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CASE REPORT

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# Irreducible open posterolateral knee dislocation due to medial meniscus interposition

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Posterolateral knee dislocations are generally irreducible due to the interposition of the medial capsule and retinaculum. These injuries have a 'dimple sign' which shows the invagination of the tissues in the medial joint line. We present an unusual case of an open posterolateral traumatic knee dislocation (KD-4 [ACL/PCL/MCL/LCL-PLC torn] open knee dislocation) without a 'dimple sign'. Closed reduction attempts were unsuccessful. In surgery, it was found that the medial meniscus was detached from the meniscocapsular junction and entrapped in the joint. The medial meniscus was extracted from the joint, and the joint was reduced. The medial meniscus was sutured to the meniscocapsular junction with anchors. This is the first study reporting medial meniscus interposition in an open posterolateral knee dislocation. Moreover, the presented case is peculiar because although it was a posterolateral knee dislocation, the posterolateral ligament complex was also torn.

**Key words:** Dimple sign; knee dislocation; meniscal interposition; posterolateral ligament complex.

Irreducible knee dislocations are frequently seen in posterolateral knee dislocations[1,2] and open traumatic knee dislocations are rare.[3] The interposing tissues are the medial capsule and retinaculum,[1,2] vastus medialis[4-6] and medial meniscus.[7] This is the first study reporting medial meniscus interposition in an open posteroateral knee dislocation. It was previously reported that posterolateral structures were usually saved in posterolateral knee dislocations.[6] The presented case is extraordinary not only because it is the first study reporting medial meniscus interposition in an open posterolateral knee dislocation, but also due to an accompanying posterolateral ligament complex disruption.

## Case report

A 44-year-old female was admitted to the emergency ward after a motorcycle accident. She had an isolated open injury in the left knee. Radiographic examination showed a posterolateral dislocation of the left knee and a distal pole patellar fracture (Fig. 1). After initial emergency care, she was taken to the operating theatre. The wound around the knee was 10 cm long and extended from the distal pole fracture of the patella to the medial side of patellar tendon insertion and medial femoral condyle, exposing the fracture site and the knee joint (Fig. 2). It was irrigated, debrided and primarily sutured. Closed reduction attempts of the dislocation were unsuccessful and the joint remained subluxed. Doppler ultrasonography (DUS) did not reveal any vascular injury. Magnetic resonance imaging (MRI) showed medial meniscal detachment and a completely ruptured medial collateral ligament (MCL), anterior cruciate ligament (ACL), posterior cruciate ligament (PCL) (Fig. 3) and posterolateral ligament complex

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**Fig 1.** Preoperative **(a)** anteroposterior and **(b)** lateral radiographic views.

(lateral [fibular] collateral ligament [LCL], popliteofibular ligament [PFL] and popliteus tendon [PoT]) injury (Fig. 4). In addition, there was a distal pole patella fracture with a partial patellar tendon rupture from the tibial side (Fig. 4). The injury was classified according to Schenck et al.'s[8] anatomic classification of knee dislocations (Table 1), modified by Wascher et al.[9] as a KD-4 (ACL/PCL/MCL/LCL-PLC torn) open knee dislocation. In the definitive surgery, an extended anteromedial incision was performed. The medial femoral condyle was extraarticular and could not be reduced. The medial meniscus was detached peripherally from the capsule and was positioned intraarticularly, creating a locking effect on the medial femoral condyle that prevented it from being reduced back to its original location. For reduction, the medial meniscus was grasped with a clamp and extracted from the joint while the medial condyle was pushed over it. The extracted medial meniscus was held in place to the capsule with suture anchors placed in the meniscocapsular junction. The ruptured ACL and PCL were reconstructed with double-bundle hamstring tendon autografts taken from the ipsilateral and contralateral knees. The MCL and posterolateral ligament complex were repaired primarily. The distal pole fracture of the patella was not anatomically reduced because the body of the patella did not rise proximally and the

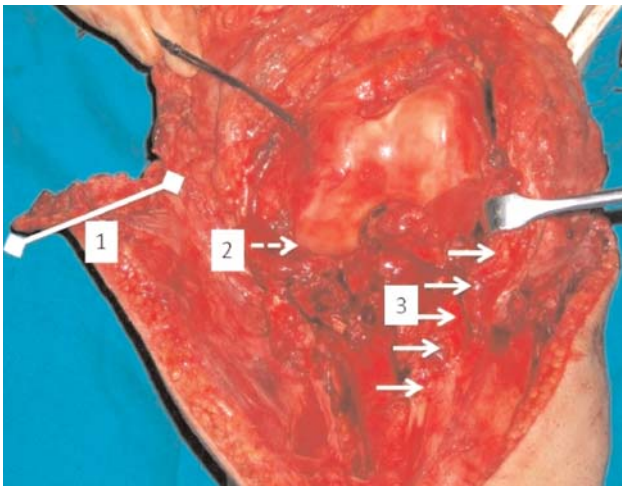


**Fig. 2.** **(1)** 10 cm long skin flap extending from over the distal pole fracture of the patella to the medial side of patellar tendon insertion and medial femoral condyle exposing the fracture site and the knee joint. **(2)** Medial meniscus is detached from the capsule and intraarticularly displaced. This interposition prevents reduction of the knee joint. **(3)** Distal patellar pole fracture with partial patellar tendon avulsion. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

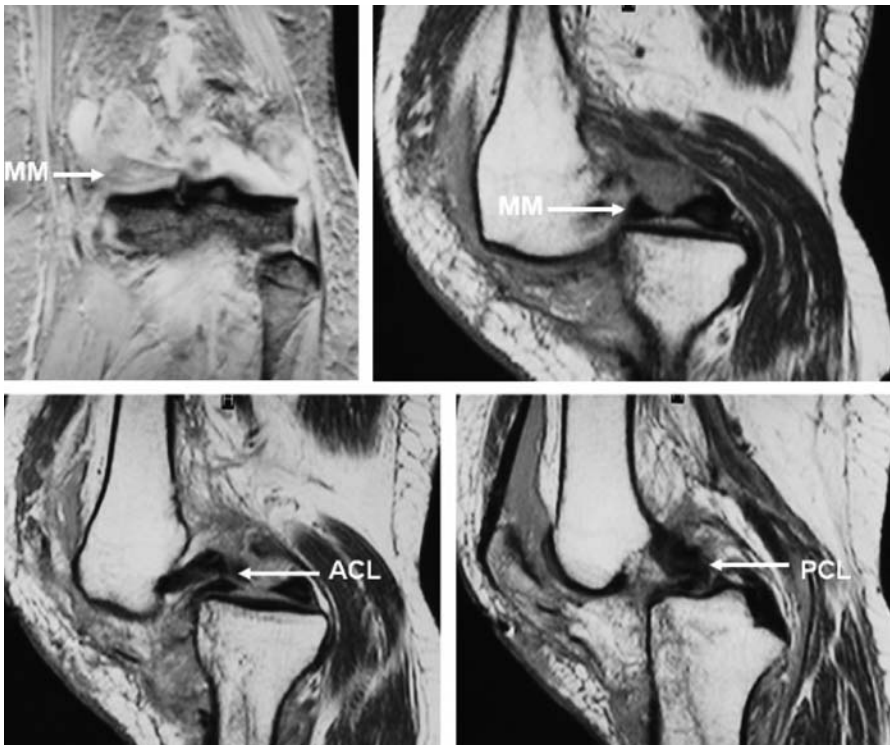


**Fig 3.** Preoperative coronal and sagittal MRI views (MM: intraarticularly displaced medial meniscus, ACL: ruptured anterior cruciate ligament, PCL: ruptured posterior cruciate ligament).

patellar tendon remained partially intact in this area. Number 2 polyester sutures were passed through the fracture site in an over-and-over fashion and the patellar tendon was secured to the patellar body in this manner. The partial patellar tendon avulsion from the tibial side was repaired with suture anchors. After a two-year follow-up, the knee joint remained reduced with no subluxation (Fig. 5).

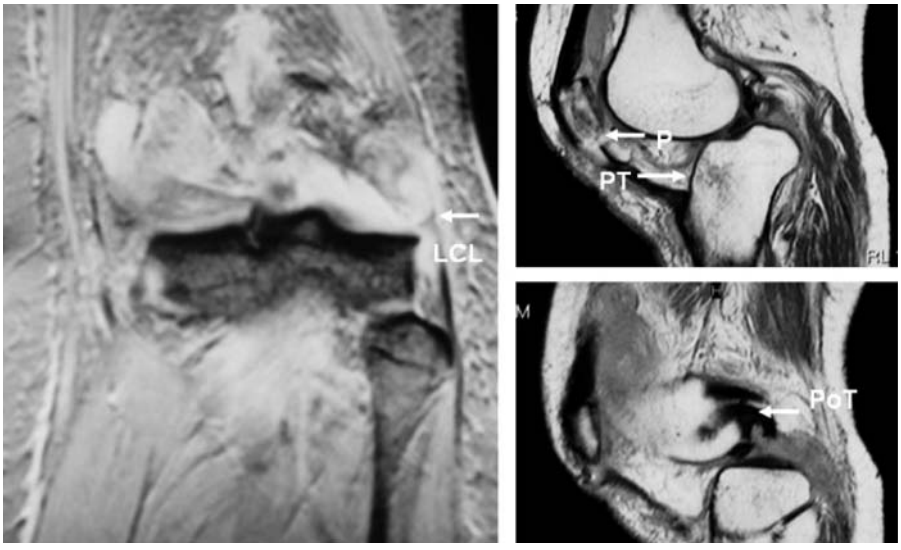


**Fig 4.** Preoperative coronal and sagittal MRI views (LCL: Ruptured lateral collateral ligament, PoT: Ruptured popliteus tendon, P: Distal pole patella fracture, PT: Partial patellar tendon avulsion from tibial side).

## Discussion

Knee dislocations are uncommon, constituting less than 0.5% of all joint dislocations.[10] The most common knee dislocations are anterior dislocations (40%), followed by posterior (33%), lateral (18%), and medial (4%) dislocations.[10] Posterolateral knee dislocations are rare and potentially irreducible.[1,2] The interposition of the soft tissue into the knee joint prevents reduction. These are the medial capsule and retinaculum,[1,2] the vastus medialis muscle[4-6] or the medial meniscus.[7]

The 'dimple sign' results from the medial capsule and retinaculum[1,2] or vastus medialis muscle interposition[4-6] and is considered the classic presentation of irreducible knee dislocation.[1,2] The 'dimple sign' was absent in Baxamusa and Galloway's two cases of closed knee dislocations with meniscal interposition.[7] Said et al. reported a chronic irreducible posterolateral knee dislocation in which the patient presented with continued instability, fixed valgus deformity, and no 'dimple sign'.[11] They attributed the absence of the 'dimple sign' to the chronicity of the injury. The 'dimple sign' was also absent in the presented case. The underlying cause can be attributed to the high-energy trauma; as the medial soft-tissue structures did not buttonhole in the joint, the energy

**Table 1.** Anatomic classification of knee dislocations.

| KD | Injury pattern |
|---|---|
| **KD-1** | Single cruciate type<br>ACL+MCL/LCL torn, PCL intact, more common<br>PCL+MCL/LCL torn, ACL intact |
| **KD-2** | ACL+PCL torn, MCL+LCL intact, clinically rare |
| **KD-3** | KD-3M = ACL+PCL+MCL torn, LCL+PLC intact<br>KD-3L = ACL+PCL+LCL+PLC torn, MCL intact |
| **KD-4** | KD-4 = ACL+PCL+MCL+LCL+PLC torn |
| **KD-5** | Knee fracture dislocation, fracture on the femoral/tibial side<br>KD-5.1 = FxDx+ACL or PCL torn<br>KD-5.2 = FxDx+ACL+PCL torn<br>KD-5.3 = FxDx+ACL+PCL+MCL or LCL+PLC<br>KD-5.4 = FxDx+ACL+PCL+MCL+LCL+PLC |
| **C** | Circulatory injury, mostly popliteal artery |
| **N** | Neurologic injury, mostly peroneal nerve |

KD: Knee dislocation; FxDx: Fracture dislocation; ACL: Anterior cruciate ligament; PCL: Posterior cruciate ligament; MCL: Medial collateral ligament; LCL: Lateral kollateral ligaman; PLC: Posterolateral kompleks; +: and; /: and/or.

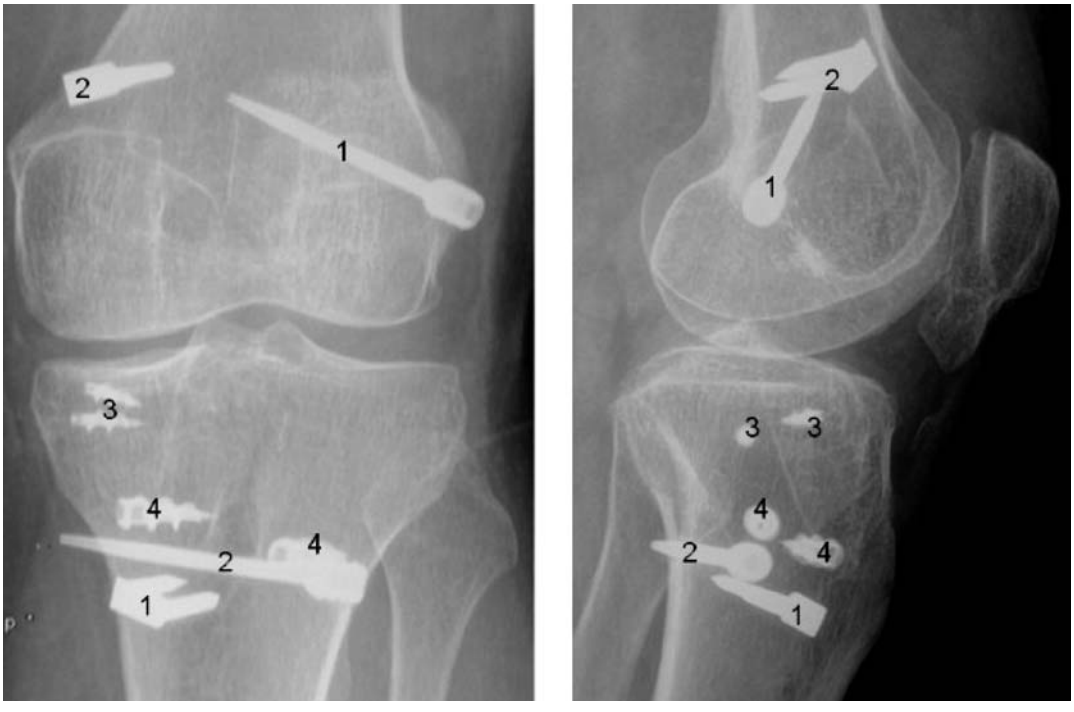


**Fig 5.** Postoperative anteroposterior and lateral radiographic views at the two-year follow-up. **(1)** Transfix, bioabsorbable screw and staple for ACL reconstruction. **(2)** Transfix, bioabsorbable screw and staple for PCL reconstruction. **(3)** Anchors for medial meniscocapsular junction repair. **(4)** Anchors for repairing patellar tendon partial avulsion from tibial side.

created could not be absorbed, resulting in an open injury.

Approximately one-third of high-velocity knee dislocations are associated with vascular injury.[12] In irreducible dislocations with a 'dimple sign', further displacement of the knee joint is prevented by the invagination of the soft tissue into the joint, reducing the risk of vascular injury.[2] However, in cases with muscular buttonholing, the destructive force created is much greater and can damage the vascular tissues.[5] In the present case, the open injury was graded as 3A according to the Gustilo open fracture classification. Despite being a high-velocity open injury, no vascular injury or impairment was detected. This supports the findings of Rios et al. who suggested that it is difficult to predict which structures will be damaged in a particular kind of dislocation.[13] It is also difficult to correlate the severity of the dislocation with the vascular injury.

Silverberg et al. proposed that the posterolateral structures remain intact in a posterolateral rotatory knee dislocation.[6] The valgus and external rotation forces applied to the tibia during injury compress the structures stabilizing the posterior and lateral side of the knee. This leads to the shortening of these structures which results in the protection from tearing or avulsion. In the present case, MRI showed a torn posterolateral ligament complex (LCL, PFL and PoT) which was confirmed by operative findings. We think that the lateral structures are at risk of damage in a posterolateral knee dislocation, depending on the direct proportion to the velocity of the injury.

The presented case is unique because the patient had a combination of rarely encountered multiple injuries, namely, an open posterolateral irreducible knee dislocation without a 'dimple sign' caused by the interposition of medial meniscus and posterolateral ligament complex disruption, without any vascular injury despite an underlying high-velocity trauma.

**Conflicts of Interest:** No conflicts declared.

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