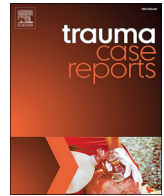


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Case Report

Rim plating for a rare variant of posteromedial tibial condyle fracture; partial coronal split, akin to Hoffa's fracture, associated with multi-ligament injuries and central depression[☆]

Prasoon Kumar, Saurabh Agarwal^{*}, Deepak Kumar, Rajesh Kumar Rajnish, Karan Jindal

Post Graduate Institute of Medical Education & Research, sector 12, Chandigarh 160012, India

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ABSTRACT

Introduction: Proximal tibia intra-articular fractures are commonly associated with ligamentous injuries and require early diagnosis and intervention. An array of fracture patterns can be encountered, and Schatzker's classification is a standard description to identify them. However, several patterns have been described that fall outside the ambits of this classification. We present a rare fracture pattern of partial posteromedial condyle coronal split associated with depression of the anterolateral plateau and mid substance tear of medial collateral ligament (MCL) and avulsions of anterior and posterior cruciate ligaments(ACL/PCL).

Case: A 45 year old male presented with swelling and severe pain in his right knee after an accident. He was diagnosed with a posteromedial tibial condyle coronal split with two fragments, along with multi-ligament injuries. He was operated with cannulated screws and a rim plate for the larger fragment. The fractures united and patient was doing well in his daily activities at final follow up of 15 months.

Conclusion: Proximal tibia fractures can present as an array of fracture patterns and require prompt diagnosis and surgical management. The one described in the present case is a rarest of rare pattern and rim plating could be a cheaper alternative to the anatomical plates.

Background

Proximal tibia intra-articular fractures are relatively uncommon injuries that require early and efficient intervention to minimise long term complications of joint dysfunction and early osteoarthritis [1]. Early anatomical reduction and stable internal fixation, followed by early mobilisation is the absolute principle for management of tibial plateau fractures.

The lateral condyle is convex in shape and slightly proximal in position as compared to the medial condyle. Depending on the velocity of trauma and the direction of the forces, various fracture patterns are commonly encountered. Schatzker classified these

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^{*} Corresponding author at: Department of Orthopaedics, Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh 160012, India.

E-mail address: saurabh_agr007@yahoo.co.in (S. Agarwal).

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Fig. 1. Lateral radiograph showing a large posterior condylar fragment.

fractures into 6 types [2]. Type 4 involves split of the medial condyle. Hohl and Moore classified these fractures into 5 types with type 1 involving coronal split of the femoral condyle [3,4]. Duparc et al. have given a separate identity to the posteromedial fractures, in isolation or combined with lateral condyle or tibial spine [5]. These fractures are not classified in almost 75% of cases with Schatzker classification, which is the most common one used in clinical practice [6]. These rare isolated posteromedial coronal splits form about 5% of the total medial condyle fractures [6]. The split can only involve the condyle or it may reach upto the metaphysis. The small splits are akin to the Hoffa's fractures described for medial femoral condyle [7]. The associated common injuries are to the collateral ligaments, Menisci and the cruciate ligaments.

We hereby present a rare fracture pattern of partial posteromedial condyle coronal split associated with central depression, along with mid substance tear of medial collateral ligament (MCL) and avulsions of anterior and posterior cruciate ligaments(ACL/PCL)

Informed consent

The patient was informed that data concerning the case would be submitted for publication and he readily agreed.

Case

A 45 year old male presented to the Advance Trauma Centre of our institute, with alleged history of road side accident (RSA), when the motorcycle he was driving, skidded off the road, injuring his right knee. He presented with swelling and severe pain in the knee. On plain radiograph in the lateral view, a large bony fragment was seen posteriorly, that was obstructing the knee flexion (Fig. 1). The antero-posterior view was obscure (Fig. 2). Computed Tomography (CT) scan showed a partial coronal split at the postero-medial tibial plateau, probably caused by a vertical shear force, that is also postulated to cause a femoral Hoffa's fracture (Figs. 3 and 4) [7]. There was associated central depression. The CT scan also showed an avulsion fragment of ACL insertion (Fig. 5). Magnetic resonance imaging was done to confirm the ligamentous injuries. It confirmed avulsions of both the cruciate ligaments; ACL was avulsed from the tibia, while the PCL was avulsed from its femoral attachment. Mid substance MCL tear was also seen.

The patient was taken up for surgery and a dual approach was used; posteromedial and anterolateral. There were two posteromedial fragments. The smaller one was fixed with a headless screw and rim plating with a 1/3rd tubular plate was done for the larger fragment as patient could not afford the costlier anatomical plates (Fig. 6). MCL was repaired with non absorbable polyester suture (Ethibond Excel/Ethicon). The central depressed fragment was elevated using a separate medial window and bone graft was used to fill the metaphyseal void (Fig. 7). One small fragment partially threaded cannulated screw (PTCS) was used to fix avulsed ACL fragment. A trans-articular fixator was applied to facilitate soft tissue healing (Figs. 8,9). There was no intra-operative or immediate post-operative complications.

On first followup after 3 weeks the fixator was removed. A knee range of motion (ROM) brace was applied and patient was



Fig. 2. Seemingly normal looking anteroposterior radiograph of the knee.

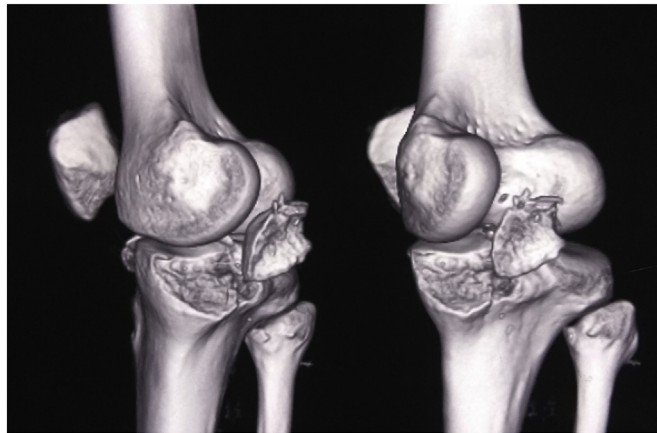


Fig. 3. CT images showing partial coronal split of the posteromedial tibial condyle.

allowed active knee ROM exercises with non weight bearing mobilisation. On follow up at 6 weeks knee ROM was 0–60 degrees and patient was allowed partial weight bearing. At last follow up of 15 months patient had a functional ROM of 0–100 degrees with no clinical instability and was walking without assistance (Fig. 10). The fractures had united (Figs. 11,12).

Discussion

Tibial plateau fractures often present as a diagnostic and interventional challenge. Proximal tibia is encompassed with a multitude of ligamentous structures that are often injured along with such fractures. Injuries to the menisci and MCL are commonly associated [8]. Schatzker classification is the most common and easily recognised system to identify these fractures. It is based on a simple plain antero-posterior (AP) radiograph of the knee [2]. However, there have been reported fracture patterns that do not represent any of the types in this classification [9,10].

Khan et al. identified a unique fracture pattern that is bicondylar or subcondylar with a coronal split [10]. The AP view tends to miss such posteromedial coronal fracture lines, akin to the classical Hoffa's fractures of the femoral condyle. The beam does not run at a tangent to the fracture line and the anterior intact condyle obscures it, specially in cases of undisplaced fractures [7,11]. In the

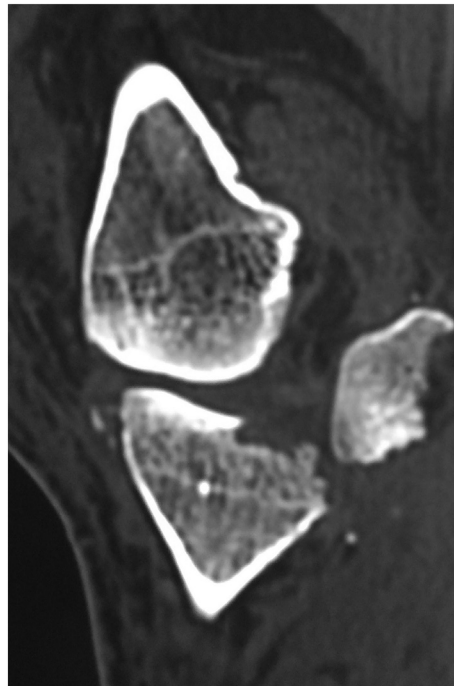


Fig. 4. CT images showing partial coronal split of the posteromedial tibial condyle.

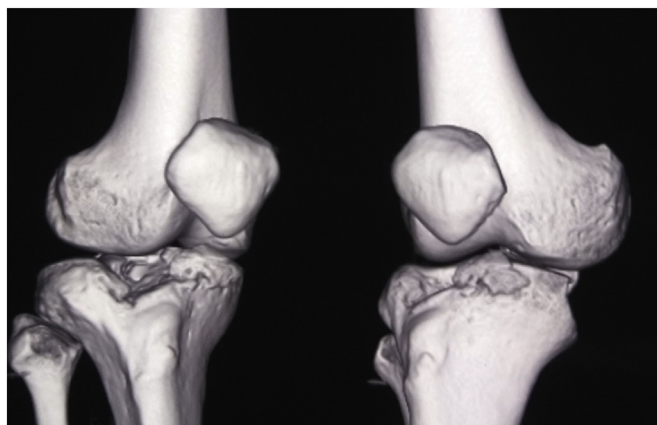


Fig. 5. CT scan showing avulsion of the anterior cruciate ligament.

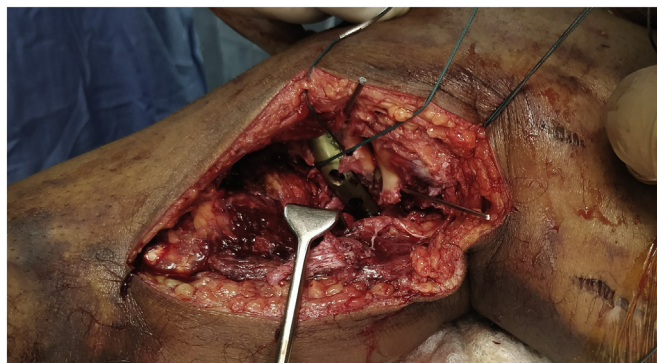


Fig. 6. Intra-operative clinical image showing the technique of rim plating for the posteromedial fragment.

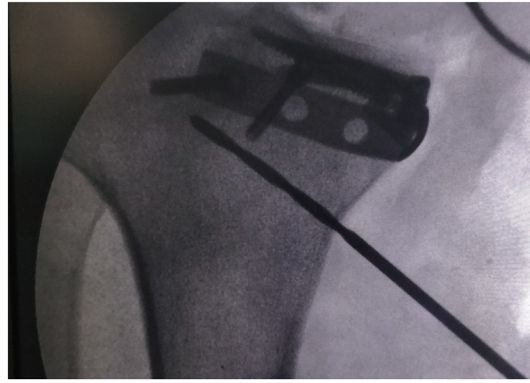


Fig. 7. Intra-operative C arm image showing method to elevate the depressed fragment.

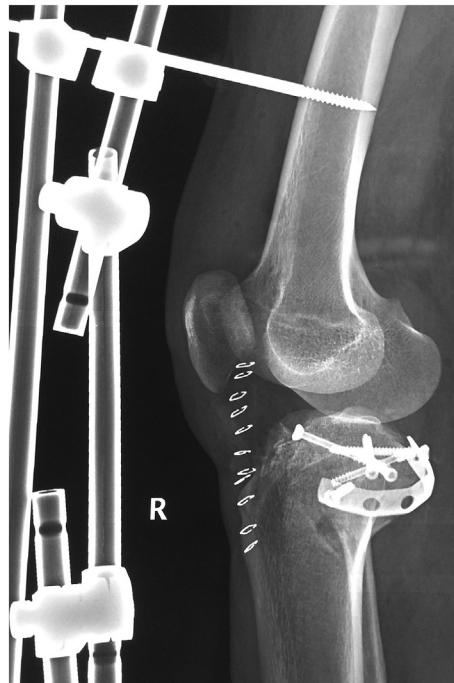


Fig. 8. Post-operative radiographs showing the rim plating and fixation of the posteromedial fragments.

present case, the standard AP view was obscure and only the lateral view showed the fragment of the posteromedial tibial condyle.

Such fragments are seen in 35–75% of bicondylar fractures [12,13]. The normal exit of fracture line involves the whole condyle and could extend to the metaphysis [1]. They often require a posterior approach and buttress plating [1,14].

Walquist et al. have sub-classified type 4 Schatzker fractures by their exit point in relation to the tibial spine [15]. The Duparc classification identifies the posteromedial fractures as a separate entity [5].

In the present case, the posteromedial fragments were peculiar. Only the posteromedial corner was involved; the fracture was a partial coronal split with involvement of only the posterior 1/3rd of the condyle. The adjacent area was depressed. There were avulsions of the cruciates and tear of the MCL. The injury of the posteromedial condyle was probably due to a vertical rotatory shear force that was transmitted with high velocity, when the patient fell on the involved side. Similar mechanism has been postulated along with direct impact, for the Hoffa's fractures [7]. In addition there could have been a transient knee dislocation that is believed to occur in patients with Type 4 Schatzker types [16]. This could have caused the tears of the cruciates and the MCL, causing instability, both to the valgus and anteroposterior strains.

The diagnoses of such injuries present a certain challenge. CT scans have evolved as a potent tool to diagnose atypical fracture lines. However, for evaluation of Schatzker types, its addition does not have much effect on the reliability, as compared to simple usage of AP radiographs [17]. However, for posteromedial fractures, often associated with subluxation or dislocation, cross sectional imaging by CT do add to the diagnostic adequacy. This could lead to modification in surgical planning and better outcomes for the patients. Even MRIs have shown to be important modality to assess the ligamentous integrity around the knee, and better surgical



Fig. 9. Post-operative radiographs showing the rim plating and fixation of the posteromedial fragments.



Fig. 10. At 15 months of follow up, patient showed functional range of knee movements.

planning and outcomes [18,19].

In the present case we used all the three imaging modalities to arrive at the final diagnosis. CT scan helped in identifying the presence of two postero-medial fragments and also avulsion of the ACL. MRI confirmed the MCL tear and avulsions of the cruciates.

We approached the posteromedial fragment through the posteromedial approach in supine position. Rim plating has been a described technique for tibial plateau fractures involving the posterolateral corner [20]. Since one of the two fragment was relatively large we buttressed it with an indigenous plate, using this technique instead of a simple PTCS. This is a cheaper option than the anatomical plates available in the market. This helped us to approach both the condyles in supine position without the need of posterior buttress, in a prone position.

The present case shows a very rare combination of injuries to proximal tibia and knee joint. None of the discussed classification systems encompass such a combination of osseo-ligamentous injury pattern and this is the 1st reported case of its kind. We profess on not relying on the Schatzker classification for every proximal tibia fracture, and assess each individual case, utilising every clinico-radiological tool at disposal. Thereafter an early potent surgical planning is to be done so that the patient benefits the maximum and has long term positive outcomes. Rim plating can be a suitable technique for smaller fragments.



Fig. 11. Plain radiographs at 15 months of follow-up, showed union of the posteromedial fragments.

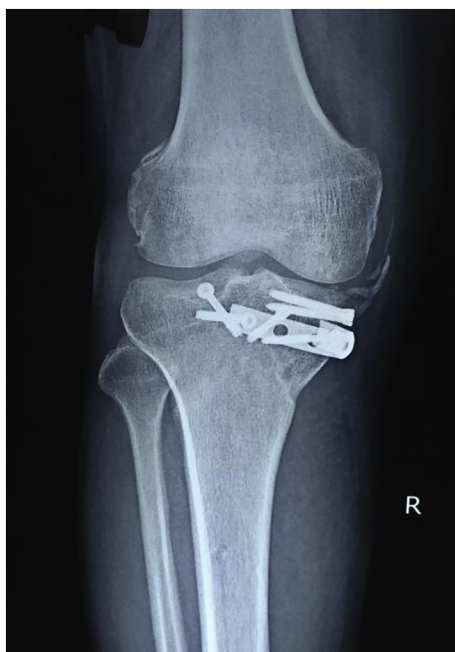


Fig. 12. Plain radiographs at 15 months of follow-up, showed union of the posteromedial fragments.

Conclusion

Surgical management of proximal tibia fractures is the gold standard. It should be carefully planned on case by case basis, utilising different diagnostic modalities, to ascertain the extent and type of the osseo-ligamentous injury.

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Conflict of interest

None.

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