Medial-Sided Repair in Multi-Ligamentous Knee Injury

Rohan R. Patel,* BS, Joshua S. Green,† MS, Jay Moran,‡ MD, Estevao Santos,‡ MD, and Michael J. Medvecky,‡§ MD
Investigation performed at Yale School of Medicine, New Haven, Connecticut, USA

Background: Injuries to the medial structures of the knee are common in multi-ligamentous knee injuries (MLKIs), which account for 0.02% of orthopedic injuries each year. The most common medial structure involved is the superficial medial collateral ligament (sMCL) with possible additional injury to the posterior oblique ligament (POL) and deep medial collateral ligament (dMCL). There has been little evidence for the superior management of these structures regarding the use of repair or reconstruction to reproduce overall knee function. Although reconstruction may provide more valgus stability postoperatively, the use of sMCL repair over reconstruction may be superior at reestablishing native anatomic alignment and kinematic relationships of the knee while also preserving proprioception and providing similar valgus stability.

Indications: Surgical repair of medial structures is typically indicated for third-degree injuries, bony avulsions, tibial plateau fracture, intra-articular entrapment of the end of the ligament (Stener-type lesions), or anteromedial stability. They are particularly indicated in the elite athlete who presents with excessive valgus laxity due to valgus knee loading, external rotation, or combined force vectors.

Technique Description: This surgical technique video demonstrates an open, medial-sided femoral and tibial approach to repair proximal and distal medial knee structures in the setting of MLKIs using case examples of a Stener lesion and a combined sMCL, POL, and medial patellofemoral ligament tears.

Results: Repair of sMCL injuries has been reported to show favorable healing, knee stability, and function.

Discussion/Conclusion: The use of fixation of the sMCL to its anatomical attachment points offers similar valgus stability and improved functional and patient-reported outcomes when compared with sMCL reconstruction.

Patient Consent Disclosure Statement: The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

Keywords: medial repair; Stener lesion; superficial medial collateral ligament; multi-ligamentous knee injury; sMCL avulsion

VIDEO TRANSCRIPT

In this video, we are going to present medial-sided ligament repair in multi-ligamentous knee injuries (MLKIs).

We have no disclosures to report.

MLKIs account for 0.02% of orthopedic injuries in the United States each year, with male incidence 2 times greater when compared with females.[3] The most commonly repaired or reconstructed medial structures in MLKIs are the superficial medial collateral ligament (sMCL), posterior oblique ligament (POL), and deep medial collateral ligament (dMCL).[3,9] Given the low incidence of MLKIs and slow development of further research on medial-sided repair, there is still ongoing discussion to determine the superior MCL management strategy. First- and second-degree tears have historically been treated nonoperatively while third-degree tears undergo operative treatment with additional consideration of location, associated injuries, and particular imaging characteristics.[3,4] Ligament repair may provide superior preservation of knee proprioception,[2]

§Address correspondence to Michael J. Medvecky, MD, Section of Sports Medicine, Department of Orthopaedics & Rehabilitation, Yale School of Medicine, Yale University, New Haven, CT 06510, USA (email: Michael.Medvecky@yale.edu).
*College of Medicine, State University of New York Upstate Medical University, Syracuse, New York, USA.
†Frank H. Netter MD School of Medicine, Quinnipiac University, North Haven, Connecticut, USA.
‡Section of Sports Medicine, Department of Orthopaedics & Rehabilitation, Yale School of Medicine, Yale University, New Haven, Connecticut, USA.

Submitted October 2, 2023; accepted December 28, 2023.

One or more of the authors has declared the following potential conflict of interest or source of funding: M.J.M. receives travel, food costs, and educational conference speaking fees from Smith & Nephew. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

Video Journal of Sports Medicine (VJSM®), 4(3), 26350254241226723
DOI: 10.1177/26350254241226723

while with reconstruction it is difficult to restore the native anatomic alignment as the attachments, graft type tensioning, and size are determined by the surgeon and can be variable.[3]

The sMCL, POL, and medial patellofemoral ligament (MPFL) are the major knee structures typically involved in surgeries for medial repair of the knee. The sMCL is the more commonly injured structure with a femoral insertion site anterior and inferior to the POL's femoral insertion and just inferior to the MPFL's femoral insertion. As you go more distally, the sMCL has both proximal and distal tibial attachments and sits directly anterior to the POL. The proximal tibial attachments primarily to soft tissue of which the majority consists of the anterior arm of the semimembranosus tendon, which attaches directly to the bone itself. The distal tibial attachment sits anterior to the posteromedial crest of the tibia and the posterior aspect of the tibial portion of the sMCL blends with the distal tibial expansion of the direct arm of the semimembranosus.

The primary aim of surgical repair of third-degree injuries is to reattach the affected medial structures to their respective proximal and/or distal attachment sites. In doing so, surgical repair can restore overall knee function by recreating the distinct functions of the MCL, POL, and other involved medial structures.

In the following case, our patient is a 30-year-old female who suffered an abrupt twisting injury to the left knee when she got her foot caught on the edge of a slide and felt as if her knee dislocated. The patient self-realigned the leg before being brought to the emergency room. Radiograph at the time of arrival was unremarkable, so the patient was placed into a knee immobilizer and discharged with crutches.

Physical examination demonstrated limitation of motion to 100° of flexion secondary to the acuity of injury, increased lateral patellar translation at 30°, grade IB Lachman, grade zero posterior drawer, with 12 mm of medial compartment opening at 30° with soft endpoint and 3 mm of opening near full extension.

Medial compartment gapping during valgus stress testing at full extension and 20° of flexion is useful in indicating injury to the POL and the sMCL, respectively. Anteromedial drawer and dial tests can further elucidate injuries to the POL or dMCL.[5] Valgus stress radiographs demonstrating gap increases of 3.2 mm are common in isolated sMCL tears while concomitant injuries to the POL and dMCL typically increase the gap by at least 9.8 mm.[5] Even though stress radiographs are typically done in the chronic setting of medial knee injury, acute imaging can provide important information on ligament integrity.

Magnetic resonance imaging (MRI) proves useful to confirm the diagnosis of any medial structure tears suspected on physical examination and radiograph findings. In a different patient from the one initially introduced, coronal imaging demonstrated a femoral-sided sMCL injury.

Further axial imaging demonstrated femoral avulsion of the MPFL.

In our original patient presenting with MLKI of the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), sMCL, and MPFL, these coronal MRI images revealed a tibial-sided sMCL tear with the distal tissue widely separated from the tibia. A medial retinacular tear including a dMCL tear was also visualized.

Further axial imaging demonstrated the gracilis and semitendinosus tendons superimposed between the tibia and the sMCL, characteristic of a Stener lesion.

A recently published repair of Stener lesions used a modified Kessler technique with 3 double-loaded suture anchors with the knee positioned in 30° of flexion with gentle varus stress. The 2 proximal suture anchors were placed directly distal to the tibial joint line for sMCL and dMCL repair, and the distal anchor was placed 6 cm below the joint line accounting for the second sMCL attachment. If the patient presented with a concomitant femoral sMCL tear, the tendon was reattached to the medial epicondyle attachment site using 1 to 2 suture anchors.[8]

Repair of injury to additional medial knee structures such as the MPFL and POL can be accomplished in a variety of ways.[1,6,7] However, the most important detail is to identify the correct femoral attachment sites so that adequate function of the medial knee can be maintained.

Primary indications for medial-sided repair in the presence of MLKI include severe retraction or displacement of the sMCL,[2,10] a Stener-type lesion,[2] combined injury with other ligaments or cartilaginous structures of the knee,[2] and avulsions 4 weeks out or less from injury, but ideally repaired within 1 to 2 weeks.[3]

For the open repair of medial structures, patient positioning can be adapted based on surgeon preference or surgical need. For concomitant arthroscopic or intra-articular procedures, patient can be positioned in surgeon's typical arthroscopy setup.

For a femoral-sided repair, a focused incision was made along the medial aspect of the knee from the supracondylar region down to the medial joint line. Upon entering the subcutaneous tissue, the sartorial fascia was opened and split in line with the superficial incision. Once visualization of the knee joint was obtained, the avulsed proximal aspect of the sMCL was identified. Sutures were applied to the MPFL and the sMCL before determining the appropriate reattachment points for the respective structures. The MPFL is visualized well here. Another remnant of the sMCL still attached to its origin on the medial femoral condyle is visualized here, and a stitch applied to the sMCL can also be seen around the periosteum that avulsed from the femoral condyle. The sutures of the sMCL and additional sutures applied to the POL were used to tension both structures and simulate their native locations respective to each other. Once the reattachment sites were determined, a pin with passing sutures was used to pull the krackow sutures attached to each ligament through their respective holes. All 3 structures were then tensioned into their native attachment sites with the transosseous sutures tied over a button on the lateral femoral condyle with the knee at 30° of flexion for the sMCL and full extension for the POL. Alternatively, the sutures could be placed into a knotless suture anchor. Once all structures were in their final attachment sites, valgus stress was tested

at 30° flexion to confirm integrity and functionality of the sMCL and MPFL and then at full extension to test the POL.

For a Stener lesion, a focused anteromedial incision was made from the tibial tubercle down to the attachment site of the distal sMCL and dissection was carried down along the incision. Upon entering the subcutaneous tissue, the sartorial fascia was opened and split in line with the superficial incision. The avulsed portion of the distal sMCL was first identified before moving forward. Here, you can see the sMCL positioned above the pes anserinus. A tonsil clamp was subsequently used to identify the path of the distal sMCL under the gracilis and semitendinosus tendons. The sMCL was then held distally to approximate the distance of attachment relative to the pes anserinus tendons. Krackow sutures were placed in the distal sMCL before final tensioning. The sMCL was subsequently fed underneath the gracilis and semitendinosus tendons and tensioned with the knee at 30° of flexion. Final fixation was completed by placing the krackow sutures into 2 separate knotless tibial anchors, one at the anterior aspect and the other at the posterior aspect of the sMCL attachment site. Retracting the gracilis and semitendinosus tendons post-repair allows for visualization of the anchors securing the distal sMCL to its final reattachment site. Final repair of the stener lesion results in the appropriate tracking of the distal sMCL underneath the gracilis and semitendinosus tendons and attachment to its distal tibial site.

Stepwise progression of weightbearing and range of motion during the post-op period was undertaken to avoid stress to the medially repaired structures.[5]

Typical postoperative complications such as deep venous thrombosis, pulmonary embolisn, and infection exist with this surgery, but increased attention has been placed toward the monitoring of the development of arthrofibrosis due to the acute nature of the surgery.[5] The proximity of the saphenous nerve branches can also lead to saphenous neuritis.[9]

Large-scale studies are lacking on this topic, but several studies have shown excellent outcomes with acute repair but limited comparison studies exist.

Here our references are listed.

Thanks for taking the time to watch our video.

ORCID iDs

Joshua S. Green https://orcid.org/0000-0003-2121-019X
Michael J. Medvecky https://orcid.org/0000-0003-1481-3232

REFERENCES

1. Canata GL, Chiey A, Leoni T. Surgical technique: does mini-invasive medial collateral ligament and posterior oblique ligament repair restore knee stability in combined chronic medial and ACL injuries? *Clin Orthop Relat Res*. 2012;470(3):791-797. doi:10.1007/s11999-011-2018-4.
2. Fanelli GC, Chavez EM, Ibe I, Medvecky MJ. Surgical treatment of combined ACL and medial-sided knee injuries: acute and chronic. In: Fanelli G, ed. *The Multiple Ligament Injured Knee a Practical Guide to Management*. Cham, Switzerland: Springer; 2019:139-152.
3. Hanley JM, Anthony CA, DeMik D, et al. Patient-reported outcomes after multiligament knee injury. *Orthop J Sports Med*. 2017;5(3):232596711769481. doi:10.1177/2325967117694818.
4. Kini SG, du Pre K, Bruce W. Posttraumatic incarceration of medial collateral ligament into knee joint with Anterior Cruciate Ligament Injury. *Chin J Traumatol*. 2015;18(6):367-369. doi:10.1016/j.cjtee.2015.11.004.
5. LaPrade RF, DePhillipo NN, Dornan GJ, et al. Comparative outcomes occur after superficial medial collateral ligament augmented repair vs reconstruction: a prospective multicenter randomized controlled equivalence trial. *Am J Sports Med*. 2022;50(4):968-976. doi:10.1177/03635465211069373.
6. Nomura E, Inoue M, Osada N. Augmented repair of avulsion-tear type medial patellofemoral ligament injury in acute patellar dislocation. *Knee Surg Sports Traumatol Arthrosc*. 2004;13(5):346-351. doi:10.1007/s00167-004-0544-2.
7. Rayes JE, Fradin T, Ngbilo C, et al. Posterior oblique ligament repair concomitant to anterior cruciate ligament reconstruction. *Arthrosc Tech*. 2021;10(2):551-554. doi:10.1016/j.eats.2020.10.037.
8. Thompson JW, Rajput V, Kayani B, Plastow R, Magan A, Haddad FS. Surgical repair of Stener-like injuries of the medial collateral ligament of the knee in professional athletes. *Am J Sports Med*. 2022;50(7):1815-1822. doi:10.1177/03635465221093807.
9. Wijdicks CA, Griffith CJ, Johansen S, Engebretsen L, LaPrade RF. Injuries to the medial collateral ligament and associated medial structures of the knee. *J Bone Joint Surg Am*. 2010;92(5):1266-1280. doi:10.2106/jbjs.i.01229.
10. Wijdicks CA, Michalski MP, Rasmussen MT, et al. Superficial medial collateral ligament anatomic augmented repair versus anatomic reconstruction. *Am J Sports Med*. 2013;41(12):2858-2866. doi:10.1177/0363546513503289.