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Case Report

Knee Dislocation with Tibial Shaft Fracture

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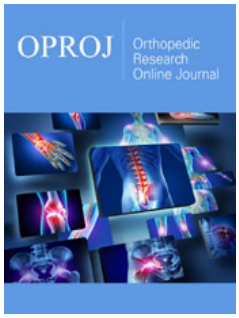

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Abstract

We present a case of anterior dislocation of the knee combined with tibial shaft fracture and multi-ligament injury. To our knowledge, a complex case like this has rarely been documented. A 53-year-old male was involved in a car crash. Radiographies showed a fracture in the shaft of the tibia and fibula, anterior dislocation of the knee, and an avulsion fracture of the fibula. In MRI scan, ACL was torn entirely, and PCL had a high-grade intra-sheath tearing. The surgery was performed in two steps with 4-day interval. At first step, we fixed the tibial shaft fracture with a plate and screw, and in the second step, we reconstructed the ligament injury. All components of this lesion were quickly diagnosed and treated appropriately. Three months after treatment, the patient had achieved adequate daily functioning following the onset of early rehabilitation exercises.

Keywords: Knee dislocation; Tibial fracture; Ligament; ACL; PFL; Avulsion fracture

Introduction

Acute knee dislocation is a limb threatening emergency due to complications such as extensive soft tissue injury and disruption of regional arteries [1]. Since 50% of knee dislocations reduce spontaneously [2], they make it difficult to diagnose damage to the ligaments as well as the accompanying vascular injury, and if missed, can cause significant dysfunction in the limb [3]. This partly explains why, despite the low incidence of knee dislocations, the injury is associated with a high rate of complications such as amputation [4].

There is still debate about how to manage a traumatic complex, multiple ligamentous knee injury, and choosing between surgical treatment options or closed immobility is a controversy [5]. Concomitant fractures, including ipsilateral tibial diaphysis fractures, often challenge immediate ligament repair. Simultaneous occurrence of tibial diaphysis fracture and an anterior knee dislocation, leading to multiple ligamentous injury, is uncommon which occurs in only 2% of tibial fractures [6,7].

The treatment of choice for tibial shaft fractures is intramedullary nailing (IMN) [8]. Recent studies, however, show that transtibial tunnels implantation is difficult and challenging in the event of simultaneous occurrence of knee ligament injury and tibial shaft fracture and approach to both injuries at the same time should be avoided, and repair of ligament damage should be delayed until bone damage has healed [9]. We report a case of traumatic close left tibial shaft fracture and an anterior knee dislocation associated with extensive injuries in lateral, anterior, and posterior compartments of the knee.

Case Report

A 53-year-old man was admitted to the emergency department of Sina Hospital following a car accident causing his left leg trapped between two vehicles. The principles and protocols of Advanced Trauma Life Support (ATLS) was applied on admission. After the initial examination and stabilization of the patient, he had severe pain, deformity and swelling on his left knee. There were skin abrasions on the left knee, left leg, and left medial malleolus. Physical examination was not possible, because of the severe pain. Neurovascular examinations of the limb were normal. There was no numbness or weakness in the limb, and pulsation was normal. Plain radiography and Magnetic Resonance Imaging (MRI) of left lower limbs were taken.

Radiographies revealed an anterior dislocation of the knee, a spiral-oblique fracture through the one-third mid-distal diaphysis of the tibia and fibula, and an avulsion fracture of the fibula (Figure 1). A closed reduction of dislocation was performed under sedation in operation room, and neurovascular examinations were rechecked. Then the limb was immobilized with a splint.

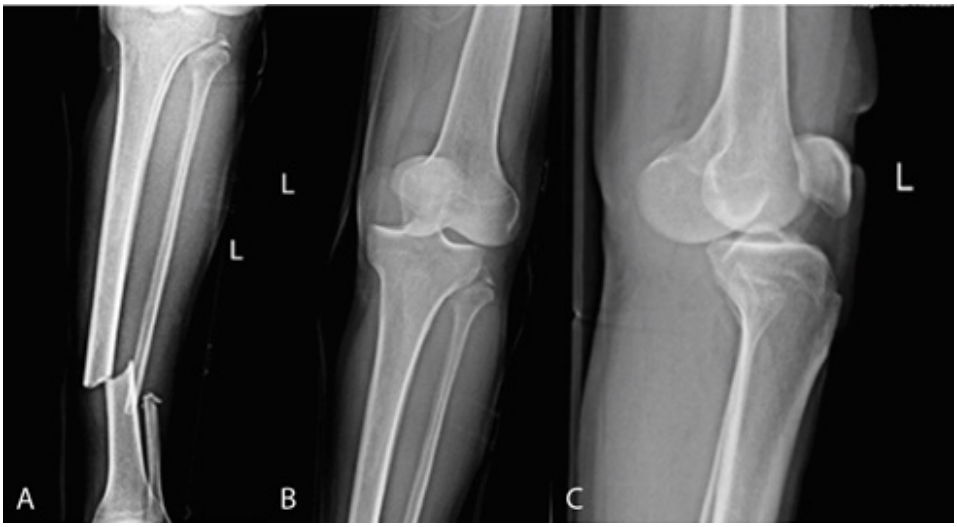

Figure 1: Initial radiographs showing the dislocated knee with simultaneous fracture of the tibial shaft. (A) Tibial shaft fracture. (B) Anterior dislocation of the knee combined with LCL and PFL avulsion. (C) Anterior dislocation of the knee.

MRI scan of the patient demonstrated a longitudinal meniscal tear, extending to the posterior horn and meniscofemoral ligament and a complete tearing of Lateral Collateral Ligament (LCL). Anterior Cruciate Ligament (ACL) was entirely torn, and Posterior Cruciate Ligament (PCL) had a high-grade intra-sheath tearing. Medial Patellofemoral Ligament (MPFL) showed a grade 2 sprain along with a partial avulsion from femoral insertion. Arcuate fracture at the fibular tip along with subjacent edema was also noticed as a result of Popliteofibular Ligament (PFL) avulsion (Figure 2).

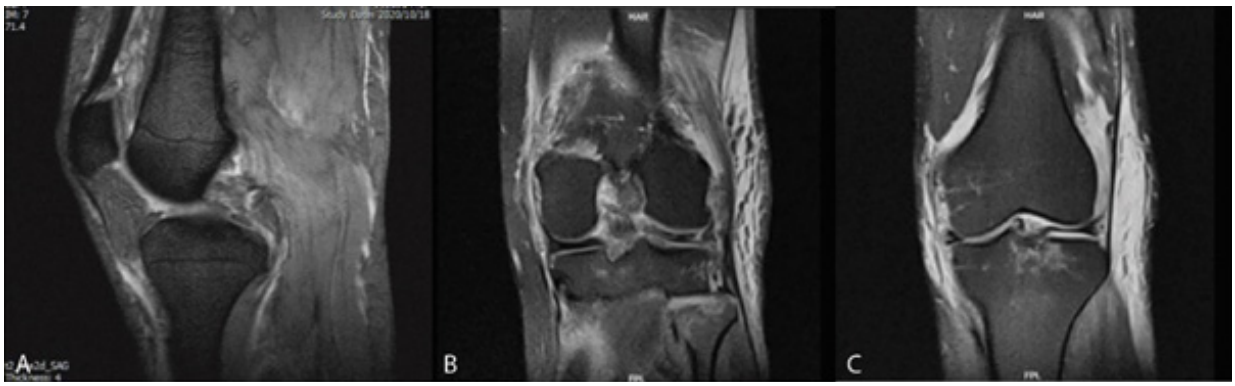

Figure 2: The preoperative MRI images. (A) ACL is completely torn. (B) LCL is completely torn. (C) MCL is severely injured.

According to the MRI report, it was a severe injury. 3 out of 4 compartments of the knee were severely injured. To detect any neurovascular injury The patient was carefully examined.

The surgery was performed after stabilizing the patient's condition which was two days after the accident. Tibial shaft fracture was fixed using plates and screws to obtain proper stability

and facilitate a later, second stage ligament reconstruction. Four days after initial surgery, the patient was taken back to operation room to repair the ligament injury. ACL and LCL tearing were fixed using suture anchors and PFL tearing was fixed with a screw (Figure 3). Hinged knee brace was used for immobilizing the limb for six weeks. After six weeks, gradual rehabilitative exercises began, and three month later the patient was able to do daily activities. In the case of knee joint capsule sprain and acute phase edema, PCL injury was managed non-operatively.

Figure 3: Immediate postoperative radiographs. (A) and (B) Tibial shaft fracture fixation with plate and screw. (C) and (D) Suture anchor used for fixation of LCL avulsion.

Discussion

Knee dislocation is uncommon and accounts for less than 0.5% of joint dislocations [10]. The incidence of knee dislocation observed at the time of admission to any institution is even lower per year and varies from 1/10,000 to 1/100,000 [11,12]. Common mechanisms of injury include high-energy injuries, including collisions with motor vehicles and sports-related injuries [13]. There are five types of knee dislocation: anterior, posterior, medial, lateral, and rotatory [1]. Anterior dislocation of the knee is the most common type of knee dislocation, which occurs as a result of hyperextension of the knee [14]. Dislocation of the knee is commonly combined with multi-ligament injury [15]. The internationally accepted treatment of choice in ligament injury is immediate surgical reconstruction [16].

In 2004, Harner [17] conduct a clinical study on a series of 33 patients underwent surgical treatment for the knee dislocation acutely (less than three weeks after the injury) and twelve, chronically. Those who underwent early treatment were had higher subjective scores and better objective restoration of knee stability than patients treated chronically. However, there was no difference in the range of motion and almost all patients had few problems with performing daily activities [17]. In another similar study, Liow et. al. [18] demonstrated that there was no difference in knee functional loss between acutely and chronically treated groups. However, the results were better in terms of overall knee function, activity level, and anterior translation of the tibial in those who had been treated within two weeks of injury [18].

Tibial shaft fracture can be treated by limb immobilization in low energy fractures or intramedullary nailing in high energy fractures. Although, the treatment choice is intramedullary nailing, in complex fractures, we are not able to use this procedure [19]. As a result, we look into another treatment choice.

The exact mechanism of injury causing knee dislocation, multi-ligament injury, and tibial shaft fracture is unknown. However, it is a limb threatening trauma that could cause severe limb disfunction in the long term if not managed properly. In our patient, according to the severe multi-ligament injury in lateral, anterior, and posterior compartments of the knee with simultaneous tibial shaft fracture, we performed two-stage surgical treatment with delayed reconstruction of ligament injury. Tibial shaft fracture was fixed with plate and screw in first stage to obtain stability for second stage surgical reconstruction of multi ligament injury. Suture anchor was used for ACL repair while PCL was managed non-operatively.

An important point to note is that in the presence of such complex fractures, the small components of the injury may be easily missed, which can lead to long-term devastating consequences for the patient. One of the components of this complex damage in our case was the arcuate line caused by an avulsion fracture of the fibular head [20] and consider as a pathological sign for posterolateral injuries of the knee. A fibular styloid arcuate complex avulsion is due to damage to the posterolateral structure of the knee or tearing ACL, PCL, LCL, and Medial Collateral Ligament (MCL). It is critical to diagnose and treat avulsion fractures due to the problems they may cause in the long term, like joint instability or osseocartilaginous injuries [21,22].

Conclusion

The knee Is a very complicated joint with many soft tissue components including vessels, nerves and ligaments. Every trauma to the knee must be evaluated and managed carefully. In this case of combined tibial shaft fracture and dislocation of the knee, it was essential to fix the tibial shaft fracture, at the first place. After stabilizing the fracture, the ligaments injuries were repaired. As a result, we were able to start the rehabilitative exercises in 6 weeks after surgery.

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