

## Case report

# Open reduction of irreducible posterolateral rotary knee dislocation without sectioning of incarcerated vastus medialis: A case report with video illustration



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## ABSTRACT

Traumatic knee joint dislocations are relatively rare. Most of knee dislocations are reduced by closed manipulation. However occasionally, especially in the case of soft tissue incarceration, closed reduction may not be possible and open reduction is mandatory. This report introduces a case of irreducible posterolateral rotary knee dislocation with interposition of vastus medialis treated through two-staged operations. In this report, we included preoperative magnetic resonance images (MRI), detailed intraoperative descriptions with photographs and video illustration that show the status of an injured knee joint and the effectiveness of the treatment.

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## 1. Introduction

Knee dislocation is an uncommon but serious injury with potential long-term implications representing less than 0.2% of all orthopedic injuries [1]. Irreducible knee dislocations are much more rare and should be reduced using open manipulation. Various soft tissue structures have been found to be cause of irreducibility including medial retinaculum and joint capsule, medial collateral ligament and muscles around knee joint. These structures can invaginate into the femorotibial joint and prevent the closed reduction. Most commonly the free end of torn medial collateral ligament (MCL) contributes to failed closed reduction, however rarely the vastus medialis can be the cause of irreducibility by interposing in the narrow intercondylar notch. And in the previous case, the muscle belly crossing the notch was sectioned for the reduction [2].

In this study, we present a case of irreducible posterolateral rotary knee dislocation with vastus medialis interposition. Here, we describe the preoperative physical status and MRI, intraoperative findings, treatment and postoperative progress in a more detailed manner using photographs and video illustration.

## 2. Case report

A 45-year-old man was admitted to the emergency service 6 h after trauma for definitive treatment. The patient received initial care at other

local hospital for recognized knee joint dislocation, but closed manipulation failed. In his history, it was reported that he injured his right knee from crushing to a fence during skiing and at the time of injury his knee was slightly flexed and abducted.

Physical examination revealed that the right knee joint nearly fixed at 25° of flexion with prominent swelling. So the ligament stability could not be evaluated. In addition to the posterior sag of the right tibia, lateral subluxation of patella was accompanied. On the medial aspect of the injured knee, characteristic dimpling of skin, so called “dimple sign”, with skin bruise was observed over the medial joint line (Fig. 1) [3]. Because this sign indicated the irreducibility, we did not try closed reduction any more. The medial femoral condyle was palpable under the ecchymotic skin on the medial aspect of the injured knee joint like bone to skin area in the anteromedial aspect of proximal tibia. There was no neurovascular deficit in the injured limb revealed by arterial Doppler examination and the ankle-brachial index (ABI) was 1.1 (An ABI less than 0.9 suggests a vascular injury). But the concern for possible occult vessel injury (ie, intimal tear) prompted further evaluation, and the following CT angiography showed no remarkable finding in the injured limb.

In plain anteroposterior and lateral radiographs of knee joint, medial joint space was wider than normal and tibial posterolateral displacement with valgus alignment was observed. As examined, lateral subluxation of patella was identified. No ligamentous bony avulsion and concomitant fracture were notified (Fig. 2).

The magnetic resonance images (MRI) revealed an abnormal 1.5-cm thick band-like structure in the intercondylar notch and patellar groove. The signal intensity was similar to adjacent muscles and the structure was wrapping the distal femur completely in sagittal images at intercondylar notch area (Fig. 3-C). So, we thought this abnormal

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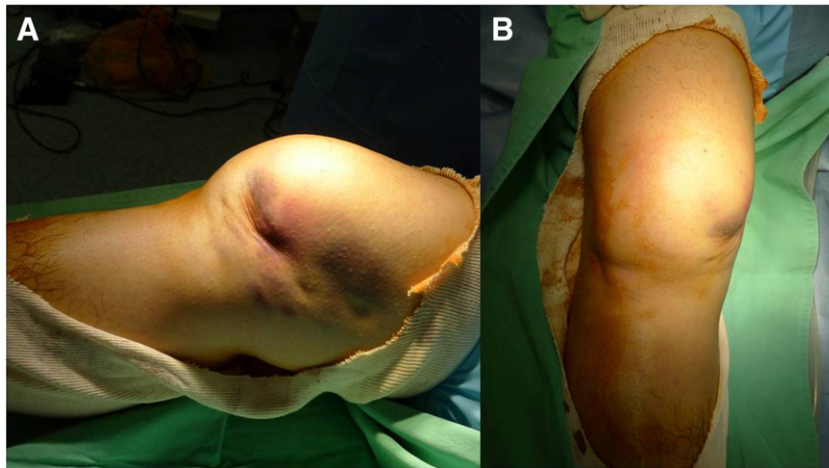


Fig. 1. A, B. Preoperative clinical photographs. Characteristic skin puckering (Dimple sign) over the medial joint line with ecchymosis.

structure to be an incarcerated muscular structure. In the coronal images, the medial capsule and torn MCL were invaginated into medial joint space along with the large muscular mass (Fig. 3-A, B). Both anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) were completely ruptured at their substances without evidence of avulsion fracture. There were no remarkable findings in lateral soft tissue structures and cartilage surfaces. However, it was difficult to evaluate the exact status of the menisci. In the fat suppressed T2-weighted images, we could identify bone edema in lateral femoral condyle.

The first surgical intervention was performed on the day of admission. There was no further trial of closed reduction under general anesthesia. After the skin and soft tissue dissection by a median longitudinal incision, the medial femoral condyle was observed just under the subcutaneous tissue with buttonholing the vastus medialis (Fig. 4-A). Arthrotomy was performed using medial parapatellar approach and then an interposed muscle bundle in the intercondylar notch was more clearly identified (Fig. 4-B). Gentle reduction of incarcerated bundle of vastus medialis was performed using a Cobb's elevator by fulcrum and lever effect (Video 1). The other invaginated soft tissues including capsule and torn MCL were also removed from medial joint space. Finally concentric reduction of the knee joint was achieved. It was seen that both ACL and PCL were completely ruptured, both superficial and deep MCL and semimembranosus tendon were injured completely near the tibia attachment sites. But the posterolateral structures were intact.



Fig. 2. A, B. Preoperative plain radiographs. A. Widening of medial joint space with lateral patellar subluxation. B. Posterior displacement of tibia with inferiorly displaced patella. There is no evidence of ligamentous bony avulsion.

The MCL was repaired with direct suture and reinforced with an additional bony staple. The semimembranosus tendon was secured to its tibial attachment site with bony anchor suture (Fig. 4-C). After two weeks' immobilization, patient started ROM exercise increasing the degree by 15° weekly under protection of the PCL brace. At 2 months after operation, patient restored nearly full range of motion (ROM) from 0° to 130° and physical examination revealed grade II Lachman test and grade III posterior drawer test.

At three months after initial surgical intervention, we performed second operation for injured knee joint instability. After routine arthroscopic examination, we performed the reconstruction for both ruptured ACL and PCL simultaneously. For the ACL rupture we used tibialis anterior allograft and for the PCL rupture Achilles tendon allograft was used. Six months following second operation, grade I posterior drawer test was identified but Lysholm knee score was 85 points and HSS score was 100 points. There was no lack of ROM in the right knee compared with the left knee (Fig. 5).

### 3. Discussion

Knee joint dislocation is relatively an uncommon injury with a high rate of associated vascular and neurologic injuries as well as potentially limb-threatening complications. According to the direction of displacement of dislocated tibia, knee dislocations are classified into anterior, posterior, lateral, medial and rotary [4]. Although the irreducible knee dislocations are rare, posterolateral rotary dislocations are mostly irreducible due to the soft tissue interposition [3,5–7]. The posterolateral rotary knee dislocations are induced in the knee flexion position under the effect of valgus stress with tibial internal rotation or external rotation [3]. Considering laterally subluxated patella, the mechanisms of the injury in our patient were knee flexion, valgus stress and tibial external rotation.

At the physical examination in these posterolateral rotary knee dislocations, skin furrow at medial joint line is one of the most characteristic findings. Already several previous literatures described it as 'Dimple sign' [3,7]. The dimpling of skin results from incarceration of underlying soft tissue structures into medial joint space. It means irreducibility of the dislocation and can be an indicator for open reduction. If there is a delay in performing open reduction, the risk of skin necrosis will increase. In this case, we were already aware of the importance of this sign through review of literatures, so we did not try any more closed manipulation. Above the skin puckering, we could palpate buttonholed medial femoral condyle circumscribed by around soft tissue under the subcutaneous tissue. This hard palpation can be a clue for vastus medialis or medial retinacular buttonholing and an additional evidence of irreducibility in posterolaterally dislocated knee physical examination. Major concern

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