people with a high level of activity who indulge themselves in traveling because majority of the morbidity is due to RTA. In the present study the commonest mode of injury is road traffic accidents (74%) other being fall from height (26%). Chaix et al reported 71.6 of their cases were due to R.T.A 16% due to fall from height, 12% due to fall from level surfaces and 1% due to sports injuries. There was not much difference in the laterality of the fracture. The right tibia was affected in 58% and left tibia in 42% of cases.

In the present study, Schatzkar type V and type VI dominated the total fractures making 50% in contrary to other studies.
Orthopedic surgeons have relied on physical examination, x-rays, CT scan and arthroscopy to diagnose ligament and meniscal injuries, and have now widely embraced MRI as playing a critical role in preoperative evaluation. We listed tears of the ligament and avulsions as injuries to the ligament and opted to exclude ligament sprain from the class of ligament injury as they are not operationally treated. Injuries to soft tissue are commonly associated with tibial plateau fracture. Delamarter et al 10 found that 22% of patients with tibial plateau fractures have collateral or cruciate ligaments damage coexisting. Blokker et al 11, found 20 patients (31%) with injuries to menisci, ligaments, and/or extensor system in a series of 64 patients with tibial plateau fractures. Among 94 patients, Schatzker et al 12, reported only eight ligament injuries. It is difficult to detect a ligament injury clinically in an acute tibia plateau fracture. The pain and soft tissue swelling hampers the physical examination. It can be difficult to obtain stress x-rays. With MRI, 23(64.7%) of 34 patients in the present study were found to have tear in at least one major ligament group (ACL, PCL, PLC). The prevalence of ligament tear or avulsion in our study was 65%, which is comparable to previously reported series. Kode et al13, in a study of 22 patients with tibial plateau fractures found 68% had partial or complete ligament tears. A recent study by Gardner et al 14 found 77 percent of complete ligament rupture in 103 patients with proxial tibia fractures. In 41C fractures(AO classification), 53 torn ligaments (80%), compared with 20 in 41B fractures (54%). This was a statistically significant difference. In the present study, there were 17 torn ligaments in 41C fractures (67.64%) compared to 6 in 41B (26.08%) fractures. This difference was statistically significant (the same p < 0.05 of Fisher). The minor differences in the diagnosis of ligament injury are partially due to the wider definition of injury. It suggests that MR Imaging is more accurate than physical examination or CT scan for evaluation of soft tissue injuries. During reduction and fixation, the cruciate and collateral ligaments are often not directly observed and after fixation in particular the knee is not tested for instability; thus, due to its increased sensitivity, MRI is likely to have shown ligamentous injuries that were not deemed clinically significant.

The meniscus is the knee’s stabilizer and detecting meniscal injury is critical. Schatzker et al 15 asserted the menisci should be preserved at all costs, failure to do so could lead to degenerative osteoarthritis. Vangsness et al 16, performed arthroscopy in 33 patients with tibial plateau fractures and 17 patients (52%) had meniscal injuries. Kode et al 13, reported that in 12(55 percent) of 22 patients meniscal injury was observed and Gardner et al 14, stated that 50(49 percent) of 103 patients sustained meniscal injury in MRI study. In the present study series 22(65 percent) of 34 patients sustained meniscal injuries that are higher than the range reported in previous publications. A study conducted by Gardner et al 14, in 103 patients with surgical fractures showed that 50 patients had meniscus tears.
(49%), with 25 medial menisci and 35 lateral menisci injuries. There were 10 patients who tore both menisci. Of the 41B fractures, 49% had meniscal tears, compared with 48% of the 41C fractures. In the present study 22 out of 34 patients had meniscus tears (64.7%), with 13 medial menisci and 12 lateral menisci injuries 3 patients had both menisci torn. Of the 41B fractures, 5(23%) had meniscal tears and 17(77%) of the 41C fractures. The severity of fracture displacement predicts the meniscal injury as opposed to previous studies. Chan et al found that CT scanning improves management plan in tibial plateau fractures relative to flat x -rays. Our results show substantial soft tissue injuries associated with high-energy proximal tibia fractures that would require operating surgeons formulating an operational plan based on MRI with plain radiographs along with CT scanning. In the plain x-rays with the MRI, management plans were modified compared to the plain x-rays alone with CT scan. Such findings suggest that the MRI assessment of tibial plateau fractures has a distinct advantage in terms of both soft tissue injury identification and operational management. As reported in earlier studies soft tissue injuries identified by the MRI help in the evaluation and treatment of high-energy tibial plateau fractures to prognosticate the outcomes and plan definitive treatment before surgery.

**SUMMARY**

Most proximal tibia fractures are associated with soft tissue injuries. This study was conducted to evaluate the incidence of soft tissue injuries in proximal tibia fractures using MRI. The study was a prospective study conducted in the Orthopaedics department, Chettinad Hospital and Research Institute, Kancheepuram District, Tamilnadu. The estimated sample size was 34 and purposive sampling was adopted to achieve the sample size in the study. The study participants full filling the inclusion criteria were pre operatively assessed with plain radiographs, CT scan and MRI. The mean age of the participants was 42 years and majority belongs to the age group 26-50 years. The commonest mode of injury among the study participants was road traffic accidents. The commonest mode of injury among the study participants was road traffic accidents. 9 females and 25 males were evaluated, with 20 right and 14 left tibial plateau fractures. Using AO’s classification 41C fractures were found in 22 patients, 41B fractures in 12 patients. 23 patients (64.7%) tore at least one major ligament group (ACL, PCL, posterolateral corner) 17 torn ligaments were in 41C fractures (67.64%), compared to 6 in 41B fractures (26.08%). This difference was statistically significant (p .03 Fisher’s exact). Using Schatzker’s classification, the authors found the following correlation: A statistically significant difference (p .02 Fisher’s exact) was also found when analyzing ligament injuries in high-energy (IV, V, and VI) versus low-energy (I, II, III) patterns. Using AO’s classification, 22 patients
sustained meniscus tears (64.7%), with 13 medial menisci and 12 lateral menisci injuries. 3 patients tore both menisci, 5(41.6%) of the 41B fractures had meniscal tears, compared with 17(77.7%) of the 41C fractures. This difference was statistically significant (p<.04 Fisher’s exact). In multivariate analysis, soft tissue injuries including ACL, PCL, PLC and menisci were significantly associated with the high energy proximal tibial plateau fractures. There was statistical significance between soft tissue injuries and high energy proximal tibial plateau fractures.

CONCLUSION

In conclusion, the fracture of proximal tibia accounts for 1% of all fractures and is increasing. In this review 34 cases of tibia plateau fractures were diagnosed with plain X-rays, CT scan and MRI.

- In younger participants, proximal tibia fracture is caused by high energy trauma especially road traffic accidents.
- The less severe trauma produced significant injury in patients with advanced age.
- Majority of the fractures were type V and VI fractures according to the Schatzker’s classification.
- CT and MR imaging are more accurate than plain radiography for characterization and classification of tibial plateau fractures, and results of CT and MR imaging can be important for surgical planning.
- The results of the study was statistically and clinically comparable with the other literatures.

It can be concluded with the study that MRI, which can show a significant soft tissue injuries in addition to fracture configurations should become the imaging technique of choice for evaluating tibial plateau fractures due to high energy mechanism.

REFERENCES


