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TECHNIQUE

Surgical Treatment of Primary Traumatic Patellar Dislocations

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ABSTRACT

Traumatic patellar dislocation is an injury that can predispose an individual to recurrent instability, chronic pain, and loss of function. These injuries are usually associated with disruption of the medial patellofemoral ligament and often have osteochondral lesions present. We feel that restoration of the normal anatomy will provide the best chance for return to full function. Therefore, in some patients, there may be a role for treatment of acute traumatic patellar dislocations surgically, with an emphasis on repair of the medial patellofemoral ligament and open reduction and internal fixation of associated osteochondral lesions.
Keywords: dislocation, mediopatellofemoral ligament, patella

HISTORICAL PERSPECTIVE

The management of patellar instability is controversial. Numerous clinical factors must be taken into consideration to appropriately treat patients with patellofemoral instability, such as bony alignment, ligamentous laxity, and the status of articular cartilage. For the purposes of this article, we will discuss the treatment of acute, traumatic, first-time dislocators without evidence of mechanical malalignment.

The traditional management of acute first-time patellar dislocators has been nonoperative; however, the results of this approach have been unpredictable. The recurrent instability rate in this population has been reported between 17% and 44%.[1,2] More concerning, Cofield and Bryan reported 60% poor results in patients managed nonoperatively,[1] whereas Atkin et al reported 58% of patients had limitation of strenuous activities at 6 months.[3] Therefore, some authors have recommended an early operative approach.[4–7]

PATHOPHYSIOLOGY

The mechanism of injury for a patellar dislocation is usually classified as either contact or noncontact. A contact injury involves direct blunt trauma to the anterior knee in some degree of flexion. Contact injuries involve more energy transfer and are associated with more severe injuries. Noncontact injuries often occur as a result of pivoting on a planted foot.

For the patella to dislocate laterally, complete or partial disruption of the medial restraints must occur. The medial patellofemoral ligament (MPFL) has been shown to be the primary restraint to patellar dislocation.[8] There is a growing body of literature that supports disruption of the MPFL as the primary lesion of patellar dislocation.[7,9,10] The MPFL is a distinct structure within layer II of the medial knee that is consistently present in cadaveric studies.[11,12] The fibers of the MPFL (Fig. 1) originate from the adductor tubercle of the femur and attach to the superomedial aspect of the patella.[11] The MPFL can fail at either its patellar or its femoral insertions, but in our experience, the tear is more commonly located at the femoral attachment. It has also been reported that elevation of the vastus medialis muscle off the medial femoral condyle occurs[7,10,13,14] along with tearing of its fascia from the adductor tendon.[4]

In addition to the tension failure of the medial soft tissue restraints, lateral patellar dislocation also causes traumatic insult to the articular surfaces of the patellofemoral joint. The association of patellar dislocation with an osteochondral fracture was first noted by Milgram in 1943.[15] Since that time, many authors have noted the presence of chondral and osteochondral lesions in 70–95% of knee after acute lateral patellar dislocation.[6,7,13,16,17]

The opinions or assertions contained herein are private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or Department of Defense.

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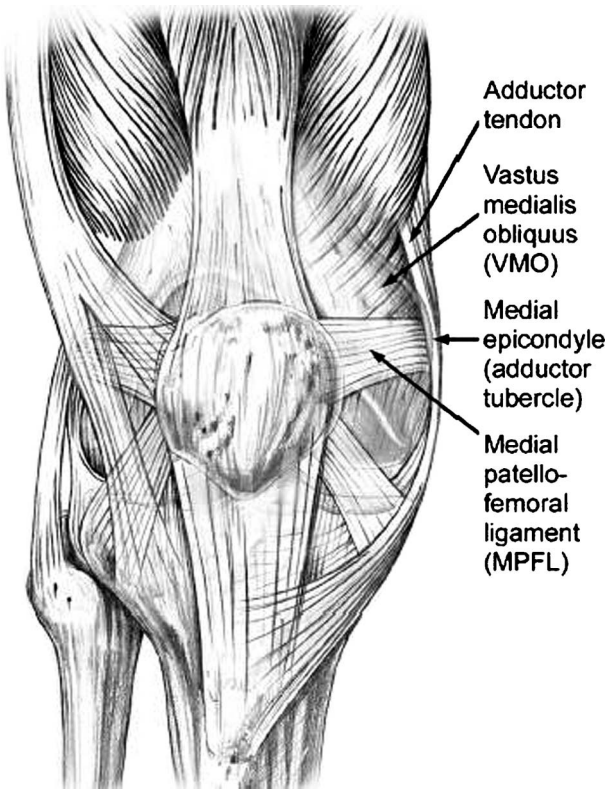

FIGURE 1. Anatomy of the medial knee.

The most common location for these lesions is the medial facet of the patella and the lateral trochlea/lateral femoral condyle. These chondral lesions can involve a significant portion of the underlying bone.

INDICATIONS

The indications for surgical management of acute first-time patellar dislocations are somewhat controversial. The presence of a large osteochondral fracture is a definite indication for anatomic repair of that fragment. The presence of a smaller osteochondral lesion or loose body is also an indication for arthroscopic removal. Although controversial, the presence of a torn MPFL and/or (VMO) avulsion injury is also an indication for repair of all torn structures.

PREOPERATIVE PLANNING

The diagnosis of patella dislocation can be relatively straightforward if the patient initially presents with the knee flexed and the patella in a lateral position. Reduction can usually be performed with gentle knee extension, rarely requiring the assistance of conscious sedation.

More commonly, spontaneous reduction of the patella occurs, often clouding the diagnosis. Disruption of the medial patellar restraints results in swelling in this area, in addition to a hemarthrosis. Patients will usually have a significant amount of apprehension to lateral subluxation and will often have a palpable defect in the medial reticular structures. A thorough knee examination is important to rule out associated injuries such as an osteochondral injury, physeal injury in the skeletally immature, medial collateral ligament tear, or anterior cruciate ligament tear. Careful physical examination can often differentiate the location of the MPFL lesion based upon the location of tenderness: either the adductor tubercle or superomedial patella.

Radiographs are always indicated and can confirm reduction of the patellofemoral joint. Plain images, including obliques, can help diagnose osteochondral fractures and loose bodies. However, Stanitski and Paletta showed a sensitivity of only 32% for lesions documented at arthroscopy.[17]

The magnetic resonance imaging (MRI) appearance of acute patellar dislocations has been described,[7,10,13,18] and this study can be a helpful adjunct in planning operative intervention. Sanders et al demonstrated 85% sensitivity in diagnosing both MPFL disruption and vastus medialis elevation.[10] MRI has also been shown to be effective in diagnosing osteochondral lesions.[13] In our practice, we routinely obtain MRI following a first-time patellar dislocation. We can determine if a chondral lesion is present, determine the location of the MPFL lesion, and rule out associated ligamentous tears (Fig. 2).

TECHNIQUE

At our institution, we have employed a technique of primary repair of the torn medial structures. This is

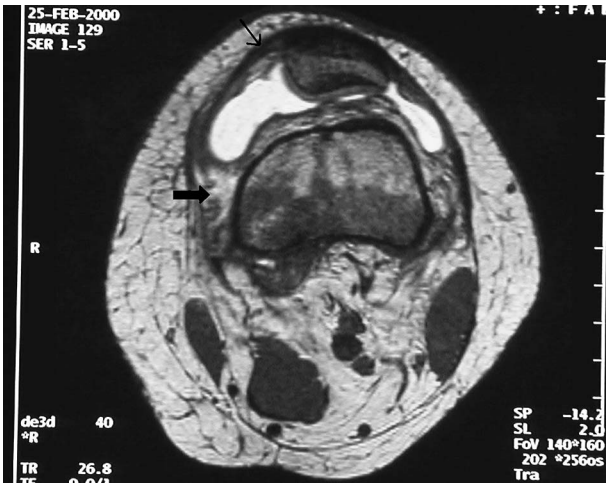

FIGURE 2. MRI showing avulsion of the MPFL from the adductor tubercle. Thin arrow denotes MPFL with an intact patellar attachment. Thick arrow points to increased signal representing area of injury.

performed in conjunction with diagnostic arthroscopy and open reduction and internal fixation of repairable osteochondral fractures.

The patient is positioned in the supine position under general or regional anesthesia. A well-padded tourniquet is placed, but only inflated if needed for visualization. A thorough diagnostic arthroscopy is performed using medial and lateral parapatellar tendon portals with an arthroscopic pump at low pressure. The diagnostic arthroscopy allows the assessment of intra-articular damage. Large osteochondral lesions can be assessed for open repair (Fig. 3). Small loose bodies can be removed arthroscopically. Loose articular flaps from chondral lesions can be excised.

An isolated MPFL repair is performed if no osteochondral fragment requires reattachment. The incision for the medial repair is positioned halfway between the patella and the medial epicondyle. Care is taken to locate and protect branches of the saphenous nerve. The vastus medialis muscle overlies the MPFL and is retracted with a rake retractor to visualize the full extent of the soft tissue injury. An avulsion of the vastus medialis fascia from the adductor tendon is often present.

The MPFL is usually found avulsed from its origin on the adductor tubercle. There may or may not be a cuff of soft tissue present. We usually deploy two suture anchors just anterior to the tubercle and pass the nonabsorbable sutures through the torn end of the MPFL. Prior to tying these down, addition sutures are placed in the remainder of the torn retinaculum. After all sutures are tied securely, the vastus medialis fascial defect is also repaired with nonabsorbable suture to the adductor tendon (Fig. 4).

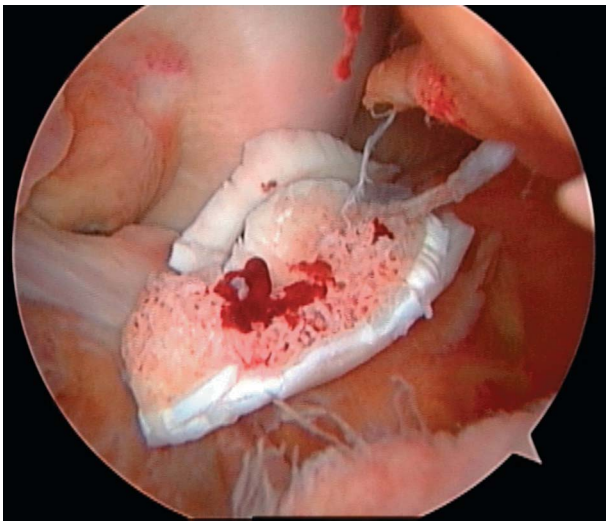

FIGURE 3. Osteochondral loose body from patella in a 14-year-old girl after traumatic dislocation. This was repaired through a small medial arthrotomy with size 0 Polydioxanone Suture through drill holes.

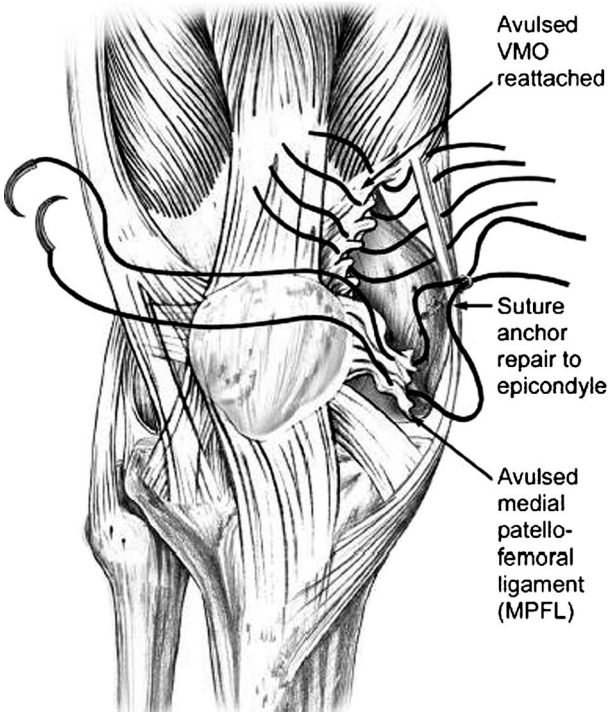

FIGURE 4. Drawing representing the described technique for MPFL repair. One or multiple suture anchors are used to secure the torn MPFL to its insertion on the adductor tubercle. A suture repair is also performed of the avulsed VMO (if present) to the adductor tendon.

If the MPFL is avulsed from the medial aspect of the patella, it is repaired using one or two suture anchors placed into the medial patella. Alternatively, if an adequate cuff of tissue exists on the patella, the ligament can be repaired primarily with nonabsorbable sutures. The knee is then taken through a full range of motion. There will not be excessive stress on the repair if performed anatomically.

After ensuring an adequate medial repair, the arthroscope is reintroduced into the joint to reassess the patellofemoral alignment. At this point, a lateral retinacular release can be considered; however, there is little support for this in the basic science or clinical literature.

Osteochondral fractures of the lateral femoral condyle can usually be addressed through a lateral parapatellar tendon incision, although these lesions can also be addressed through a medial arthrotomy and lateral subluxation of the patella. A patellar osteochondral fracture is usually approached through a medial incision. After the fracture bed is exposed and the fractured fragment located, soft tissue and clot are excised from both bony surfaces. An anatomic reduction is performed and held in place with 0.035-in K-wires. The fracture fragments are definitively fixed with screws or bioabsorbable devices. If the fragment is of adequate size, it can be fixed with headless screws or minifragmentary screws (with

countersunk heads). Smaller fragments require fixation with bioabsorbable devices. It is important to avoid prominence of any implant used to secure articular surfaces. We recommend routine removal of metallic screws used to secure articular fragments at 8 weeks. This can usually be accomplished arthroscopically. Articular cartilaginous avulsions without subchondral bone can be fixed with a circumferential suturing technique, similar to the technique of securing the periosteal patch in autologous chondrocyte implantation.

CASE EXAMPLES

Case 1

A 20-year-old man sustained a contact injury to his right knee while playing football. He denied hearing a ''pop'' and was unable to bear weight. His knee swelled immediately but did not require reduction of his patellar dislocation. On examination, he had a large effusion and tenderness at both the medial aspect of his patella and the adductor tubercle. Radiographs revealed evidence of an osteochondral loose body (Fig. 5A). MRI revealed an osteochondral fracture of the medial facet of his patella (see Fig. 5B) and an avulsion of his MPFL from his adductor tubercle (see Fig. 5C). Upon arthroscopic evaluation 2 days after the injury, there was a large hemarthrosis. Multiple small chondral loose bodies were excised. A 2 × 2–cm osteochondral fragment from his patella was located in the medial gutter (see Fig. 5D). The arthroscope was removed, and a medial incision was made between the patella and adductor tubercle. The avulsion of the MPFL was located (see Fig. 5, E and F) and repaired to the adductor tubercle with suture anchors (see Fig. 5, G and H). Next, a medial parapatellar vastus medialis–splitting arthrotomy was performed. The loose body was removed and a debridement performed. The patella was partially everted, and a debridement of the donor site was performed (see Fig. 5I). The osteochondral loose body was reduced anatomically to its donor site and was fixed with multiple bioabsorbable darts (see Fig. 5J). The arthotomy was repaired without reefing. The patient recovered according to our rehabilitation protocol.

Case 2

An 18-year-old man sustained a twisting injury to his knee while attempting to place equipment into an elevated storage area. He did not require reduction of his patellar dislocation. On examination, his knee had a large effusion and tenderness along his lateral retinaculum in addition to his medial retinaculum. Radiographs revealed a displaced osteochondral fracture of the lateral femoral condyle (Fig. 6, A and B). MRI confirmed the osteochondral lesion of the lateral femoral condyle as well as an avulsion of the MPFL from the patella (see Fig. 6, C–E). Surgery was performed at 6 days from injury. A hemarthrosis was noted at arthroscopy, and the large osteochondral lesion of the lateral femoral condyle was evaluated (see Fig. 6F). A medial parapatellar arthotomy was performed, and the avulsion of the MPFL from the patella was noted. The patella was laterally subluxated, and the lateral femoral condyle lesion was evaluated. The fragment was removed, and a debridement was performed on the back table, while the donor site was prepared. A reduction of the fragment was performed, and fixation was achieved with two headless screws (see Fig. 6G). The MPFL was repaired to the patella using bioabsorbable suture anchors, and the arthrotomy was closed. The patient underwent our rehabilitation protocol, and the screws were removed arthroscopically at 8 weeks.

POSTOPERATIVE MANAGEMENT

The knee is placed into a hinged knee brace, and the rehabilitation program begins immediately. Continuous passive motion is initiated the day of surgery. Upon hospital discharge, active and active-assisted range-of-motion exercises are initiated from 0° to 90° in the prone position, avoiding antigravity quadriceps work. Flexion is advanced to full flexion as quickly as the patient can tolerate. It is important to ensure as full motion as possible intraoperatively and to work on early full flexion to prevent stiffness. The patient is to weight-bear as tolerated with the brace locked in extension. At 4 weeks, closed-chain quadriceps strengthening is initiated. The brace is discontinued, and the patient is allowed weight-bearing when good quadriceps control has returned. Return to sport-specific training is delayed until 4 months.

RESULTS

We have reviewed our series of U.S. Military Academy cadets sustaining first-time traumatic patellar dislocation that were addressed surgically. We have treated five men (ages 18–22) with the surgical technique described previously. We had no cases of recurrent instability. All cadets were able to complete the rigorous physical training requirements of the academy and were commissioned as officers in the U.S. Army.

Two series of patients with acute dislocations repaired with a similar technique show favorable results. Sallay et al reported on 12 patients treated with MFPL repair and followed for an average of 36 months. There were no cases of recurrent instability, with 58% of patients returning to sport.[7] Ahmad et al reported on eight patients treated with acute MPFL/VMO repair and followed for an average of 36 months. They reported

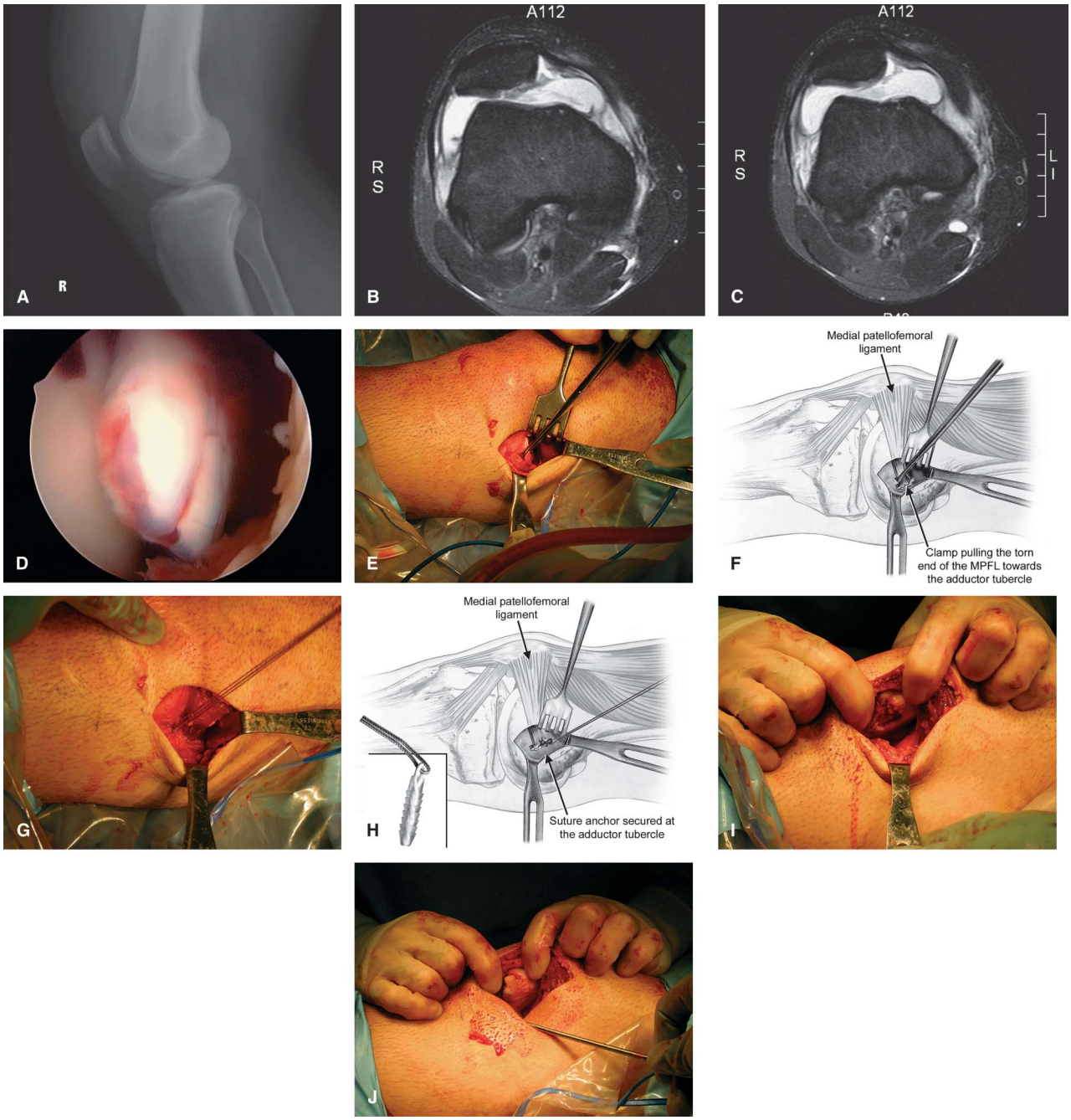

FIGURE 5. Case 1. A, Lateral radiograph showing osteochondral loose body. B, T2 MRI axial cut showing osteochondral fracture of the entire medial facet of patella. C, T2 MRI axial cut showing MPFL avulsion from adductor tubercle. D, Arthroscopic photo showing osteochondral loose body. E, Intraoperative photo showing avulsed MPFL. F, Artist's representation of intraoperative photo. G, Intraoperative photo showing MPFL repair with suture anchor. H, Artist's representation of intraoperative photo. I, Intraoperative photo showing osteochondral fracture bed on medial facet of patella. J, Intraoperative photo showing repair of osteochondral fracture with multiple bioabsorbable darts.

excellent patient satisfaction, with only one patient experiencing recurrent subluxation during sport.[4] Overall, the results of MPFL repair in acute traumatic patellar dislocations results have been excellent and reproducible and should be considered, especially in athletes.

COMPLICATIONS

The most frequently reported complication of this approach has been patellofemoral pain. This is particularly true in patients who have sustained an osteoarticular

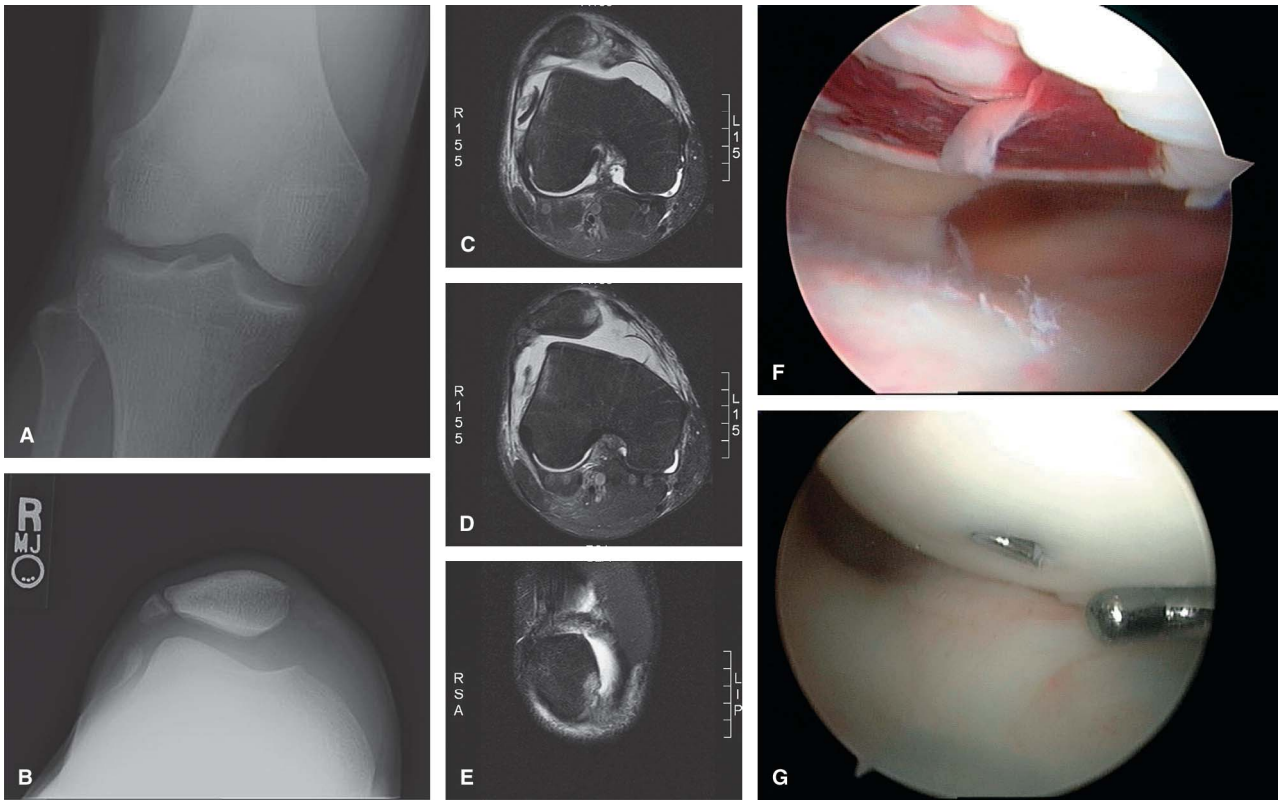

FIGURE 6. Case 2. A, Anteroposterior radiograph showing displaced osteochondral fracture from the lateral condyle. B, Sunrise view showing displaced osteochondral fracture and a bipartite patella. C, T2 MRI axial cut showing confirming osteochondral loose body in the lateral gutter. D, T2 MRI axial cut showing MPFL avulsion from the patella. E, T2 MRI coronal cut showing MPFL avulsion from the patella. F, Arthroscopic view of lateral femoral condyle donor site. G, Arthroscopic image of headless screw used to repair osteochondral fracture taken at time of screw removal.

injury that is not amenable to repair. In addition, patellofemoral pain can occur secondary to abnormal patellar tracking and abnormal contact forces due to an insufficient or overconstrained repair.

Another common complication is loss of motion, particularly flexion. This developed in two patients in the series reported by Sallay et al,[7] and both required manipulation. Some loss of flexion (10°) was lost in four of eight patients in the series reported by Ahmad et al.[4]

There are some neurovascular concerns associated with these surgical approaches. The medial incision described above is directly over branches of the saphenous nerve, which can be injured with superficial dissection. In addition, a lateral release, if performed, can result in a significant hemarthrosis.

FUTURE OF THE TECHNIQUE

The surgical treatment of acute patellar dislocations has been controversial; however, knees demonstrating osteochondral fractures, MPFL tears, and/or VMO avulsions can benefit from early repair and rehabilitation. Advances in the area of articular cartilage repair, such as growth factors or improved fixation devices, may improve the healing of articular cartilage lesions. The refinement of arthroscopic techniques may allow routine arthroscopic management of MPFL avulsions from the patella. The development of an endoscopic approach may also allow a less invasive repair of the extra-articular MPFL tears from the adductor tubercle.

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