Management of Medial-Sided Knee Injuries

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Abstract: Medial collateral ligament injuries are common and are often associated with concomitant ligamentous, meniscal, and cartilage injuries. Orthopedic surgeons should be familiar with the outcomes of nonoperative and operative treatment of isolated and combined grade I, II, and III injuries. Special attention should be paid to identifying involvement of the posterior oblique ligament and capsule; lack of such attention may lead to failed nonoperative management. The authors present an overview of the treatment of medial-sided knee injuries, as well as 2 cases demonstrating their preferred method of treating chronic medial-sided laxity and instability. [Orthopedics. 2015; 38(3):180-184.]

Medial-sided knee injuries involving the medial collateral ligament (MCL) are the most common ligamentous knee injuries, occurring primarily in young individuals participating in sports. In most cases, injuries to the medial knee ligaments are isolated; however, they can also be combined with anterior cruciate ligament (ACL) injuries, posterior cruciate ligament (PCL) injuries, and meniscus tears. The majority of combined injuries (95%) are ACL tears with MCL injuries, and grade III MCL injuries comprise 78% of these combined ACL and MCL injuries. Typically, the mechanism of injury is a direct valgus load applied to the knee with the foot planted, with or without external rotation of the tibia. The successful treatment of medial-sided knee injuries depends on the location, severity, and presence of concomitant injuries. Historically, most isolated MCL injuries have been successfully treated nonoperatively with either bracing or cast immobilization. However, failure to recognize combined injuries or incomplete healing of medial-sided injuries, particularly those with involvement of the posterior oblique ligament (POL) complex, may lead to continued chronic valgus and rotational instability and functional limitations.

Anatomy and Biomechanics

The MCL complex is composed of 3 elements: the superficial MCL, the deep MCL, and the POL. The MCL complex is not only the prime static stabilizer to valgus stress, but also a contributor to sagittal and rotational stability. The superficial MCL has both a proximal and a distal component, with the proximal portion contributing to valgus stability and the distal to external rotation stability. The deep MCL, which is more a thickening of the joint capsule than a distinct structure, has attachments to both the medial meniscus and the tibia, which contribute to valgus and external rotation stability and internal rotation stability, respectively.

Although often thought of as a single entity, the components of the MCL complex have distinctly different load-sharing characteristics. Studies have shown that the superficial MCL demonstrates the largest load response to valgus and external rotation forces, whereas the POL demonstrates the greatest load response to internal rotation forces applied with the knee near full extension.

Classification

The most commonly used classification system for medial knee injuries is the American Medical Association’s grading scale, which is based on the amount of medial-sided...
joint space opening with a valgus stress applied with the knee at 30° of flexion (Table). This is a subjective grading scale based on the perceived amount of joint space gapping; the actual amounts of medial compartment gapping corresponding to grade I, II, and III injuries may be much smaller than historically accepted values when measured objectively against the contralateral knee. Laxity at 0° should raise the examiner’s suspicion for associated injuries such as cruciate tears or posteromedial capsular injury. Acute MCL injuries are usually defined as those that present within 3 weeks from injury. Chronic MCL injuries are defined as those that present 6 weeks or more from the time of injury or grade III injuries that fail nonoperative treatment.

**Physical Examination**

A thorough examination, including a neurovascular examination, of the injured knee should be performed and the results compared with those of the contralateral knee. The MCL should be palpated along the medial aspect of the knee and assessed for tenderness, noting the location (femoral vs tibial sided) of maximal tenderness. The MCL should be tested with the knee at both 0° and 30° of flexion, assessing for medial joint space widening and feeling for a solid endpoint. The foot must be held in external rotation so that the examiner does not overestimate the amount of laxity as a result of the knee moving from internal to external rotation.

Again, laxity to valgus stress with the knee at 0° indicates the possibility of a combined injury, with likely injury to the cruciates or posteromedial capsular structures. An anteromedial drawer test can be performed to assess the amount of rotational stability present and whether the injury involves only the superficial MCL or POL and deep MCL. This can be performed with the knee at 90° of flexion and the foot externally rotated 10° to 15°. An anterior and external rotational force is applied, observing for the amount of anteromedial tibial rotation present. The examiner must also perform a dial test at 30° and 90° of flexion, as studies have shown that a positive result can be present with an isolated medial-sided knee injury.

**Imaging**

To assess for malalignment, possible bony avulsion, or an osteochondral fragment, which may alter the treatment plan, 45° flexion weight-bearing anteroposterior, lateral, and sunrise and merchant views of the involved knee should be obtained. If the severity of the injury is in question (grade II vs III), or there is concern for a pediatric physeal injury, stress radiographs with the knee in 20° to 30° of flexion may be obtained and compared with those of the contralateral knee. For complex knee injuries or obese patients, intraoperative stress radiographs after induction of the patient may help guide the surgical plan.

Magnetic resonance imaging (MRI) can be useful for diagnosis, to determine the location and severity of the MCL injury, and to assess for associated injuries, such as injury to the cruciates, meniscus, and articular cartilage. One should assess for subchondral bone bruising involving the lateral femoral condyle or tibial plateau, which was shown to be present in 45% of isolated medial knee injuries, femoral- vs tibial-sided MCL injuries, and the possibility of a displaced MCL tear that has become incarcerated into the joint (Stener lesion). Identifying the specific location of the injury is important, as some studies have reported differences in healing potential between tibial- and femoral-sided MCL injuries.

One should also note increased signal and fluid extending more posteriorly than the posterior border of the MCL, as this may indicate a more serious injury and involvement of the POL and posterior capsule.

**Treatment**

Treatment for isolated grade I and II MCL injuries is mainly nonoperative, with most treatment protocols focusing on functional bracing, early range of motion, protected weight bearing, and progression toward strengthening exercises and a gradual return to activities as pain diminishes. Return to sports is generally allowed once a patient has painless, full range of motion; no instability exists on examination; and muscle strength has returned to normal and is equal to that of the uninjured side. Historically, nonoperative management of isolated grade I and II MCL injuries has led to good results. Derscheid and Garrick* reported on a series of high school football players who were able to return to play, on average, 10.6 and 19.5 days postinjury after nonsurgical treatment of grade I and II MCL injuries, respectively. A prospective study with 10-year follow-up of 38 patients treated nonsurgically for grade I and II MCL injuries completed by Lundberg and Messner* showed that 92% had normal knee function and no complaints during sporting activities. However, Lysholm scores and participation in sports declined over time, suggesting knee joint changes may occur in some patients.

Treatment of complete grade III injuries depends on whether the injuries are isolated or combined with other liga-
mentous injuries, their location (femoral vs tibial sided), and the involvement of posterior structures. The results of nonoperative treatment of grade III injuries are not as uniform as those of grade I and II injuries; however, some authors have reported good results after nonoperative management of grade III medial-sided injuries. The majority of isolated grade III injuries are femoral based and heal with conservative treatment. A critical point involves distinguishing whether the injury involves the POL and posterior capsule: posterior extension of the zone of injury past the MCL indicates a more serious injury that is therefore less likely to heal with nonoperative management. This specific injury pattern can be easily visualized during routine arthroscopy, with a large arthroscopic drive-through sign medially and posteriorly. Surgery should be considered in certain circumstances: acute superficial MCL injuries in which the tibial insertion is displaced outside the pes anserinus tendons (Stener lesion), chronic laxity and instability after nonoperative treatment of isolated grade III injuries, multiligament injuries and knee dislocations, and some cases of MCL instability in the valgus aligned knee. Numerous reconstruction techniques exist for surgical treatment of grade III injuries, including combined repair and reconstruction, superficial MCL reconstructions, and MCL and POL reconstructions. Good results have been reported with both allograft and autograft reconstruction techniques. The current authors prefer semitendinosus tenodesis for reconstructing the MCL and POL for chronic medial laxity of the knee as described by Kim et al. The authors report 2 cases and their preferred treatment strategy for 2 chronic mediolateral knee injuries: 1 with a PCL and MCL and POL injury and 1 with an isolated MCL and POL injury.

**CASE REPORTS**

**Patient 1**

A 16-year-old male high school football player was involved in an all-terrain vehicle accident during which he sustained an isolated contact injury to the right knee. He was initially seen and evaluated by another orthopedic surgeon and found to have an injury to the PCL as well as the MCL. Magnetic resonance imaging at the time of injury showed a mid-substance disruption of the PCL with femoral and mid-substance injury to the MCL (Figure 1). The decision was made to treat the injuries nonoperatively with functional bracing, therapy, and gradual return to activities.

Four months after the injury, the patient was referred to the authors because of continued medial-sided knee pain and valgus instability with activities such as running, cutting, and pivoting. An examination of the right knee revealed range of motion from 0° to 140°, negative results on Lachman’s and anterior drawer tests, grade I posterior drawer with a firm endpoint, negative posterior sag, and grade III opening of the medial joint line with valgus stress at 30°. At this point, because of his continued medial instability, it was thought that the patient would benefit from diagnostic arthroscopy with MCL and POL complex reconstruction.

At the time of surgery, diagnostic arthroscopy showed an intact PCL with a grade I posterior drawer. There was a medial-sided drive-through sign with elevation of the medial meniscus from the tibia with an applied valgus stress (Figure 2). A 6- to 8-cm incision was made along the medial side of the knee over the course of the MCL. The sartorial fascia was identified and incised, and the semitendinosus tendon was harvested using an open-ended tendon stripper, leaving the tibial attachment intact. The posteromedial structures were loose and patulous. The tendon was then routed through the semimembranosus, passed over a 4.5-mm fragment screw and washer post, and brought back down to the proximal tibia, re-creating the POL. Three G4 suture anchors (DePuy Synthes, Raynham, Massachusetts) were placed just distal to the joint line from mid-anterior to posterior. The sutures were then passed through capturing the superficial MCL, the deep MCL, the coronary ligament of the medial meniscus, and the capsule and POL, advancing the tissues anteriorly and distally. The sutures were tied down with the knee in approximately 30° of flexion. Both limbs of the graft were also captured with the sutures and tied down to the proximal tibia. The long arm of the graft was then secured with a staple for additional fixation (Figure 3).

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**Figure 1:** Magnetic resonance imaging for Patient 1. Short T1 inversion recovery coronal cut showing femoral and mid-substance medial collateral ligament injury (A). T1 sagittal cut showing mid-substance posterior cruciate ligament injury (B).

**Figure 2:** Arthroscopic medial drive-through sign with elevation of the medial meniscus from the tibia.
Postoperatively, the patient was placed in a total range of motion brace locked at 30° and made toe-touch weight bearing to allow for healing of the repair. He was allowed immediate range of motion from 0° to 90° for the first 4 weeks to protect the repair. He will remain toe-touch weight bearing for 4 to 6 weeks while working on range of motion and transition toward a strengthening program.

**Patient 2**

A 27-year-old male professional motorcross rider with a history of previous bilateral ACL reconstructions sustained a noncontact, medial-sided left knee injury. He was initially treated nonoperatively with functional bracing and gradual return to activities. He eventually returned to motorcross riding; however, he continued to have medial-sided knee pain and complained of “looseness” despite wearing a brace when riding.

Approximately 5 months after his injury, he was referred to the authors for evaluation. An examination of the left knee showed range of motion from 0° to 140°. Lachman’s and anterior drawer tests demonstrated no laxity with solid endpoints. Pivot shift, posterior drawer, and dial tests had negative results. Magnetic resonance imaging of the knee showed an intact ACL graft and femoral-based injury to the MCL and POL with laxity of the ligament fibers (Figure 4). The patient was diagnosed as having chronic MCL and POL deficiency with continued functional instability despite wearing a brace. Therefore, it was thought he would benefit from MCL and POL complex reconstruction.

Diagnostic arthroscopy was performed and showed an intact ACL graft with slight laxity on anterior drawer testing and a medial-sided drive-through sign with displacement of the medial meniscus away from the femur with applied valgus stress (Figure 5). Reconstruction of the MCL and POL complex as described above was performed in a similar fashion; however, the gracilis, instead of the semitendinosus, tendon was used for reconstruction (Figure 6). Postoperatively, the patient was placed in a total range of motion brace locked at 30°, with the same weight-bearing and range of motion restrictions as discussed above, following the same rehabilitation protocol.

**CONCLUSION**

Injuries to the MCL are common. In most cases, grade I and II injuries can be successfully treated with functional bracing, early range of motion, protected weight bearing, rehabilitation, and gradual return to activities and sports. However, the treatment of isolated grade III injuries is more complex, as the results of nonoperative treatment are less uniform and definite indications for surgery are not well defined. A thorough history and physical examination should be performed and appropriate imaging should be obtained and carefully reviewed as part of the decision-making process. Attention should be paid to combined injuries, the location of the MCL injury, and how far posterior the zone of injury extends beyond the posterior border of the MCL, as these factors can influence the outcome of nonoperative management. Surgery should be considered for chronic medial-sided laxity and instability, combined injuries, and injuries involving the posterior structures (ie, POL, posterior capsule).

Multiple techniques for repair or reconstruction of the MCL and POL complex using both allograft and autograft, all with acceptable outcomes, have been described. The authors’ preferred technique for addressing medial-sided injuries is semitendinosus tenodesis for reconstructing the MCL and the POL, along with
an anterior or distal shift of the POL and patulous posterior capsule to help restore both medial-sided valgus stability and rotational stability.

Managing medial-sided injuries can be difficult and complex, especially in the setting of chronic valgus and rotational instability. However, these injuries can be successfully treated if accurately diagnosed with clinical examination and appropriate imaging and if the surgical technique addresses reconstruction or repair of not only the MCL but also the POL and the posterior capsule.

**References**


