Acute patellar dislocation with multiple ligament injuries after knee dislocation and single session reconstruction

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Abstract

Knee dislocation is a relatively rare condition of all orthopaedic injuries. Accompanying multiple ligament injuries are common after knee dislocations. A 41-year-old male presented to the emergency department suffering from right knee dislocation in June 2013. The patient had anterior cruciate ligament, medial collateral ligament (MCL), medial patellofemoral ligament (MPFL) rupture, and lateral meniscal tear. A single-bundle anatomic reconstruction, medial collateral ligament reconstruction, medial patellofemoral ligament reconstruction and meniscus repair were performed in single session. At twelve months follow-up; there was 160º flexion and 10° extension knee range of motion. Lysholm knee score was 90. Extensive forces can cause both MCL and MPFL injury due to overload and the anatomical relationship between these two structures. Therefore, patients with valgus instability should be evaluated for both MPFL and MCL tears to facilitate successful treatment.

Keywords: Knee, Multiligament injuries, Medial collateral ligament, Medial patellofemoral ligament, Patellar dislocation.

Introduction

Knee dislocation is a relatively rare condition with an incidence of approximately 0.2% of all orthopaedic injuries. Traffic accidents are the most common cause of knee dislocation and sports injuries are also considered an important factor due to the spread of contact sports.[1] Multiple ligament injuries are common after knee dislocations. The most frequently injured ligament is the cruciate ligament, accompanied by medial collateral ligament or posterolateral corner injury.[1] Before surgery, a detailed physical examination and preoperative planning are important to identify possible additional injuries such as popliteal artery, peroneal nerve injury and concomitant posterolateral corner and cruciate ligament injuries.

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Patellar dislocations are a common problem occurring in young physically active subjects. The medial patellofemoral ligament (MPFL) is the primary stabilizer of the patella, and biomechanical studies indicated that it accounts for 53% - 67% of the total medial restraining force preventing lateral patellar dislocation. This primary stabilizer is frequently torn with acute patellar dislocation.[2]

The medial collateral ligament (MCL) complex is one of the most commonly injured ligamentous structures of the knee joint which is the most important structure exerting the largest load response to both valgus and external rotation torques that may cause severe valgus instability with the rupture.[3]

Here, we present the case of a patient who underwent surgical treatment for medial patellofemoral ligament injury-associated acute patellar dislocation in addition to anterior cruciate ligament and medial collateral ligament injury after knee dislocation.

Case Report

A 41-year-old male presented to the emergency department suffering from right knee dislocation after a fall from a height of about 1 m at home in June 2013. The patient was conscious. There was no loss of skin or tissue. Distal pulses were palpable and no circulation problems were detected by Doppler ultrasonography. There was no evidence of compartment syndrome and ankle/brachial index was 1.2. The knee was reduced under anaesthesia, a long leg splint was applied with 20° flexion, and careful follow-up for circulation was performed. The results of physical examination were as follows: anterior drawer test, valgus stress test at 30° flexion, and McMurray findings were positive; posterior drawer test, varus stress test, external rotation recurvation test, quadriceps active test, posterolateral drawer test, and dial test were negative. The patient had patellar instability with positive apprehension test. Radiographic examination showed no evidence of fracture. MRI showed anterior cruciate ligament, medial collateral ligament, medial patellofemoral ligament rupture, and a lateral meniscal tear (Figure-1). There were no additional problems at follow-up and surgery was planned after 17 days.
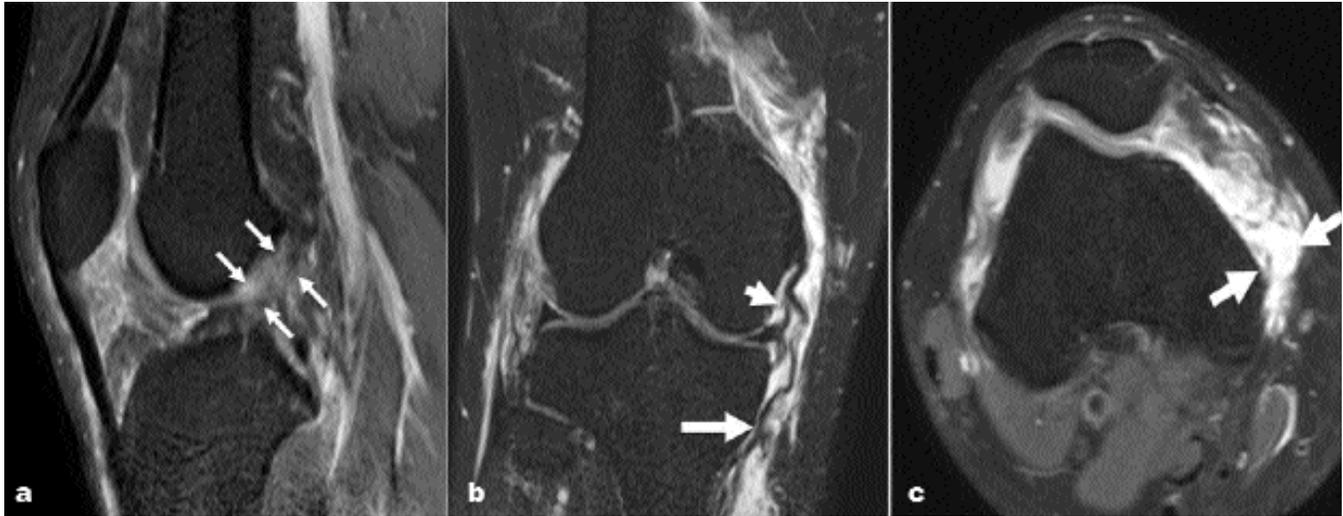
Figure-1: The ruptured ACL (a); full-thickness ruptured MCL (b); ruptured MPFL (c) is visualized with white arrows on MRI sequences.

Figure-2: Postoperative MR images of the knee show ACL graft, tibial and femoral tunnels (a); reconstructed MCL (b) and reconstructed MPFL are showed with arrows.

Single-bundle ACL reconstruction with achilles allograft was performed for ACL reconstruction (Figure-2a). The operation was performed under spinal anaesthesia and a pneumatic tourniquet was used. First, the knee joint was arthroscopically evaluated through standard anteromedial and anterolateral portals. Accompanying lateral meniscus radial tear was detected and repaired by an all-inside technique.

A single femoral tunnel was used at the center of the femoral ACL insertion. An awl was used to identify the appropriate position between the anteromedial (AM) and posterolateral (PL) bundles. The knee was hyperflexed to

produce a tunnel of adequate length to avoid articular cartilage injury and protect neurological structures. A 9-mm reamer was selected according to the size of the allograft and a 30-mm tunnel was drilled between the AM and PL bundles. Tibial tunnels were at an angle of 55° to the long axis of the tibia and a guide pin was inserted to the footprint of the tibial attachment of the torn ACL. Notchplasty was not performed during surgery. Following preparation, the achilles tendon allograft was inserted through the tunnels. After insertion of the graft into the tunnels, flexion and extension were performed to test impingement. The knee joint was then evaluated

arthroscopically in terms of tension of the graft and the position of the tibial fixation device to ensure that it did not protrude into the joint. The knee was tested using anterior drawer and Lachman tests, and the results were negative.

For MCL injury, reconstruction was performed using the technique described by Laprade et al (Figure-2b).[4] An anteromedial incision was made from 4 cm medial to the patella and extending over the midportion of the tibia 8 cm distal to the joint line. The fascial expansion of the sartorius muscle was incised and the gracilis and semitendinosus tendons were exposed to allow access to the distal tibial attachment site of the superficial medial collateral ligament. The distal tibial attachment of the superficial medial collateral ligament was identified deep within the pes anserine bursa. A passing pin was drilled through the center of the distal attachment site and transversely across the tibia. A 7-mm reamer was then used to ream to a depth of 25 mm.

At the posteromedial tibia, just anterior to the attachment of the semimembranosus tendon, the posterior oblique ligament attachment was identified. A small incision parallel to the fibers of the posterior edge of the anterior arm of the semimembranosus tendon was made and a passing pin was drilled across the tibia toward Gerdy's tubercle. Then a 7-mm reamer was used to drill into the tunnel to a depth of 25 mm. After drilling the tibial side, the attachments of the superficial medial collateral ligament and posterior oblique ligament on the femur were identified and a 7-mm reamer was used to drill into both reconstruction tunnels to a depth of 25 mm.

The posterior oblique ligament and superficial medial collateral ligament grafts were pulled into their respective tunnels. A cannulated bioabsorbable screw was then inserted to secure the reconstruction grafts into their positions. The two reconstruction grafts were then passed distally. The posterior oblique ligament graft was tightened and fixed in its tibial tunnel in full extension. Then, the superficial medial collateral ligament graft was fixed in its tibial tunnel in neutral rotation, at 20° knee flexion and slight varus.

For MPFL reconstruction, the medial border of the patella was exposed subperiosteally, avoiding injury of the joint capsule. Two parallel tunnels were drilled to a depth of about 1.5 cm at the superomedial half of the patella. The fresh frozen tibialis posterior allograft tendon was then inserted into the tunnel. The anatomical femoral insertion of the MPFL was identified under fluoroscopic control using the indirect radiographic method described by Schottle et al.[5] A blind-ending femoral tunnel was then drilled and the graft was drawn between the second and third joint capsule layers to the femoral insertion point. A locking suture was passed through the transepicondylar axis, pulling the graft into the medial tunnel. The knee was cycled from full flexion to full extension with the graft under tension. The graft was then secured within the medial condylar tunnel using a bioresorbable interference screw with the knee flexed to 30° (Figure-2c). When securing the graft, the patella was pushed slightly laterally to avoid medial overtensioning.

At twelve months follow-up; there was 160° flexion and 10° extension knee range of motion. Lysholm knee score was 90. At 90°/second isokinetic muscle strength test; muscle strength loss was 14.1% in the extensor and 9.2% in the flexor group when compared with uninvolved knee.

Discussion

It is important to evaluate patients with dislocated knee systematically. Vascular injuries receive top priority followed by osseous and then ligamentous injuries. Magnussen et al.[19] recommended the following steps for evaluation of all knee injuries: (1) brief history taking focusing on energy and mechanism of injury, (2) brief neurovascular examination, (3) urgent attempt at reduction if the knee is still dislocated, (4) radiographic confirmation of reduction, (5) second neurovascular examination including ankle/brachial index (ABI), (6) ligamentous examination with analgesia or sedation, (7) knee immobilization, and (8) definitive radiographic studies. In patients without associated injuries necessitating delay, such as vascular injury or fractures requiring reduction, early surgery is preferred because of the superior results compared to late treatment.

Arterial injury, open fracture/dislocation, and irreducible dislocation are managed by urgent surgery. After preoperative planning, all components of the instability should be corrected during the same session.

Our patient had no accompanying injuries, such as vascular injury, peroneal nerve injury, or fracture requiring reduction, so we performed early management (on day 16) and preferred to address all injured ligaments in one setting to avoid potential subluxation, reduce forces on the healing grafts, and allow the patient to begin rehabilitation. According to the Schenck classification,[7] our case was KD-IIIM. As only PCL elongation was detected on MRI and posterior drawer test was negative, we did not reconstruct this ligament. We performed ACL reconstruction using the Achilles tendon allograft with the anatomical single-bundle technique using a far medial portal. We also performed meniscus repair for radial tear of the lateral meniscus with the all-inside

technique.

For combined injuries, surgical treatment of the medial side injury is preferred. There is no consensus regarding the choice of treatment method; i.e., primary repair or reconstruction. In our case, for medial side injury, we performed posteromedial anatomical reconstruction as described by Laprade et al.[4]

The anatomy of the medial knee structures are divided into three layers and both the MPFL and the superficial medial collateral ligament (sMCL) are structures of layer two. Based on the common insertion of these two ligaments, an injury causing an sMCL lesion can cause disruption of the MPFL at its femoral insertion. Hermann et al.[8] concluded that knees diagnosed with MCL tears should be evaluated for patellofemoral instability, as temporary patella dislocation could have been caused by the same injury. They suggested that acute lateral patellar dislocation may indicate a tear of the MPFL associated with concomitant injury of the MCL and both the MPFL and MCL should be managed operatively because isolated MPFL reconstruction often fails due to a persistent increase in the Q-angle. In our case, both the MCL injury and patellar dislocation were likely caused by the same injury, and MCL injury caused the dynamic increase in Q-angle and acted as an adjunctive patellar destabilizer.

Lateral subluxation of the patella is restrained by the MPFL, medial patellomeniscal ligament, medial patellotibial ligament, medial retinaculum, and lateral retinaculum. Increased translation and finally dislocation of the patella can occur when these structures become incompetent. MPFL is the most important structure, and its disruption is often cited as the essential lesion of lateral patella dislocation.[9] Dislocation of the patella typically occurs from direct trauma to the patella, or a sudden twist of the slightly flexed knee during weight-bearing activity, as in our case. Acute patellar dislocations account for about 3% of all knee injuries and are the second most common cause of knee haemarthrosis. However, there is

as yet no consensus regarding treatment of acute patellar dislocation.[10] In our case, we decided to perform surgery because of accompanying ligament injuries and we feel that the results are better with operative compared to non-operative treatment.

Extensive forces that twist or rotate the knee, such as dislocation of the knee, can cause both MCL and MPFL injury due to overload and the anatomical relationship between these two structures. Therefore, patients with valgus instability should be evaluated for both MPFL and MCL tears to facilitate successful treatment.

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