

## Direct Impact To Lower Limb Leads To Combination Of Injury Leads To A Challenging Management - A Case Report

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### Author contribution

All authors of this case report are involved in patient management, collection of data, and writing of this article. The Clinical lead supervised the management and was involved in the correction and editing of the article.

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### 1. Abstract

#### 1.1. Introduction & Importance:

This is the first case in the literature describing a combination of avulsion fracture of the posterior cruciate ligament (PCL), open vertical patella fracture, tibial shaft fracture, and medial tibial plateau fracture on a leg is not only rare but also a difficult entity to treat. A careful sequence of planning and execution is of utmost importance in the treatment of this type of case to obtain a good outcome and prevent complications. Injury pattern, the treatment which has been provided and challenges in managing this patient has been described in this case report.

#### 1.2. Case presentation & Clinical discussion:

A 17-year-old motorcyclist admitted following a direct impact on the left leg by a speeding motor coach from the opposite side. He sustained

an open vertical fracture of the patella, avulsion fracture of the posterior cruciate ligament (PCL), tibial shaft fracture and medial tibial plateau fracture. After careful planning, he underwent surgeries in two stages. The first stage comprised wound debridement of open patella fracture, intramedullary nailing of tibial shaft fracture and stabilization of tibial plateau fracture with screws. The second stage was an open fixation of avulsion fracture of the PCL. The patient recovered without any complications and eventually walked without any assistance.

### 1.3. Conclusion:

The combination of fractures in a single limb is a challenge to Orthopaedic surgeons. Careful assessment, planning & execution are necessary to obtain a good outcome.

### 2. Keywords:

Avulsion Fracture; Posterior Cruciate Ligament; Tibial Plateau Fracture; vertical Fracture of Patella

### 3. Introduction

A combination of fractures and ligament injuries in the lower limb is a difficult entity to treat. Challenges are the timing of surgery (whether emergency or elective), Sequence of fixation, choice of implants (Screws, Plates & Nails) and rehabilitation. This is a case report and the literature review of a 17-year-old male who sustained an open vertical patella fracture, midshaft tibial shaft fracture, medial tibial plateau fracture, PCL avulsion fracture, and the possible management options and their advantages and disadvantages. This is the first case reported in the literature which describes similar complex injuries. This case report has been reported according to the SCARE guideline [1].

### 4. Case Report

A 17-year-old male presented to the Accident & Trauma unit following a motor vehicle accident. He was the rider of the speeding motorbike which had collided with a motor coach and approached him in a turn. The motorcoach impacted his left leg and he was thrown away from the motorbike. On admission, he was evaluated according to the ATLS protocol. His hemodynamic parameters were stable. He was conscious and rational. He refused to move his left leg at all. He sustained a small puncture wound over the anterior aspect of the left knee, which discharged blood. His left toe movements, distal pulses and sensations were preserved. He had no exacerbating pain on the dorsiflexion of the toes. Oxygen saturation on his left toe was 99% with good waveform.

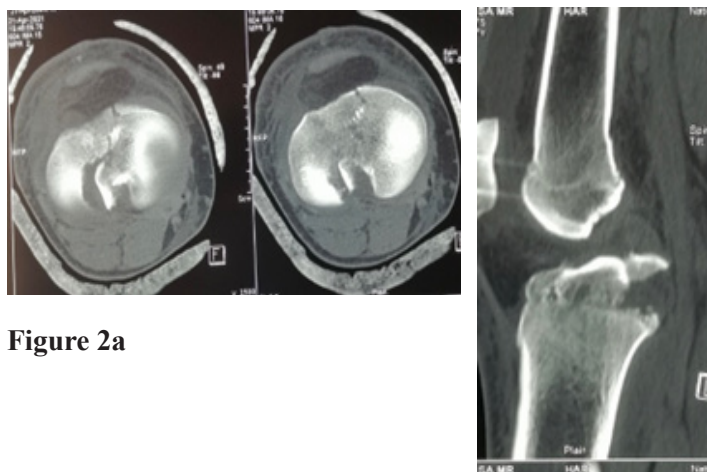
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His radiographs of the left tibia showed an un-displaced transverse fracture of the tibial shaft and it does not include the knee joint. The knee was not targeted for radiograph (Figure 1).



**Figure 1** shows an un-displaced complete fracture of the right tibial shaft and failed to include tibial plateau, PCL avulsion, and Patella fractures.

He was provided with standard open fracture management, multidisciplinary care assessment to exclude other injuries and arranged non-contrast computed tomography (CT) of the knee. The CT revealed an un-displaced fracture of the medial tibial plateau (Figure 2 a & b).



**Figure 2a**

**Figure 2b**

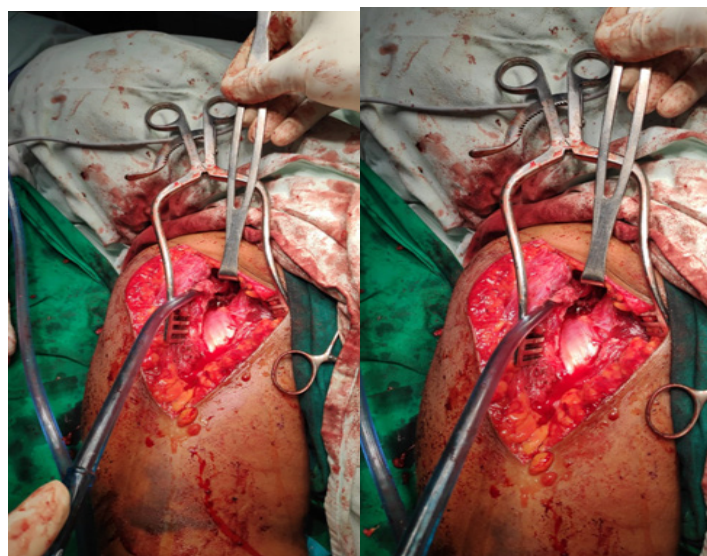
**Figures 2a&b** demonstrate axial and sagittal computed tomographic images of the right knee respectively. They show an Avulsion fracture of PCL and medial tibial plateau fracture.

He has undergone surgeries in two stages. The first stage started with a vertical extension of the wound and debridement of the patella fracture. The fragments retracted and used as the entry to the intramedullary nail. To avoid splitting while creating the entry point at the tibia through the un-displaced medial plateau fracture, it was temporarily stabilized with

two 1mm Kirchner wires. Intramedullary nail has been inserted using standard technique. The medial tibial plateau fracture was fixed with two 6.5mm percutaneous cannulated screws and transverse K-wire fixation and a figure of eight wirings were done for the vertical patella. During the intraoperative assessment of collateral, (Medial & Lateral) ligaments and anterior cruciate ligament was found stable.

One week later, he underwent posterior tibial spine fixation through the posterior approach. The patient was positioned in a prone, with the tourniquet on the mid thigh. The lazy S incision centred on the posterior skin crease [2]. While opening the crural fascia, the short saphenous vein and medial sural cutaneous nerve are safeguarded. Then, Semimembranosus muscles identified and retracted medially and the medial head of the gastrocnemius also has been retracted medially. The bony avulsion of the PCL was visible through the capsular defect. The bony avulsion has been fixed with a 3.5mm cortical screw and supported with a 3.5mm suture anchor.

The knee was splinted for three weeks and started with a range of motion exercises. The strengthening exercises especially hamstring strengthening exercises started after six weeks. He was allowed to start weight-bearing exercises in eight weeks. Full weight bearing was allowed after achieving radiological evidence of healing and a full range of motion in 12 weeks post-operatively.



**Figure 3a**

**Figure 3b**

**Figure 3 a & b** shows the intraoperative view of the posterior approach to the posterior upper tibia.

The patient was followed up at the Department of Orthopaedic Surgery, National Hospital of Sri Lanka for a regular period. He achieved complete healing of fractures and walked without any residual weakness. Following videos demonstrating the integrity of the collateral and cruciate ligaments in three months.

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Video 1 <https://youtu.be/SFOSmhBw9R4>

Shows a negative anterior drawer test demonstrating the integrity of the ACL

Video 2 <https://youtu.be/9eNwPl6wxNA>

Shows Grade II laxity of the PCL with the firm endpoint on posterior drawer test in three months following surgery.

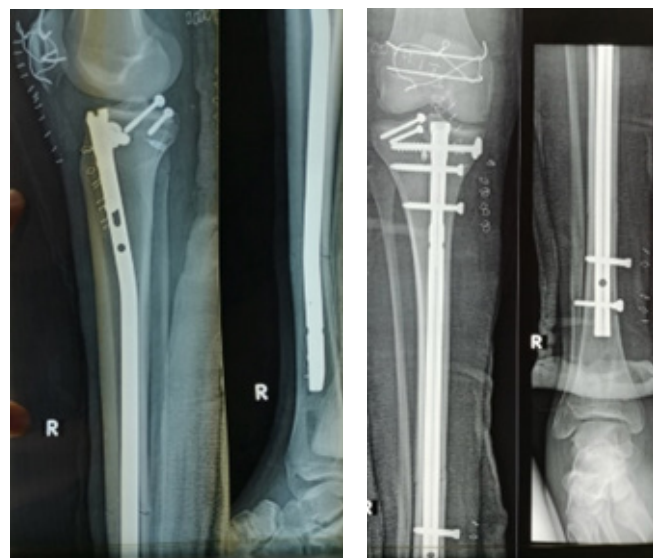
Video 3 <https://youtube.com/shorts/NelkQCYFUPw?feature=share>

Demonstrates integrity of collateral ligament of the knee

## 5. Discussion

Combined injuries in a single limb are intricate to Orthopaedic surgeons who are managing these injuries. The management of this kind of situation is completely different from the management of isolated injuries. Mechanism of injury adjunct with clinical evaluation will help in this situation to identify injuries. Likewise, injuries are “Tell-Tale signs” of the mechanism of injury. In our patient, the mechanism of injury was the direct impact on the flexed knee and the ipsilateral leg. This clarifies the reason for the transverse fracture of the tibia, vertical fracture of the patella and the avulsion fracture of the PCL. Ipsilateral femoral shaft fracture [3], lateral femoral condylar fracture [4,5], hip fracture, posterior dislocation of the hip joint, posterior knee dislocation and multi-ligament injuries [5,6] can also be possibly associated injuries with the same trajectory of force.

The classification of injuries is also confusing. Every injury should be classified separately as there is no single classification for the entire injury. Tibial shaft fracture classified as AO 42A3b[7], Tibial plateau fracture classified as AO 41B1.2 [7], displaced vertical fracture of the patella [8], PCL avulsion fracture classified as AO 41A1.3p [7]. Management of isolated fractures is different to a complex pattern of fractures. There can be challenges in diagnosis, approach, choice of implants, and avoiding impedances from other implants. Careful and accurate pre-operative planning is vital in the management of this kind of complex situation.



**Figure 4a**

**Figure 4 b**

**Figures 4a&b** show the immediate post-operative radiograph of the limb showing good positioning of the implants and the good reduction and fixation of the fractures.

To identify the fractures and associated injuries, standard radiographs (orthogonal vies of the full length of the particular bone), computed tomography (CT) and magnetic resonance imaging (MRI) is necessary. In our patient, initial radiographs failed to cover the full length of the bone. It did not reveal the patella, tibial spine and tibial plateau fractures. The CT demonstrated the un-displaced tibial plateau fracture and the tibial PCL avulsion fracture. MRI has not been performed due to the emergent nature of the open patella fracture. MRI helps rule out ligamentous injuries. We fixed the patella with transverse K-wires and a figure of eight metal wiring. Alternatively, vertical fractures of the patella are fixed with transversely oriented compression screws [7-9], plate and screws [10] and fibre wires [11]. Here the wire does not serve as a tension band, but as a compression device[12].

There are several approaches have been described in the literature. Such as arthroscopic reduction and fixation[13-16] and open technique [2]. The choice of the implant may vary with the approach such as screws, suture anchors, and toothed plate [17]. There is no gold-standard approach has been accepted in the literature. Anatomical reduction and stable fixation are vital in the management of PCL avulsion injury. Arthroscopic fixation is becoming popular in recent years. There are few studies with a lesser number of sample sizes available. They supported the arthroscopic approach in the context of feasibility to rule out other intra-articular injuries, the equal incidence of arthrofibrosis, and good clinical and radiological outcomes [13-16, 18,19].



**Figure 5a**



**Figure5 b**

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**Figures 5a & b** demonstrates complete healing of fractures in 03months time.

## 6. Conclusion

The multiple fractures in a single limb are complicated in the context of the sequence of fixation, method of fixation, choice of implant and rehabilitation. Those are completely different compared to the isolated injuries. Identifying all injuries and excluding other injuries is important during the initial evaluation. Surgical planning, approaches and choice of implants are important in the management of this intricate situation. Achieving mechanical alignment, anatomical reduction, stable fixation, and early mobilization is vital in this kind of situation.

## 7. Guarantor

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