

## ORIGINAL ARTICLE

## Association of Ligamentous and Meniscal Injuries in Patients with Tibial Plateau Fractures: A Prospective Observational Study

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## ABSTRACT

**Introduction:** Tibial plateau fractures are one of the common fractures that occur near the knee. These fractures are mainly due to high-velocity injuries. So, there is a high risk of ligamentous and meniscal injuries. It is always important to identify associated ligamentous and/or meniscus injuries in tibial plateau fracture that can change the treatment plan. This study aims to assess the association of ligamentous and/or meniscal injuries in patients with tibial plateau fractures.

**Materials and methods:** This prospective observational study was conducted in the Department of Orthopaedics in B&B Hospital from September 2021 to May, 2022. 40 patients who meet the inclusion criteria were included in the study. All tibial plateau fractures were classified according to the Schatzker classification. MRI was reported by a single radiologist with a fellowship in musculoskeletal radiology. MRI findings were recorded and an association was studied with different types of tibial plateau fractures.

**Results:** Out of 40 patients, 36(90%) patients had ligamentous and/or meniscal injuries. The mean age of the patients was 38.9 years. The majority of the cases were due to road traffic accidents. 40% of the cases had ligamentous injuries only, 15% had meniscal injuries only and 35% had both ligamentous and meniscal injuries. Among ligamentous injuries (isolated or combined), ACL injury was common (77%). Among meniscus injuries (isolated or combined), lateral meniscus injury was common (70%). Schatzker type II fracture had a high association with ligamentous and/or meniscal injuries.

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**Conclusion:** Tibial plateau fracture is commonly associated with ligamentous and/or meniscal injuries.

## KEYWORDS

• Ligament injury • Meniscus injury • Magnetic resonance imaging • Tibial plateau fracture

## INTRODUCTION

Tibial plateau fractures are one of the common fractures among the fractures of lower extremities and account for approximately 1% of all fractures. These fractures often result from high-energy trauma. As this type of fracture is due to shearing and axial loading, there is always a high chance of ligamentous and meniscal injuries.<sup>1</sup> There are several studies that have reported up to 30-70% association of ligamentous and meniscal injuries in patients with tibial plateau fractures.<sup>2-4</sup> Various studies have suggested the use of magnetic resonance imaging (MRI) to detect the incidence of ligamentous and meniscal injury in patients with tibial plateau fractures.<sup>5-9</sup>

This study aims to assess the association of various ligamentous and/or meniscal injuries with tibial plateau fractures in our population.

## MATERIALS AND METHODS

This is a descriptive cross-sectional study conducted in Department of Orthopaedics, B&B Hospital from September 2021 to May 2022. Ethical approval was taken from IRC of B&B Hospital (IRC-2021-09-10-07) and informed consent was taken from every patient. Our study included all the patients older than 18 years of age with tibial plateau fractures presenting to our center who underwent MRI scan of the injured knee. Patients who were not eligible for MRI scan and those with a prior history of knee injuries or surgeries were excluded. Schatzker classification was used to classify the fractures.

A 1.5-tesla unit was used for the knee MRI. Axial, coronal, and sagittal scans with both T1 and T2 weighted sequencing were studied. All the reporting of MRI was done by a single radiologist with a fellowship in musculoskeletal radiology. MRI findings focusing Anterior cruciate ligament (ACL), Posterior cruciate ligament (PCL), Medial collateral ligament (MCL), Lateral collateral ligament (LCL), Lateral meniscus (LM), and Medial meniscus

(MM) were recorded. Ligament injuries were graded as 0,1,2 and 3. Only grades 2 and 3 were included in the study. The meniscus injury was reported as tear or intact. All data were entered and analyzed with SPSS version 21.

## RESULTS

Forty patients were included in the study. Among forty patients, 36 (90%) patients had ligamentous and/or meniscal injuries. The mean age of the patients was 38.9 years (range 18 to 78 years). Majority of the patients were male (65%) and right side was the commonly involved (58%). Majority of cases were due to road traffic accidents (88%). (Table 1)

**Table 1:** Demographic data of the patients

|                       | No of patients |
|-----------------------|----------------|
| <b>Sex</b>            |                |
| Male                  | 26(65%)        |
| Female                | 14(35%)        |
| <b>Side</b>           |                |
| Right                 | 23(58%)        |
| Left                  | 17(42%)        |
| <b>Mode of Injury</b> |                |
| RTA                   | 35(88%)        |
| Fall injury           | 5(12%)         |

Among 90% of the patients with ligamentous and/or meniscal injuries, majority of the patients have only ligamentous injuries (40%) followed by ligamentous and meniscal injuries (35%) and only meniscal injuries (15%). Among the isolated or combined ligamentous injuries (30 cases), ACL injury was the most common injury (77%). Among isolated or combined meniscal injuries (20 cases), the majority were lateral meniscus injury (70%). (Table 2)

**Table 2:** Overall incidence of Ligamentous and meniscal injuries

| Ligamentous and Meniscal injuries | No of patients |
|-----------------------------------|----------------|
| <b>Only Ligament injuries</b>     | 16 (40%)       |
| Isolated injury                   | 7 (44%)        |
| Combined injury                   | 9 (56%)        |

| Ligamentous and Meniscal injuries        | No of patients | Ligamentous and Meniscal injuries | No of patients |
|------------------------------------------|----------------|-----------------------------------|----------------|
| <b>Only Meniscal injuries</b>            | 6 (15%)        | <b>LM</b>                         | 14 (70%)       |
| Isolated injury                          | 4 (67%)        | Isolated injury                   | 2 (14%)        |
| Combined injury                          | 2 (33%)        | Combined injury                   | 12 (86%)       |
| <b>Ligamentous and Meniscal injuries</b> | 14 (35%)       | <b>MM</b>                         | 13 (65%)       |
| <b>ACL</b>                               | 23 (77%)       | Isolated injury                   | 2 (15%)        |
| Isolated injury                          | 4 (17%)        | Combined injury                   | 11 (85%)       |
| Combined injury                          | 19 (83%)       |                                   |                |
| <b>PCL</b>                               | 8 (27%)        |                                   |                |
| Isolated injury                          | 1 (13%)        |                                   |                |
| Combined injury                          | 7 (87%)        |                                   |                |
| <b>MCL</b>                               | 15 (50%)       |                                   |                |
| Isolated injury                          | 1 (7%)         |                                   |                |
| Combined injury                          | 14 (93%)       |                                   |                |
| <b>LCL</b>                               | 10 (33%)       |                                   |                |
| Isolated injury                          | 1 (10%)        |                                   |                |
| Combined injury                          | 9 (90%)        |                                   |                |

Among six types of Schatzker classification, 13 cases of type II fracture (36% of all cases) had ligamentous and/or meniscal injuries. 10 cases of type V fractures had ligamentous and/or meniscal injuries. Isolated ACL injuries were present in schatzker type II and type IV fractures (two cases each). Isolated PCL injury was present in one case of Schatzker type V fracture. Isolated medial meniscus was present in one case of type I and VI each. In majority of cases, various combination of ligamentous and meniscal injuries was present in different types of fractures according Schatzker Classification. (Table 3).

**Table 3:** The distribution of Ligamentous and meniscal injuries based on the schatzker classification

| Schatzker type | No of pts. | Ligaments only | Meniscus only | Both     | ACL | PCL | MCL | LCL | MM | LM |
|----------------|------------|----------------|---------------|----------|-----|-----|-----|-----|----|----|
| I              | 2          | 0              | 2 (100%)      | 0        | 0   | 0   | 0   | 0   | 2  | 1  |
| II             | 13         | 6 (46%)        | 2 (15%)       | 5 (39%)  | 9   | 3   | 4   | 2   | 3  | 6  |
| III            | 2          | 0              | 0             | 2 (100%) | 1   | 0   | 2   | 2   | 1  | 1  |
| IV             | 5          | 3 (60%)        | 0             | 2 (40%)  | 5   | 2   | 1   | 1   | 2  | 1  |
| V              | 10         | 5 (50%)        | 1 (10%)       | 4 (40%)  | 5   | 2   | 8   | 4   | 3  | 5  |
| VI             | 4          | 2 (50%)        | 1 (25%)       | 1 (25%)  | 3   | 1   | 2   | 0   | 2  | 0  |

## DISCUSSION

High-energy tibial plateau fractures are serious injuries that are commonly accompanied by multiple skeletal injuries and soft tissue injuries (ligament, articular cartilage, and meniscus) around the knee. Treatment for these injuries has frequently yielded subpar outcomes, with discomfort, instability, and loss of motion.<sup>2,8,10</sup> When high-energy fracture patterns are selected for independent analysis, unsatisfactory results are reported in 20 to 50% of the older literature.<sup>2,9,11-13</sup> In our study, 90% of the patients had some sort of ligamentous and/or meniscal injuries which includes 40% cases of ligamentous injury, 15% cases of meniscal injuries and 35% cases of combined ligamentous and meniscal injuries. In the study done by Shepherd *et al.*<sup>14</sup>, 90% of cases had ligamentous and/or meniscal injuries where ligamentous injuries were present in 40%

and meniscal tears in 80% of cases. Another study by Colletti *et al.*<sup>13</sup> found 97% of the cases had some sort of ligamentous or meniscal injuries. This shows that findings in our study is comparable with other studies and suggest high percentage of associated ligamentous and/or meniscal injuries in cases of tibial plateau fracture. This may be due to the reason that majority of tibial plateau fractures in our study are due to road traffic accident (88%).

In their study, Colletti *et al.*<sup>13</sup> cruciate and collateral ligaments. The presence of a lipohemarthrosis or a simple joint effusion was also noted. The tibial plateau fractures were classified according to the scheme devised by Schatzker. Results. Evidence of internal derangement of the knee was found in 28 (97% reported 55% of MCL injuries followed by 45% of LM injuries, 41% of ACL injuries, 34% of LCL injuries, and 28% of PCL injuries, and

21% of MM tear. Stannard *et al*<sup>4</sup> and 55 (53% reported 44% of ACL tears, 40% of PCL tears, 25% of MM tears, and 34% of LM tears. In our study, ACL (63.88%) was the common among all ligamentous and/or meniscal injuries, followed by MCL (41.66%), LM (38.88%) and the least common injury is PCL injury (22.22%). This shows that ACL, MCL and LM are the commonly injured ligamentous and/or meniscal injuries which are associated with tibial plateau fractures.

In their study, Colleti *et al*<sup>13</sup> reported 55% of MCL injuries followed by 45% of LM injuries, 41% of ACL injuries, 34% of LCL injuries, and 28% of PCL injuries, and 21% of MM tear. Stannard *et al*<sup>4</sup> reported 44% of ACL tears, 40% of PCL tears, 25% of MM tears, and 34% of LM tears. In our study, ACL (63.88%) was the common among all ligamentous and/or meniscal injuries, followed by MCL (41.66%), LM (38.88%) and the least common injury is PCL injury (22.22%). This shows that ACL, MCL and LM are the commonly injured ligamentous and/or meniscal injuries which are associated with tibial plateau fractures.

In our study, Schatzker type II had the highest percentage of ligamentous and/or meniscal injuries (36% of all ligamentous and/or meniscal injuries cases). Among these Schatzker type II cases with ligamentous and/or meniscal injuries, 46% had ligamentous injury only, 15% had meniscal injuries only and 39% had both ligamentous and meniscal injuries. Similar to our study, Kode *et al*<sup>9</sup> found that 40% cases of Schatzker type II had associated ligamentous and/or meniscal injuries. Colleti *et al*<sup>13</sup> also found Schatzker type II fracture as the most common fracture type which was associated with ligamentous and/or meniscal injuries. This might be because lateral tibial condyle is more convex and located more proximal than the medial tibial condyle and the most common mechanism of tibial plateau fracture is Valgus stress with axial loading.

The use of MRI in individuals with high-energy tibial plateau fractures is debatable. According to Barrow *et al*, MRI depicts soft tissue damage and comminution better than tomography and depicts articular depression equally well<sup>5</sup>. When compared to radiographs alone or radiographs combined with CT scans, Yacoubian *et al* discovered that MRI dramatically boosted interobserver agreement on fracture classification and treatment plan.

They reported that after getting MRI scans, the treatment plans of 23% of their patients changed.<sup>15</sup> So, MRI should be the important investigation of choice to diagnose ligamentous and/or meniscal injuries associated with tibial plateau fractures which may change the treatment plans.

## CONCLUSION

Tibial plateau fracture due to high-velocity injury is associated with high percentage of ligamentous and/or meniscal injuries. So, MRI scan should be considered as an important investigation of choice to diagnose such injuries which may alter the treatment plan.

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