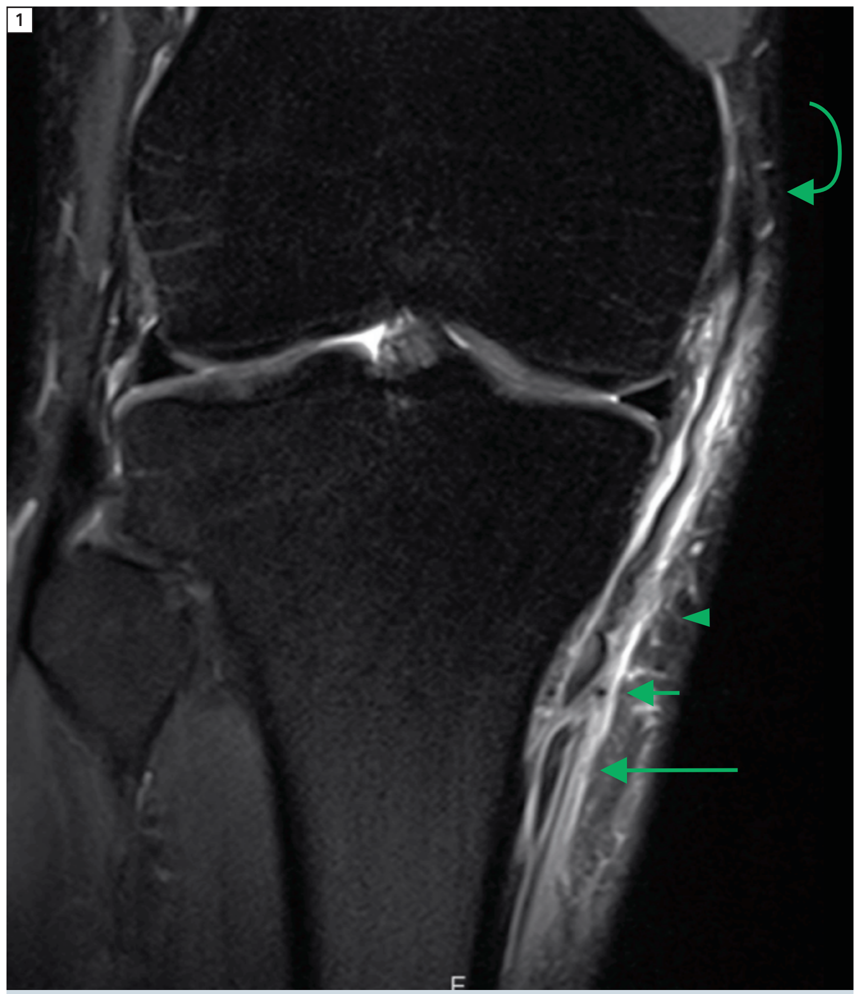
Case Report: Distal Medial Collateral Ligament Tear of the Knee

Eric K. Fitzcharles, M.D.; Charles P. Ho, Ph.D., M.D.

Steadman Philippon Research Institute Vail, CO, USA



1 Coronal fat suppressed proton density-weighted image (19/36) showing diffuse soft tissue edema and fluid about the medial knee. There is partial tearing and stripping of the proximal MCL attachment (curved arrow). There is undulating, stretched ligament contour (arrow head). Retracted distal ligament fibers (medium arrow) are superior and superficial to the intact pes anserinus tendon (long arrow).

History of present illness

New patient evaluation for right knee pain. Patient is a professional ski patroller. He was out skiing for fun, landed and felt a pop in his knee. He was able to ski down to the base area, but felt like his knee was unstable and he was unable to continue to ski. He had knee pain and feelings of instability since then. He has not been able to return to his athletics. He states that his pain at rest is a 1/10 and at its worse, it is 4/10. It is improving and occasional. He also experiences giving away and popping in his knee. He has never had a knee injury before. He has tried bracing, ice and decreased activity to treat it. No history of knee surgery.

Musculoskeletal examination

The patient is tender to palpation over the right knee medial collateral ligament. Otherwise, he is nontender to palpation throughout his bilateral knees. His range of motion today is -5 to 135 on the right, and -5 to 150 on the left. He is stable to Lachman, anterior and posterior drawer, and varus stress. He opens significantly to valgus stress on the right knee, but not on the left knee. He has normal patellar motion and glide. He has no crepitus. His light touch is intact in all dermatomes distally. His motor strength is 4+/5 on the right and 5/5 on the left in all myotomes.
X-rays show that he has no bony abnormalities, but he does have opening to valgus stress on the right knee.

Table 1: MRI technique.

Weighting and planes	Field-of-view	TR	TE	Sequence	Slice thickness	Gap	Matrix size
T2-weighted axial	115	5320	100	Turbo Spin Echo	3.2 mm	0.3 mm	512 x 512
Proton Density-weighted axial fat suppressed	150	1200	45	Turbo Spin Echo fat suppressed	2 mm	0.0 mm	256 x 256
Proton Density-weighted sagittal	140	2570	41	Turbo Spin Echo	2 mm	0.0 mm	256 x 256
Proton Density-weighted sagittal fat suppressed	150	1200	45	Turbo Spin Echo fat suppressed	2 mm	0.0 mm	256 x 256
Proton Density-weighted coronal	120	2770	31	Turbo Spin Echo	3 mm	0.3 mm	640 x 640
Proton Density-weighted coronal fat suppressed	160	6040	41	Turbo Spin Echo fat suppressed	2 mm	0.3 mm	512 x 512

Clinical assessment

High-grade Medial Collateral Ligament (MCL) disruption.
MRI (Table 1, Figs. 1– 4): High-grade complete tear and stripping and retraction of the distal medial collateral ligament from its tibial insertion site, with possibly a few residual continuous but elongated and stretched fibers, which may be from interstitial tearing. The majority of ligament fibers appear retracted to a level 4.5 cm below the joint line, proximal to pes anserinus and superficial to the distal pes tendons. There also appears to be partial tear involving the proximal medial collateral ligament, with adjacent edema and evidence of stretching. Osteochondral impaction fracture injury of the posterolateral femoral condyle with mild cortical flattening and underlying osseous edema, as well as some overlying chondral thinning. Small joint effusion is noted.

Discussion

Anatomy

There are three tissue layers in the medial knee [1]. The superficial crural and sartorial fascia form the outer layer. The superficial and deep medial collateral ligament forms the middle and deep layers [1]. The superficial MCL proximal attachment site is the posterior aspect of medial femoral condyle, proximal and posterior to the medial epicondyle.

There are two distal attachments:

1. The anterior arm of the semimembranosus tendon.

2. A broad insertion just anterior to the posteromedial crest of the tibia.

The broad tibial insertion of the superficial medial collateral ligament is located deep and posterior to the pes tendons [2]. The superficial ligament can also be divided into anterior and posterior portions. Anterior fibers tighten with knee flexion. Posterior fibers form the posterior oblique ligament (POL). The POL extends distally from adductor tubercle with three arms [3]:

1. Tibial arm to the posterior tibia.

2. Capsular arm blends into the capsule and the proximal oblique popliteal ligament.

3. Inferior arm to the semimembranosus tendon sheath, and inserts just distal to the semimembranosus.

The superficial layer of the MCL provides restraint to valgus stress at knee, providing from > 60–70% of restraining force depending on knee flexion angle. At 25° of flexion, the MCL provides 78% of the support to valgus stress. At 5° of flexion, it contributes 57% of the support against valgus stress [1]. The semimembranosus, pes anserinus, and quadriceps tendons also provide medial stability [3].

The deep MCL is divided into meniscofemoral and meniscotibial ligaments. It inserts directly onto the edge of tibial plateau and medial meniscus. Unlike the superficial MCL, it does not provide significant resistance to valgus force [1].

Clinical history and examination findings

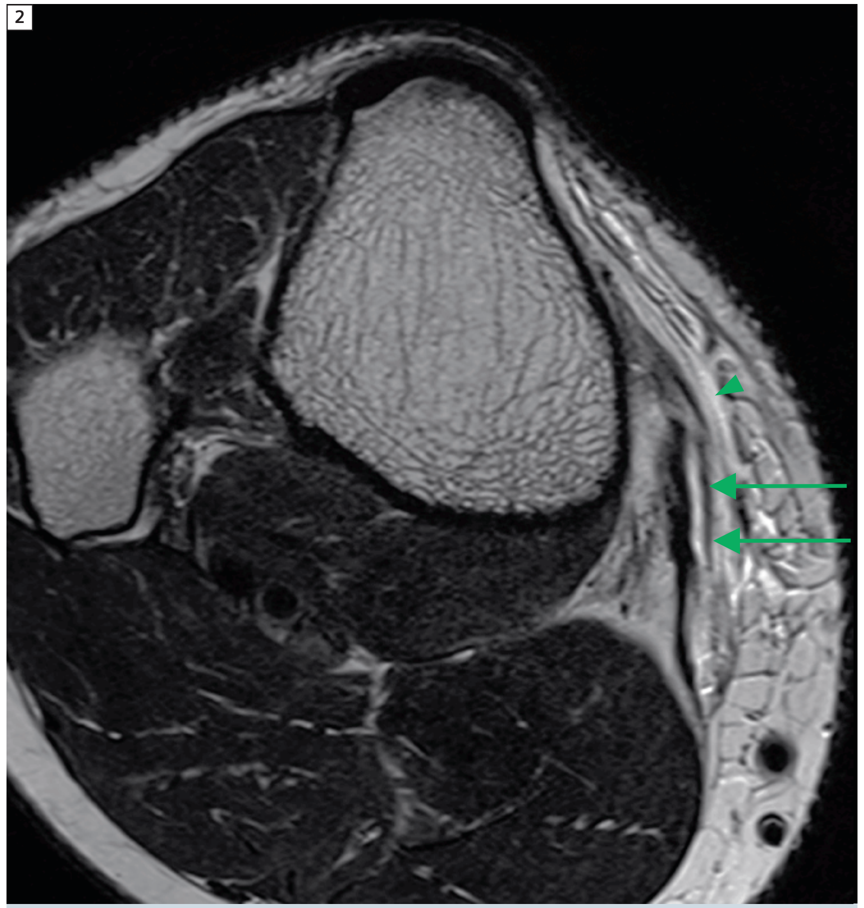
The overall cause of MCL injury is valgus stress across the knee joint. There are several mechanisms of injury. The most common is a direct blow to the lateral side of the knee while the foot is planted on the ground and the knee is partially flexed, exemplified by the common football 'clipping' injury. MCL injury may also occur without ground contact, by a forced external rotation of the tibia, as is often seen in skiers. A valgus force to the knee with the foot in unloaded external rotation may also act as a mechanism.

MCL sprains can and often do occur along with other injuries, such as Anterior Cruciate Ligament (ACL) / Posterior Cruciate Ligament (PCL) tears and meniscal injuries.

Exam findings may be subtle, even with complete MCL rupture. Comparison to the opposite knee is essential. It is very important to assess for valgus laxity, with or without an endpoint, and to determine the point of maximal tenderness.

In mild flexion, such as 30 degrees, valgus stress testing is specific for just the MCL [1]. In extension, the examiner is testing the posterior portion of the MCL, the posterior oblique ligament, the ACL, medial portion of posterior capsule, and possibly also the PCL.

If the ligament is torn from medial epicondyle, it may avulse or elevate a small bony fragment, causing focal tenderness to palpation. This is the classic Pellegrini-Stieda phenomenon, showing calcification or a bone fragment at origin of MCL on X-ray.



2 Axial T2-weighted image (27/40) showing retracted distal MCL fibers (arrow head) superficial to the intact pes tendons including most anterior, the sartorius tendon (long arrows).

If there is a mid-MCL tear, the overlying tendons may also be torn. There can be a palpable defect with focal tenderness at the level of the medial joint line.

With a distal tibial tear, tenderness may be felt 6–8 cm down medial tibial shaft, along length of the ligament insertion.

A 'Stener-like' injury (see below) should be suspected in the presence of remarkable, abnormally tender swelling and ecchymosis over the medial joint line and proximal tibia [4]. Valgus laxity testing is not necessarily conclusive.

Associated knee injuries, most commonly ACL and meniscal tears, will obviously exhibit additional exam findings.

MRI

The vertical and posterior oblique components of the MCL are depicted consistently on coronal MRI sequences. The MCL appears as a thin, taut, well-defined, low signal linear structure running from the medial femoral epicondyle to the medial tibial metaphysis [5]. The MCL runs parallel and adjacent to the medial femoral epicondyle and medial tibial metaphysis. The grading system for MCL and other ligament tears [5] is:

Grade I: Sprain

Grade II: Partial tear

Grade III: Complete tear

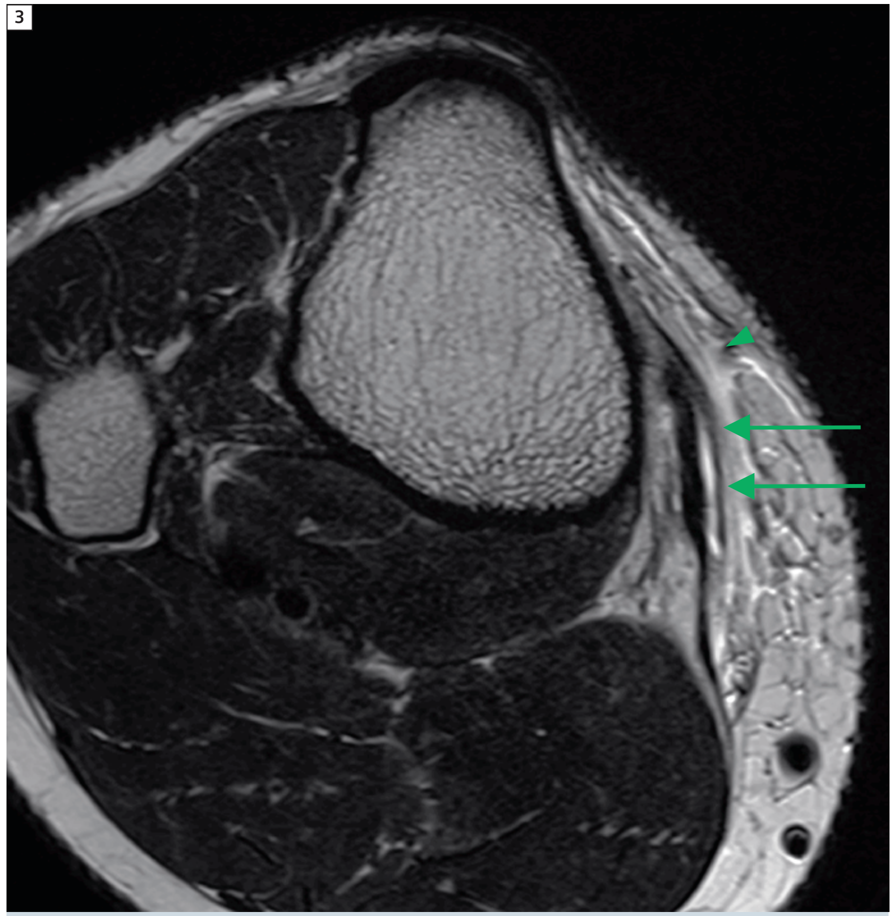
Calcification in and near the proximal MCL can be seen radiographically in the setting of chronic MCL tear, or acute avulsion fracture.

Acute MCL tear appearance depends on severity. Grade I sprains of the MCL are the most frequent ligamentous injury of the knee [4]. Sprains exhibit an intact ligament of normal thickness, surrounded to a variable degree by soft tissue edema.

Grade II tears show thickening and/or partial disruption of MCL fibers, with surrounding soft tissue edema and possibly hemorrhage. There are residual intact ligament fibers visible.

Grade III MCL tears show complete disruption of the ligament with corresponding surrounding hemorrhage and edema. There may be avulsion of either attachment site, and there is often an undulating, stretched appearance to the ligament. Proximal tears are more common than distal tears. If there is complete ACL tear, complete disruption of the MCL is more likely.

A chronic MCL tear is seen as an ill-defined, thickened ligament with low T1 and T2 signal. The MCL can partially ossify in a chronic setting, and normal bone marrow signal may be seen proximally.



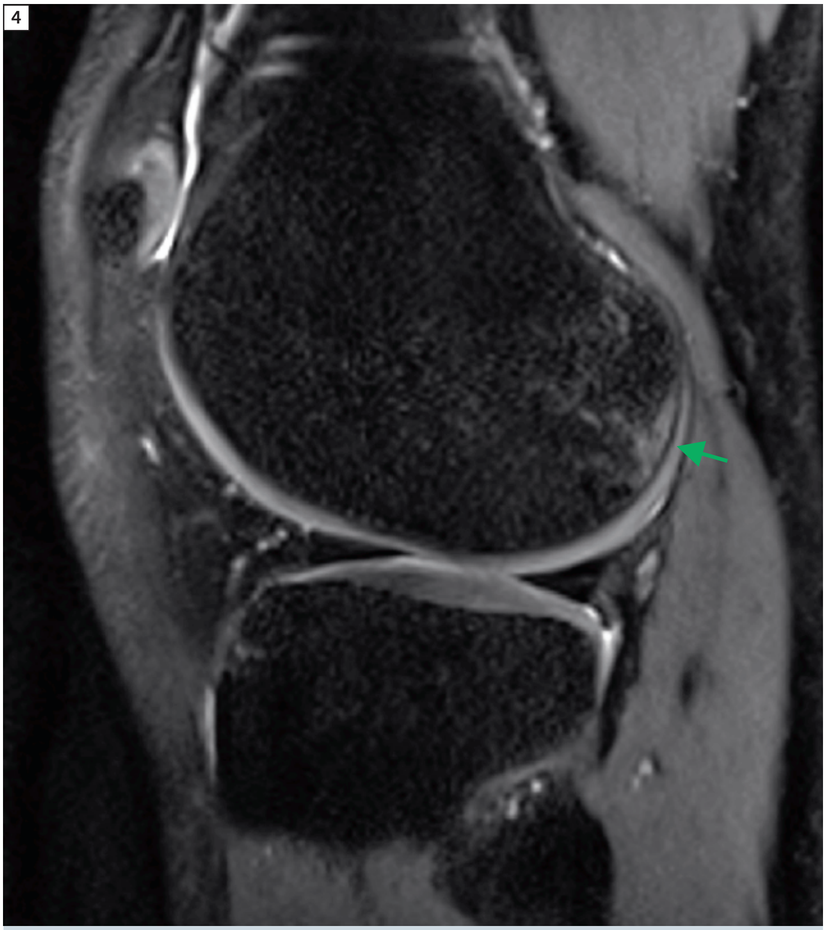
3 Axial T2-weighted image (28/40) distal to Figure 2 showing retracted distal MCL fibers (arrow head) superficial to the intact pes anserinus tendons (long arrows).

'Stener-like' MCL tear

In the thumb, disruption of the distal insertion site of the ulnar collateral ligament of the first metacarpophalangeal (MCP) joint and displacement over the adductor aponeurosis were described by Stener [6] in 1962. A similar 'Stener-like' tear of the MCL is uncommon, but warrants special consideration due to its unique features and treatment [4]. Valgus laxity testing is not always conclusive, but MRI will show MCL fibers retracted from their normal position deep to the pes tendons [2]. Similar to a Stener lesion of the thumb, if these stripped or torn MCL fibers are displaced superficial to the pes tendons, direct healing is not possible, resulting in persistent valgus laxity and instability. Surgical repair should be considered in these cases.

Bone contusions

With a classic clip injury, bone marrow edema is most prominent in the lateral femoral condyle, due to the direct blow. There is often a second smaller area of edema in the medial femoral condyle or medial tibial plateau, from avulsive MCL stress [7].



4 Sagittal fat suppressed proton density-weighted image (44/59) showing edematous impaction fracture of the posterior lateral femoral condyle (arrow).

MCL tears are not usually isolated. Aside from bone contusions, other injuries such as ACL tears and medial meniscal tears (O'Donoghue's triad) are often seen [5]. 73% of complete MCL tears are associated with other knee injuries, most commonly ACL tear [5].
Compared to the Lateral Collateral Ligament (LCL) injuries, the sensitivity, specificity, and accuracy of MRI for MCL injuries are less well established due to their nonsurgical nature, but they may be assumed to be similar to those of the LCL. High T1-weighted fatty tissue interposed between the layers of the MCL is a normal finding that may mimic an MCL tear.

Non operative treatment

MCL tear healing potential is directly related to size of the gap between the torn ends. Optimal healing occurs when the ends are directly opposed. MCL fibers heal much better than the ACL [3]. Maturation of scar tissue occurs from 6 weeks to one year. The ligament reaches approximately 50% of its original strength at 12 months. Mature scar tissue is about 60% as strong as a normal MCL, but the total load necessary for failure can be about the same as that of an uninjured MCL, since the thickness of scar tissue is usually greater than that of the original ligament.

Operative treatment

Surgery is obviously tailored to the location of the tear. If there is femoral avulsion, the location of the reattachment is very important. Reattachment anterior to its original location may limit knee flexion, where as posterior reattachment may cause laxity. The knee should be held in 30 degrees flexion during reattachment.
Surgical repair or at least relocation of Stener-like MCL tears should be considered [4]. This consists of refixation to the tibial insertion site. The surgeon may restore normal tension by securing the retracted ligament to an area of roughed up bone, and secure with sutures or a staple.

References

1 Wheeless, CR (original text). Medial Collateral Ligament. Wheeless Textbook of Orthopedics Web site. http://www.wheelessonline.com/ortho/medial_collateral_ligament. Updated August 30, 2011. Accessed November 4, 2011.
2 De Maeseneer M, et al. Sonography of the Medial and Lateral Tendons and Ligaments of the Knee: The Use of Bony Landmarks as an Easy Method for Identification. AJR 2002; 178(6): 1437-1444.
3 Phisitkul P, et al. MCL Injuries of the Knee: Current Concepts Review. Iowa Orthopaedic Journal 2006; 26:77–90.
4 Corten K, et al. Case Reports: A Stener-like Lesion of the Medial Collateral Ligament of the Knee. Clin Orthop Relat Res 2010; 468(1):289–293.
5 Freitas A, et al. Collateral Ligament Injury MRI. Medscape Reference Web site. http://emedicine.medscape.com/article/401472-overview. Updated May 25, 2011. Accessed November 7, 2011.
6 Stener B. Displacement of the ruptured ulnar collateral ligament of the metacarpo-phalangeal joint of the thumb: a clinical and anatomical study. J Bone Joint Surg Br. 1962;44:869–879.
7 Sanders TG, et al. Bone Contusion Patterns of the Knee at MR Imaging: Footprint of the Mechanism of Injury. RadioGraphics 2000; 20:S135-S151.

Contact
Charles P. Ho, Ph.D., M.D.
Steadman Philippon Research Institute
181 W. Meadow Dr. Suite 1000
Vail, CO 81657
USA
Karen.briggs@sprivail.org