Medial Collateral Ligament “Tibial” Injuries: Indication for Acute Repair

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T he medial collateral ligament (MCL) is the most commonly injured knee ligament.1-3 The mechanism of injury is typically a contact valgus load on the lateral side of the knee with the foot planted; however, noncontact external rotation valgus injuries are also common. Medial collateral ligament failure can occur alone or in combination with cruciate and meniscal injury. Fetto and Marshall4 found concomitant knee injury in 80% of grade III MCL injuries. The most common combined injury is anterior cruciate ligament (ACL) rupture followed by meniscal tear, and these must be ruled out when a patient presents with a complete MCL injury.

TREATMENT

Treatment for isolated complete MCL injury historically was surgical with acute repair of the medial structures including the superficial MCL, the capsular or deep ligament, and the posterior oblique ligament.5-9 O’Donoghue5,6 and Hughston7,8 reported their case series including combined injuries that did well with surgical repair of the medial structures when complete grade III MCL injury was present. Over the past three decades, many authors have reported equally successful results with conservative treatment of complete MCL injuries, which has now become the most common current standard of care for isolated lesions.4,10-16

Few reports of treatment have identified the injury site of the medial structures and how this affects healing and prognosis of the injured MCL. O’Donoghue5 demonstrated distal failure of the superficial MCL in most cases with proximal or mid-substance failure of the deeper capsular ligaments. Ellsasser et al10 showed by clinical examination 50

Complete avulsions of the superficial and deep medial collateral ligament from the tibia with disruption of the meniscal coronary ligament should be managed with acute surgical repair for maximum benefit.
64 nonoperative MCL patients had proximal lesions based on tenderness. Nakamura et al described the usefulness of magnetic resonance imaging (MRI) in determining a treatment regimen for combined ACL/MCL injuries. Medial collateral ligament injuries with complete disruption of the MCL on MRI failed to heal with valgus stability and required augmented MCL repair at ACL reconstruction. These studies suggest that the injury site is important for the prognosis of MCL injuries.

In our practice, several complete injuries of the MCL off the tibial insertion failed to heal reliably. Patients have been left with varying amounts of valgus knee instability, preventing return to competitive sports and causing dysfunction in activities of daily living. After reconstructing several chronic MCL injuries of this type, our evaluation and treatment based on the clinical examination and MRI of the patient have been modified. Most MCL sprains should be treated nonoperatively. However, complete avulsions of the superficial and deep MCL from the tibia with disruption of the meniscal coronary ligament have a poor prognosis with conservative treatment and should be managed with acute surgical repair for maximum benefit.

**CASE REPORTS**

**Case 1**

A 19-year-old NCAA Division 1 collegiate football defensive lineman presented with medial knee pain after sustaining a contact injury in practice. He was hit by another player on the lateral side of the knee with his foot planted and felt his knee give way under valgus load. He reported sudden pain on the medial side of the knee with focal swelling.

Physical examination showed no significant effusion but medial soft-tissue swelling around the proximal tibia. Significant tenderness to palpation was noted at the proximal medial tibia with less at the medial joint line. The adductor tubercle and lateral joint line were not tender to palpation. Ligamentous examination demonstrated a negative Lachman, negative anterior and posterior drawer, and good stability to varus at 0° and 30° of knee flexion. Valgus stress at 0° was stable but at 30° instability was >10-mm with a soft endpoint compared to the uninjured knee. The leg had all neurovascular structures intact and symmetric to the other side.

Anteroposterior and lateral radiographs revealed no osseous fracture or bony avulsion and no malalignment. Magnetic resonance imaging confirmed complete avulsion of the superficial and deep capsular MCL from their tibial insertion with laxity in the ligament fibers (Figure 1).

Arthroscopy demonstrated intact cruciates, intact lateral meniscus, and intact chondral surfaces. The medial joint line showed a positive drive through (>10-mm medial opening) with elevation of the medial meniscus from the tibia and hemorrhage at the meniscocapsular junction (Figure 2). Rasping of the meniscocapsular margin was performed followed by a medial open approach to the MCL.

The superficial MCL was avulsed from its distal insertion and the capsular MCL was elevated from the tibial joint line. Two anchors (G4 suture anchors; Mitek, Norwood, Mass) with two #5 ticon sutures each were placed just below the articular surface of the tibia and the capsular and posterior oblique ligament were advanced anteriorly and distally restoring normal tension with the knee in full extension. The superficial MCL was tensioned and repaired to the tibia at 30° of flexion with two additional anchors also loaded with #5 ticon sutures. Both the deep MCL and coronary/meniscal ligament and the superficial MCL distally were anatomically repaired.

Postoperatively, a hinged brace was locked from 30°-90° for 3 weeks followed by unlimited motion. Weight bearing was limited for 3 weeks with crutches and then progressed to full weight by 4-6 weeks. Bracing was discontinued at 6 weeks and nonimpact conditioning was allowed with running started by 3 months. He participated in spring ball with a func-

**Figure 1:** Case 1. MRI demonstrating medial collateral avulsion off the tibia. **Figure 2:** Arthroscopic image of a probe in the tear of the meniscotibial ligament and posterior-medial capsule.
Case 2
A 14-year-old high school football player presented 3 days after sustaining a contact valgus injury to the right knee. He reported pain and instability. He denied any previous injury to the knee.

On examination, a swollen knee with significant medial tenderness was noted. Tenderness to palpation was noted medially on the tibia at the medial joint line and distal over the tibia with no tenderness proximal to the joint line. Grossly positive laxity to valgus stress at 0° and 30° was noted with >10-mm opening with a soft endpoint. With the knee held in internal rotation, a firm endpoint was noted on the Lachman test. The knee was stable to varus stress with a negative posterior drawer and no increase in external rotation. Anteromedical rotation was increased.

Radiographs of the knee were negative for fracture. Magnetic resonance imaging showed disruption of the superficial and deep MCL off of the tibia (Figure 3). The cruciates and menisci were normal. No other injury was evident on MRI.

An examination under anesthesia was unchanged from the previous examination. Arthroscopy demonstrated that the distal end of the superficial MCL was displaced and in the joint underneath the coronary ligament and meniscus (Figure 4). The medial meniscus would lift off the tibia with medial joint line opening to valgus stress. The surgical approach included a medial longitudinal incision beginning 1 cm above the joint line and extended distally approximately 4-6 cm. The crural and sartorius fascia were divided transversely just above the hamstring tendons with retraction of the tendons, saphenous nerve, and vein posteriorly. Two #5 nonabsorbable sutures were placed in the superficial MCL and posterior oblique ligament; the proximal tibia was roughened to stimulate a healing response at the anatomic insertion of the deep MCL and coronary ligament.

Posteriorly at the posterior aspect of the coronary meniscotibial ligament, suture anchors were placed in the proximal tibia to reattach the posterior oblique ligament and deep MCL with #2 nonabsorbable sutures (G4 suture anchors, Mitek). Sutures were placed at the meniscosynovial junction and tied down on the tibia working from posterior to anterior until the coronary ligament, deep MCL, and posterior oblique ligament had been repaired anatomically. Attention was taken to tie these sutures with the knee held in varus at full extension. Subsequently, the superficial MCL was isolated and the ligament was tensioned with the knee in varus and at 30° of flexion. It was anchored on the proximal tibia with suture anchors. Range of motion was assessed from 0°-90° without excessive tightness in the knee. The patient was placed in a hinged postoperative knee brace set at 30° and locked.

Postoperatively, the patient followed the same rehabilitation protocol as the patient presented in Case 1. At 3 months, sport-specific activities were begun and full return to sports was allowed once adequate strength had been obtained. The patient returned to sports and was kept in a MCL hinged knee sleeve for the 9 months postoperatively. At 12-month follow-up, the knee had no laxity in extension and 5 mm of opening to valgus stress at 30°. He was symptom free and returned to play without difficulty.

Discussion
The treatment goal for liga-

![Image](link)

**Figure 3:** Case 2. MRI demonstrating medial collateral avulsion off the tibia with proximal retraction.

**Figure 4:** Arthroscopic image of the superficial MCL displaced into the joint underneath the medial meniscus.
TABLE
Grading Systems for MCL Injuries

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hughston</th>
<th>AMA</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>No clinical instability</td>
<td>0- to 5-mm opening, with up to 2 mm being physiologic</td>
</tr>
<tr>
<td>II</td>
<td>No clinical instability</td>
<td>6- to 10-mm opening</td>
</tr>
<tr>
<td>III</td>
<td>Varying instability—</td>
<td>&gt;10-mm opening with valgus stress at 30° of flexion</td>
</tr>
<tr>
<td></td>
<td>1+ (3- to 5-mm opening)</td>
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<tr>
<td></td>
<td>2+ (6- to 10-mm opening)</td>
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<tr>
<td></td>
<td>3+ (&gt;10-mm opening)</td>
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Abbreviations: AMA=American Medical Association and MCL=medial collateral ligament.

mentous injuries about the knee is to restore the knee to its preinjury function. Medial collateral ligament injuries are among the most frequent in the athlete’s knee and vary considerably in terms of severity and whether concomitant injury is present. Associated injuries occur commonly with complete grade III MCL injuries, and the treating physician must use physical examination, current imaging including radiographs and MRI, and possibly examination under anesthesia to rule out associated knee pathology.4 Once isolated injury to the MCL has been determined, optimal treatment varies with the severity of injury and is still controversial.

Classification of MCL injury has been accepted although nomenclature is not always consistent or uniform between studies and physicians. The two primary grading systems used in the literature are those of Hughston8 and the American Medical Association (AMA).19 According to Hughston, grade I and II injuries result in no clinical instability whereas grade III injuries are complete and vary in the amount of instability produced. A grade III injury may have 1+ (3- to 5-mm opening), 2+ (6- to 10-mm opening), or 3+ (>10-mm opening) instability at 30° of knee flexion. According to AMA classification, injuries are: grade I, 0- to 5-mm opening with up to 2 mm being physiologic; grade II, 6- to 10-mm opening; or grade III, >10-mm opening with valgus stress at 30° of flexion (Table).

Although controversy exists over the best treatment of isolated MCL injuries, much of the debate is due to the lack of agreement on the grade of injury in these studies.8 Many studies fail to accurately identify the amount of instability present on examination and thus confusion over optimal treatment of varying grades of instability still exists. Also, the historical studies do not specify the anatomic location of the injury to the MCL. Therefore, the true natural history of tibial-sided MCL avulsions treated conservatively is unknown.

Classically, treatment of complete MCL injury was operative with acute surgery being superior to delayed intervention. Palmer20 along with other early investigators5,9 advocated early surgical repair of torn ligaments although some noted this dictum needed further follow-up and clinical support. In 1950, O’Donoghue8 described the triad injury and recommended repair of all structures including the MCL and cruciate ligament based on his observations with good results especially in those seen acutely. In 1973, O’Donoghue6 reported >200 knees, with 60 having only injury to the medial structures. In these early repairs, he reported 59 of 60 improved with good medial stability after surgery and no significant loss of motion. Hughston and Barrett7 also advocated early repair of medi- al grade III injuries, designating the posterior oblique ligament as the key structure for a successful outcome. His follow-up report9 after 22 years confirmed good results in 93% of 50 knees after surgical repair of the medial complex regardless of whether the cruciate had been repaired.

More recent literature has produced many studies of nonoperative treatment with early functional rehabilitation for complete MCL injuries with results equal to those obtained with surgery. Fetto and Marshall14 reported isolated MCL injury from grade I to III with equal results with operative and nonoperative treatment, noting that grade III lesions had slightly worse function. Elsasser et al10 compared surgical repair and nonoperative treatment noting a 98% success in nonsurgical early functional treatment versus 74% with surgical knees. The surgical knees, however, had significantly more severe injury and these groups were not comparable.

In 1983, Indelicato11 described early functional rehabilitation for complete MCL tears and compared these to a surgical group with the same isolated injury pattern. Both groups underwent arthroscopy and examination under anesthesia to confirm isolated injury status. The objective rating for the groups was 94% excellent (surgical) versus 85% excellent (nonsurgical) and the combined objective and subjective scores were 88% excellent versus 90% excellent, respectively. Other reports have shown equally good results with nonsurgical treatment of MCL injuries further supporting this as a standard for treatment.13,16,21 The results of Kannus,22 however, contradict those above in that grade II sprains did well despite mild residual laxity after non-surgical treatment but grade III injuries had a poor outcome with residual symptoms and objective instability.

Most studies of conservative and operative treatment of complete isolated MCL injuries fail to delineate the site of injury. O’Donoghue5 reported the anatomy of injury from his surgical repairs with most having superficial MCL avulsion from the tibia but many capsular ligament injuries from the femur or mid-substance of the liga- ment. Indelicato’s11 surgical group also consisted of mostly tibial-based superficial MCL avulsions although he does not describe the deep capsular...
injury. Bergfeld states that most injuries present with well-localized pain over the injury site, which is most commonly the femoral origin. Some patients in these studies who fail to regain adequate stability must modify their activity, which is not acceptable as they are usually in their teenage years and places them at risk for future knee problems. We question whether the failure to identify the injury site in some of those groups is part of the reason some have failed to achieve uniformly good outcomes.

Nakamura et al described the usefulness of MRI to identify the injury site for prognosis of combined ACL/MCL injuries. Medial collateral ligament injuries with complete disruption on MRI failed to heal with valgus stability and needed augmented MCL repair at ACL reconstruction. We postulate that complete grade III injuries and some grade II injuries that consist of tibial insertion avulsion of the superficial and deep MCL lead to good outcomes in our patients. We have not had any knees with arthrofibrosis after surgery, which may be attributed to our early motion protocol, a departure from plaster casting, which was routine in the past after surgery.5,7,9

We advocate early surgical repair when an athlete has a complete tibial avulsion of the MCL due to the failure of conservative treatment to restore optimal stability in these cases. This treatment is recommended only for an athletic population and conservative treatment is acceptable for non-athletically active individuals.  

REFERENCES