CASE REPORT

Irreducible lateral knee dislocation with incarceration of the lateral femoral condyle in the posterolateral capsuloligamentary structures: a case report and literature review

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Introduction

Knee dislocations are relatively rare¹, often associated with neurovascular injury, and usually amenable to closed reduction². The irreducible knee dislocation is an even rarer occurrence^{3,4}. Irreducibility of a knee dislocation is usually due to the medial femoral condyle being button-holed through the gap formed by medial capsuloligamentary structures. We have treated a rare irreducible dislocation of the left knee in which the neurovascular status was intact. MRI revealed entrapment of the posterolateral capsuloligamentary structures in the intercondylar notch. Emergency operation was performed to reduce the dislocation and reconstruct the injured ligaments. We have described the case in order to present the characteristics of this dislocation and guidelines for its diagnosis and treatment.

Case report

The patient was injured in a car-pedestrian accident when crossing a road on 17 April 2009. The car struck his left knee directly on its anteromedial aspect. Severe pain and abnormality was noted by the patient immediately after injury and he was transferred to our department complaining of pain in his left knee. Careful physical examination revealed normal vital signs, intact airway and clear breath sounds. His neurovascular status was intact. The pulses were strong and equal in all extremities. The patient had an obvious lateral dislocation of the left knee,

with both femoral condyles tenting the skin and a characteristic puckering on the medial aspect of the knee. Lateral dislocation was documented on radiographs (Fig. 1). The anteroposterior view demonstrated lateral dislocation of the left knee, the lateral view showing no obvious dislocation in the sagittal plane. The radiographs also revealed avulsion fracture of the superior patellar margin. Several attempts at manual manipulation under sedation and anesthesia were made but it was not possible to reduce the dislocation.

Magnetic resonance imaging was performed to detect ligamentous injury. The MR images showed disruption of the anterior and posterior cruciate ligaments, medial and lateral collateral ligaments, menisci and capsule (Fig. 2). It could also be observed on the MR images that manual reduction was being prevented by interposition of the posterolateral capsuloligamentary tissues, which appeared to be tightly adherent to the lateral femoral condyle (Fig. 2).

Emergency surgery was therefore indicated to reduce the dislocation and repair the injured ligaments. Antero-medial arthrotomy was performed and the knee joint exposed. Direct observation revealed that the proximal left tibia had dislocated laterally to the femur, the lateral joint capsule and fibular collateral ligament were disrupted, and the posterolateral capsuloligamentary structures had dislocated into the intercondylar notch. The posterolateral capsuloligamentary structures were incarcerated in the lateral compartment and tightly adherent to the lateral femoral condyle. This was what had prevented reduction of the dislocation of the knee joint. The left knee was flexed and both anterior and posterior cruciate ligaments were found to be disrupted. The posterolateral capsuloligamentary structures had been extruded from the intercondylar notch, which had almost resulted in spontaneous reduction of the knee joint. The dislocation was reduced and rigidly fixed with an external fixator, the knee being held in slight flexion. The menisci were

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Figure 1 (A) Anteroposterior and (B) lateral radiographs of the left knee demonstrating lateral dislocation.

trimmed and sutured. The anterior and posterior cruciate ligaments were reconstructed with autologous patellar tendon and the tendon of the biceps femoris using biodegradable interference screws, respectively. Six staples were used to further reinforce the reconstruction. The lateral and medial collateral ligaments were tightly sutured by weaving prosthesis. Postoperative radiographs demonstrated that the dislocated knee joint had been anatomically reduced (Fig. 3). The joint space of the left knee seemed normal.

The clinical course after operation was uneventful. The patient was initially managed with knee immobilization and no weight bearing. The external fixator was removed 6 weeks after surgery, after which the patient was allowed to move the knee and gradually increase weight bearing. At 15 months follow-up, radiographs of the left knee were

taken (Fig. 4A, B) and clinical examination revealed excellent function of the knee with some asymptomatic laxity in terms of stability.

Discussion

Knee dislocation is an uncommon injury. A significant proportion of knee dislocations reduce spontaneously at the scene of the accident⁵. Some of the remaining dislocations are amenable to manual reduction. However, not all knee dislocations are easily reduced. Irreducible knee dislocation, which cannot be reduced by manipulative reduction even with the patient under general anaesthesia, is rare. The majority of irreducible knee dislocations are posterolateral⁴. Irreducible knee dislocation is usually due to buttonholing of one or both femoral condyles through

Figure 2 MR images at different levels revealing disruption of the cruciate and collateral ligaments and, in particular, interposition of the posterolateral capsuloligamentary structures, which are entrapped in the intercondylar notch. (A) Coronal T1-weighted MR images; (B) coronal T2-weighted MR images.

Figure 3 A unilateral external fixator spanning the distal femur and the proximal tibia was applied to maintain reduction. (A) Anteroposterior view; (B) lateral view.

the joint capsule⁶. Entrapment of the capsuloligamentary elements in the intercondylar notch, with or without dislocation of the patella, is the specific causal mechanism for irreducible dislocation⁷⁻⁹. Up until now, incarcerated patellar tendon¹⁰, vastus medialis¹¹⁻¹⁴, anteromedial

capsule and retinaculum³, and the major part—the medial capsuloligamentary structures such as the medial capsule, the medial retinacular structures and the medial collateral ligament^{1-4,6,8,11,15-20}, have been emphasized as the principle factors which prevent closed manipulation.

Figure 4 Radiographs of the left knee at the latest follow-up. (A) Anteroposterior view; (B) lateral view.

Irreducible knee dislocation usually results from posterolateral dislocation but may exceptionally occur after lateral dislocation¹⁹. The medial collateral ligament and both cruciate ligaments are often injured in irreducible knee dislocations, but the lateral ligaments are usually spared^{2,6,21}. In the current case, not only the anterior and posterior cruciate ligaments, but also the lateral and medial collateral ligaments, were avulsed at the lateral dislocation of the left knee. Interposition of the posterolateral capsuloligamentary structures, which had dislocated into the intercondylar notch, prevented closed reduction. To the best of our knowledge, there are no previous reports describing irreducible dislocation of the knee joint secondary to incarceration of the posterolateral capsuloligamentary structures tightly adherent to the lateral femoral condyle.

A visible skin furrow along the medial joint line has been present in all cases of irreducible knee dislocation reported^{22,23}. Such a furrow is considered by Brennan *et al.* to be diagnostic²², and by Wand to be an indication for open reduction¹⁷, because it denotes interposition of the medial soft tissue into the joint space. This clinical finding is of great help in the diagnosis and treatment of such lesions and was present in our case. In addition to the interposition of the medial soft tissue into the joint space, the sign can also indicate irreducible lateral knee dislocation resulting from the interposition of posterolateral capsuloligamentary tissue into the joint space.

Substantial ligamentous injuries cannot be adequately assessed on the basis of their radiographic features. Siegmeth *et al.* have reported a case which had the same radiological characteristics as ours, yet in their case the fibular collateral ligament and both menisci were intact¹⁶. MRI scans are preferable because they allow preoperative diagnosis of entrapment of capsuloligamentary structures or muscle bundles^{14,19}. In our case, a preoperative MRI scan identified the main reason for the dislocation being irreducible, which facilitated surgery. Arthroscopy of a knee dislocation can help in identification of the incarcerated structures and planning of the surgical procedure. However, we did not perform arthroscopy in our case because it would have been difficult to reduce the knee dislocation and reconstruct the disrupted ligaments under arthroscopy. Knee dislocation is a potentially devastating injury with a reported high rate of neurovascular injury^{24–26}. However, in our case, examination of the left lower limb demonstrated intact neurovascular structures.

Evidence suggests that knee flexion, valgus stress, and external tibial and internal femoral rotation are important mechanisms in irreducible knee dislocations¹. Considering both the patient's description of the accident

and the characteristics of the dislocation, it seems likely that the injury mechanism was as follows: the initial impact on the left tibia dislocated it and avulsed the posterolateral capsuloligamentary tissues, the subsequent impact on the distal femur then shifted its external condyle posterolaterally to the posterolateral capsuloligamentary elements. The significant dislocation of the tibia, comparatively moderate dislocation of the femur and mild dislocation of the avulsed capsuloligamentary structures together lead to a rare irreducible dislocation of the left knee.

Because major ligamentous injury, which would result in severe instability of the knee, is likely to be present, irreducible knee dislocation should be managed surgically. The goal is to provide stability of the knee joint without causing long-term stiffness and reduction in range of movement. Surgery followed by early mobilization and gradual increase in weight bearing can ensure a satisfactory outcome.

This paper highlights rare irreducible dislocation of the knee joint resulting from entrapment of the posterolateral capsuloligamentary elements in the intercondylar notch. We recommend that patients with irreducible dislocation of the knee joint should routinely undergo MR scan to determine the main reason for the irreducibility. We also wish to emphasize the importance of prompt surgical intervention followed by early rehabilitation and exercise. Open reduction, external fixation, and early physical therapy can lead to an excellent functional outcome.

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