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Case Report

Dual split and dislocation— a variant of Schatzker type-I tibial plateau fracture: A case report

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ABSTRACT

Schatzker type-I tibial plateau fracture is a split fracture of the lateral tibial plateau in sagittal plane, consequent to valgus impaction caused by low velocity of trauma. However, a deep understanding of the different columns of the tibial plateau and patho-mechanisms of the injury led to the unmasking of atypical fractures around the tibial plateau. We have encountered 2 cases with unusual fracture pattern of the lateral tibial condyle caused by road traffic accidents. The fracture pattern and severity of injury deviate from the original description of Schatzker type 1; in view of dual plane split, there is rotation of the posterolateral column fragment along its sagittal plane plus grade-III medial collateral ligament injury. The patients were initially treated with knee spanning external fixator and after a latency of 5 days, definitive fracture specific fixation was done, combined with repair of grade-III medial collateral ligament injury. At the 6 months follow-up both the patients achieved satisfactory knee functions (knee society score case 1: 100 and case 2: 92) and returned to their jobs. The severity of fracture pattern and displacement as described should prompt for examination of associated ligament injury. Because of timely diagnosis, early and appropriate care promised an excellent function outcome even in such a severe nature of knee injury. To prompt the description of injury pattern we coined the name “dual split and dislocation” of lateral tibial plateau, as a complex injury variant of split fracture of lateral tibial plateau fracture.

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Introduction

The Schatzker classification of proximal tibia fractures is the most widely followed classification, which is based on 4 parameters: pattern of fracture, quality of bone, velocity of trauma and age of patient.¹ Lateral tibial plateau split is a cleavage type of fracture, more commonly seen in young people who have a dense cancellous bone that resists impaction. It was assumed that the split fracture is oriented in the sagittal plane, which require buttress from the lateral side with lag screws or plate. However, in the last decade column theory^{2,3} has led to routine use of CT scan in management of tibial plateau fracture, which has revealed multiple patho-anatomical variants of tibial plateau fracture.^{4,5} To overcome the initial limitation and to incorporate such variants, the detailed fracture description revisiting the Schatzker classification based on CT scan published.⁶

Despite the evolution in the available classification, some of the injury patterns do not match with the given description of the

injury. We reported 2 encountered patients, hoping to reveal one of variant of split type of lateral tibial plateau fracture. The written informed consent from both the patients were obtained and the study was approved by institute ethics committee.

Case report

Case 1

A 20-year-old male victim of a road traffic accident was initially managed by emergency medical services, thereafter referred to a level-1 trauma center. After advanced trauma life support protocol, the patient was shifted under orthopaedics care, with the chief complaints of pain, in-ability to move and severe soft tissue swelling in and around the left knee. Clinical sign and symptoms of compartment was absent and neurological status was normal. Knee was put in a splint and advised for trauma series along with anterior-posterior and lateral radiograph of the left knee.

The antero-posterior (AP) radiographs confirmed the diagnosis of split and depression type of lateral tibial plateau fracture, and lateral plateau revealed unusual posterior displacement of a part of

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lateral tibial plateau (Fig. 1A&B). CT scan was ordered for more clarity, which identified split type of lateral tibial plateau fracture in coronal and sagittal plane without any area of articular depression, furthermore the posterolateral column rotated along its sagittal axis and dislocated posteriorly (Fig. 1C&D).

Correlating the history, clinical presentation and radiology confirmed the high velocity valgus impaction injury of knee. An emergency *trans*-articular external fixator was applied due to swelling at the time of presentation and to dis-impact the severely displaced fracture fragment.

On the post-operative day 5, the swelling subsided significantly and wrinkling sign was positive, so a call for definitive fixation of the fracture was taken. In view of 2 column fracture involving the anterolateral and shear fracture of the posterolateral column, buttressing of each column was planned. The posterolateral fragment was more severely displaced and bigger fragment, so we used the gastrocnemius raphe splitting approach in the prone position to manage it first. The posterolateral fragment was found lying extruded posteriorly out of the knee joint (Fig. 2A) which was reduced and stabilized with buttress principle using the fixed reconstruction plate. Keeping the patient in the same position, anterolateral fragment was lagged with two 6.5 mm partially threaded cannulated screws and washer.

After completing the osteosynthesis, the knee was examined for instability, stress radiography confirmed Grade III medial collateral ligament (MCL) injury (Fig. 2D). The medial approach was performed to further confirmed complete MCL at tibial attachment (Fig. 2B). MCL was repaired with fiber wire and fixed to the suture post (Fig. 2C).

In postoperative period, a hinged knee brace was applied for early knee range of motion and non-weight bearing walking started immediately. The patient was followed clinic-radiologically at 1st, 3rd and 6th months. At 3 months of follow-up, the patient was able to walk pain-free without any aid, no varus-valgus instability and complete radiological healing of fracture (Fig. 3B&C). He resumed routine activity of daily life and job at 6 months of follow-up with knee society score of 100 (Fig. 3A&D).

Case 2

A 32-year-old motorcyclist crashed into a car and suffered a blow over the right knee. The patient was referred to a level-1 trauma center. Following the advanced trauma life support protocol, the patient was advised routine radiograph and CT scan.

The AP radiograph showed a type-II Schatzker fracture i.e., split and depression (Fig. 4A). CT scan clearly depicted a dual plane split i.e., coronal and sagittal of lateral tibial condyle with severe displacement of posterolateral column as in the case 1 (Fig. 4B&C). Furthermore, osteochondral rim avulsion of the medial tibial

plateau with suspicion of MCL injury seen over the 3 dimensional computed tomography (Fig. 4D).

In agreement to the principles of damage control orthopaedics, a knee spanning external fixator was applied on post-operative day 1. A similar strategy as first case was followed. Firstly the patient was placed in a prone position and the posterolateral fragment was buttressed with a proximal tibia periarticular plate through gastrocnemius splitting approach. Subsequently the patient was placed in supine position and anterolateral column was buttressed with anatomical lateral column plate. Intraoperative finding confirmed the rim avulsion from medial tibial plateau with grade-III MCL injury. A direct medial approach was used and showed the rupture of MCL from tibial attachment (Fig. 5A). All-suture type of suture anchors were used at joint level and under surface of osteochondral fragment (Fig. 5B). The suture bridge type of repair with knotless anchor at 5 cm below the joint line were performed in the end (Fig. 5C).

The rehabilitation protocol was complied the same as the earlier, a hinged knee brace for early knee range of motion and to prevent joint stiffness. At 4 months follow-up the patient was pain free and ambulatory; fracture united radiologically; and knee was stable on clinical examination. He resumed routine activity of daily life and job at 6 months of follow-up with knee society score of 92 (Fig. 6A&B).

Discussion

Fractures involving the lateral tibial plateau are believed to happen with low velocity of trauma.¹ Increasing rate of road traffic accidents and improved understanding of fractures stretched the confines of the Schatzker classification, which directly affected the reliability and prognosis of injury. Both of our patients fall in such a grey zone, as the fracture type does not match to the severity of injury, the pattern of fracture and displacement (Table 1).

Initially based on AP radiograph, both the cases were labelled as split and depression type of lateral tibial plateau fracture. Afterward careful evaluation with the multiplanar CT scan revealed the details of fracture pattern which we found important in surgical planning. (1) There was a visible split of the lateral tibia plateau in the coronal plane and the sagittal plane, which split apart the lateral tibial condyle into the anterolateral and posterolateral column. (2) No part of the articular surface was found depressed, which was appreciated on the radiograph. (3) The posterolateral column was displaced posteriorly and rotated along the sagittal plane. It was only the part of the lateral tibial plateau dislocated posteriorly which gave impression of articular depression on the AP radiograph. In presence of above mentioned findings, we coined the term “dual split and dislocation” for this peculiar fracture of lateral tibial plateau to match the morphology of fracture and severity of injury.

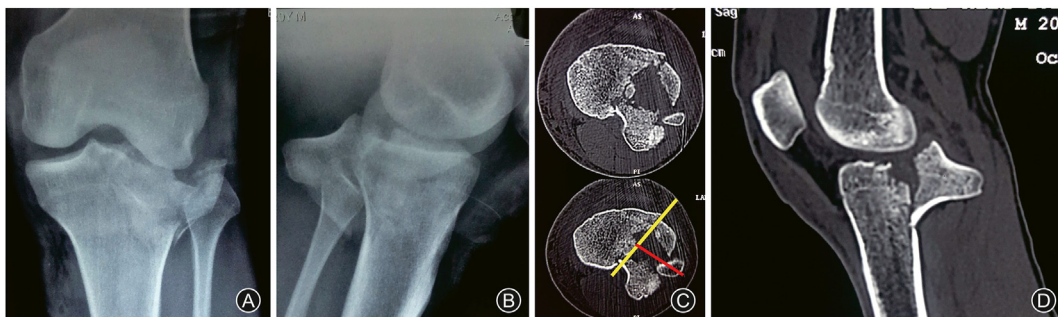


Fig. 1. The radiograph (A), (B) and CT scan (C), (D) depicts a coronal (red dotted line) and sagittal (yellow dotted line) split with posterolateral fragment dislocation posteriorly and rotated posterior along the sagittal axis.

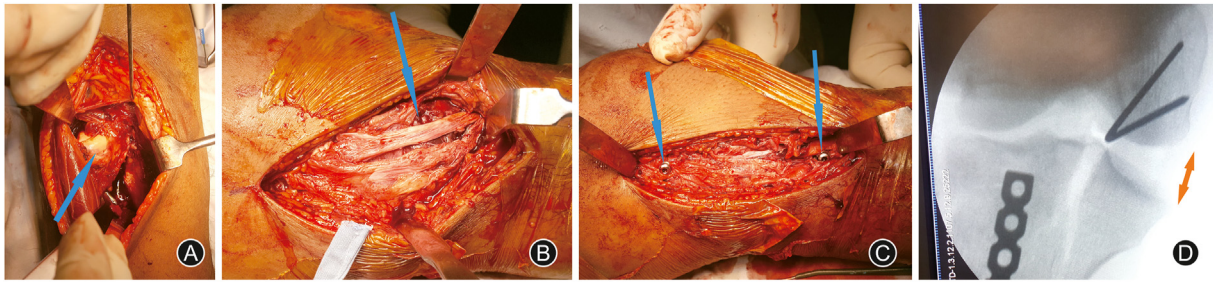


Fig. 2. Gastrocnemius raphe splitting approach showing (A) posteriorly dislocated posterolateral fragment; (B) tibial side rupture of medial collateral ligament; (C) medial collateral ligament repair with fiber wire and post screw; (D) stress view showing widening of joint line (red arrow).

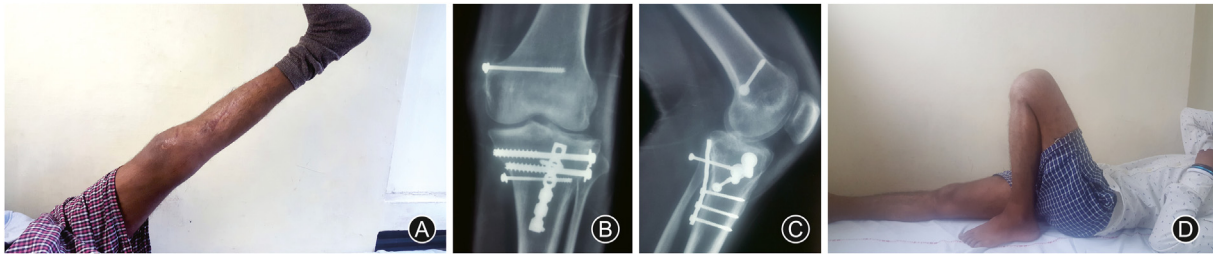


Fig. 3. Post operative radiographs at 6 months (B&C) along with the clinical image (A&D) depicting the excellent function post-surgery.

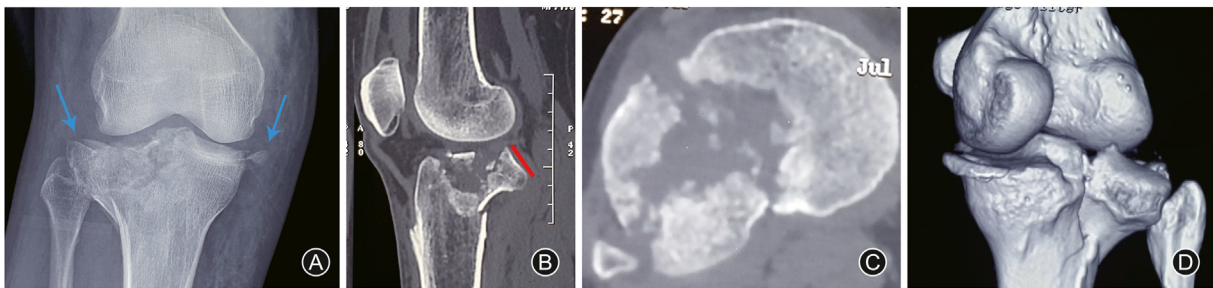


Fig. 4. (A) Radiograph and (B), (C), (D) CT cuts showed the unusual fracture pattern may be considered as variant of type-I Schatzker in view of coronal split with posterolateral fragment dislocation (blue arrow in (A) showed lateral tibial plateau fracture along with rim avulsion injury of medial collateral ligament).

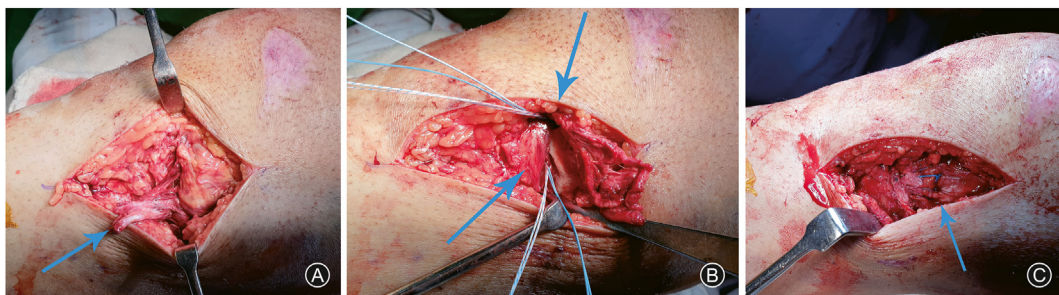


Fig. 5. Systematic representation of the identification and repair of medial collateral ligament through direct medial approach. (A) Medial collateral ligament rupture from tibial attachment; (B) All-suture type of suture anchor at joint level (blue arrow) and under surface of osteochondral fragment (blue arrow); (C) Suture bridge type of repair with knotless anchor at 5 cm below the joint line.

Both patients in our report had injury subsequent to road traffic accident and presented with severe soft tissue swelling, which mandated emergency external fixator and period of latency before definitive fixation. Subsequently because of the dual plane of split, involving the 2 columns of the lateral tibial plateau, each column was buttressed using the fracture/fragment specific approach.⁷ The posterolateral fragment was identified as the bigger chunk of plateau,⁸ so it was stabilized first with buttress principle using the Gastrocnemius raphe splitting approach.⁹ After completing the osteosynthesis, the knee was examined for the associated injury to

ligament, which confirmed the diagnosis of grade-III MCL injury. Association of MCL injury with severely displaced fracture of lateral tibial plateau has been reported by Kolb et al.¹⁰ and they proposed preoperative MRI or appropriate radiology. However, getting MRI was not possible in our case because of severity of soft tissue swelling.

We could not find description of such cases in the literature. So, we find it worth reporting to raise the level of awareness and a guide for management in such unusual injury. However, consistency of the injury pattern, establishing the treatment guideline and prognosis would require longer series to establish the protocol.

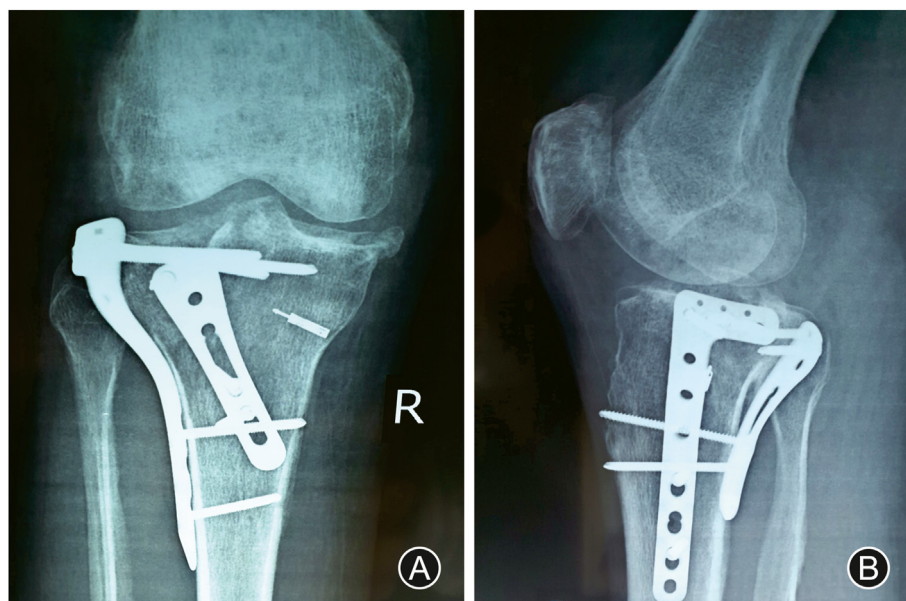


Fig. 6. Seventh month follow-up radiograph show complete healing of lateral tibial plateau fracture and medial tibial plateau osteochondral fragment.

Table 1

Description of clinical presentation and management of the 2 cases.

Case no.	Age (years)/ Gender	Mode of injury	Fracture pattern	Column involved	Soft tissue injury	Emergency management	Definitive surgery
1	20/Male	RTA	Sagittal & coronal split	Anterolateral & Posterolateral	Grade-III MCL injury	Trans-articular external fixator	Posterolateral buttress plate, anterolateral lag screws & MCL repair
2	32/Male	RTA	Sagittal & coronal split	Anterolateral & Posterolateral	Rim osteochondral avulsion with Stener-like tear of MCL	Trans-articular external fixator	Posterolateral & anterolateral buttress plate, fixation of rim avulsion with MCL repair

RTA: road traffic accident; MCL: medial knee ligament.

An unusual fracture pattern does not fit to the available classification and should be evaluated in detailed. CT scan is always an essential tool to understand the fracture morphology and definitive surgical planning. Threshold to investigate for associated ligament injury should be low in severely displaced lateral tibial plateau fracture.

Funding

Nil.

Ethical statement

The written informed consent from both the patients were obtained and the study was approved by institute ethics committee.

Declaration of competing interest

None.

Author contributions

Devendra Kumar Chouhan made the surgery and edited manuscript. Aman Hooda was be responsible for structuring, writing and editing of the article.

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