

Original research article

A Study on Medial Collateral Ligament Primary Repair Vs Reconstruction of Knee Joint

¹Dr. Ankit N Gujarathi, ²Dr. Monika A Gujarathi, ³Dr. Mahantesh Y Patil, ⁴Dr. Roopa M Patil

¹Specialist Orthopaedic and Head of Department, Dept of Orthopaedic, Phoenix Hospital Abu Dhabi

²Specialist Ophthalmologist, Dept. of Ophthalmology, Lifecare Hospital Abu Dhabi

³Professor, Dept. of Orthopaedics, GIMS, Gadag

⁴Associate Professor, Dept. of Conservative and Endodontics, Gadag

Corresponding Author: Dr Roopa M Patil

Abstract

The medial collateral ligament (MCL) is commonly injured in the setting of anterior cruciate ligament (ACL) injuries. Because the MCL has better healing capacity than the ACL, the general perception is that MCL injuries can be treated conservatively. Treating these injuries conservatively, however, can lead to residual valgus laxity. Furthermore, it delays time to surgery, which prevents acute treatment of concomitant ACL injuries using primary repair or acute reconstruction. Several treatment methods for MCL injuries have been proposed, including primary repair, augmented repair with autograft tissue, or primary reconstruction. In this surgical technique article, we present the technique of acute primary MCL repair with internal bracing with 2 limited/mini-open incisions. With this technique, early surgical intervention is possible, and early rehabilitation is safe because of the internal bracing. Advantages include fast recovery, avoidance of muscle atrophy because of early mobilization, prevention of residual valgus instability, and maintenance of proprioception.

Keywords: MCL, Operative, Repair

Introduction

The medial collateral ligament (MCL) is the most common knee ligament to be injured during knee trauma (1). The annual incidence of MCL injury has been reported as 0.24-7.3 per 1,000 people with a male to female ratio of 2:1 (1, 2). A ten-year observational study demonstrated that the injury occurs in 7.9% of all athletic knee injuries (3). It is a common injury during popular sports, such as soccer, skiing, or ice hockey, as a result of either a direct valgus force to players' knees or cutting maneuvers, when athletes plant a foot and suddenly shift their direction or speed (1, 4, 5). The injury may result in knee instability against the rotational or valgus force. In their study, Memarzadeh et al. indicated that MCL injury often presents as an isolated injury; nonetheless, it may occur in combination with other ligament injuries, mostly anterior cruciate ligament injury (1). Since the MCL is an extra-articular ligament with a high healing ability, most of its injuries can be treated nonoperatively; however, the surgery may be indicated in certain instances (5). In this review, we discuss this concept with the aim of delineating the management principles of the MCL injury.

Methodology

Preoperative Evaluation and Radiographic Imaging Findings of the patient's physical

examination should include a positive valgus stress test. We also conduct other physical examinations, such as range of motion (ROM), tenderness, instability including the Lachman test, the anterior drawer test, and posterior drawer test, and the McMurray test. It is important to pay attention to other combined symptoms, including multiligament injury. A routine radiograph is required to exclude the presence of a fracture, as an avulsion fracture of femoral attachment of MCL should be treated operatively. The preoperative valgus stress radiograph shows valgus instability at 20° flexion and extension (Fig 1). Magnetic resonance imaging (MRI), which is also important for diagnosing other concomitant injuries, showed deep MCL and superficial MCL tears at the femoral side (Fig 2); therefore, this case was diagnosed as grade III MCL injury.³ The preoperative location of the MCL tear should be confirmed because this surgical technique is indicated for femoral-side MCL tear. (we are considering all femoral side grade III MCL tear (superficial&deep) in this surgical technique)

Surgical Technique

Knee arthroscopy is performed with the patient in the supine position under general or spinal anesthesia. A tourniquet is placed on the operative thigh and used if necessary. Routine arthroscopic evaluation is performed to assess intra-articular lesions using anteromedial and anterolateral portals. Arthroscopic evaluation of the medial compartment should be performed during valgus stress. Arthroscopic evaluation



Fig 1. Preoperative valgus stress radiograph. Right knee shows valgus instability (white arrow) at 20° (A) flexion and (B) extension

shows the “drive-through” sign or “floating meniscus” sign, which indicates injury of the meniscocapsular junction (Fig 3).^{4,6,7} Capsular (superficial) tear and deep MCL tear are confirmed when evaluating the medial femoral epicondyle (Fig 4). A medial portal (MP) is established at the medial femoral epicondyle because attachment of the superficial MCL is in the posterior position of the medial femoral epicondyle (Fig 5A).⁸ If it is difficult to identify the medial femoral epicondyle to establish MP, fluoroscopy may help in identifying radiographic bony landmark. A 1.5-mm JuggerKnot Soft Anchor (Zimmer Biomet, Warsaw, IN) is inserted at 3mm posterior to the medial epicondyle through the MP (Fig 5B). A far anteromedial portal is established for suture relay. A 20-G needle with PROLENE (ETHICON, Johnson & Johnson, Blue Ash, OH) is penetrated through the MP to the joint capsule and deep MCL at femoral attachment, after which the suture relay is performed through the FAMP (Fig 5 C and D). If it is difficult to locate superficial-deep MCL, MP portal can be incised further to make mini open. This

work is repeated and knot tying is performed at 20° to 30° flexion keeping knee isometry in mind (Fig 5E). After knot tying, the capsular (superficial) and deep MCL tear are repaired (Fig5F). Arthroscopic view of the medial compartment in the right knee shows improvement of the drive-through sign after MCL repair (Fig 6).

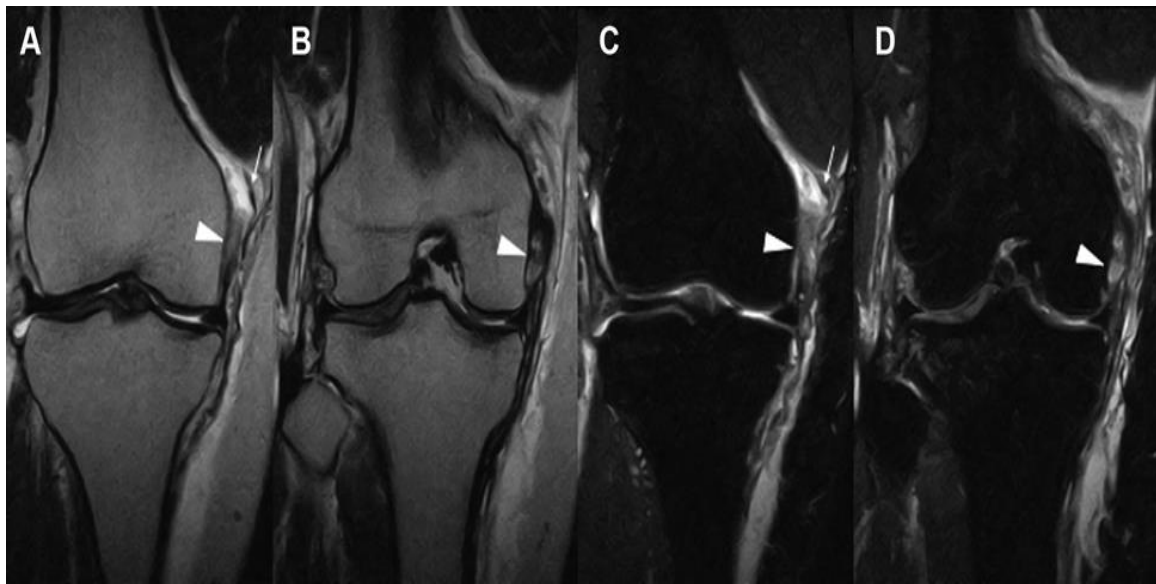


Fig 2. Preoperative MRI of right knee. MRI shows a deep MCL tear (white arrowhead) and superficial MCL tear (white arrow).(A) and (B) show T2 coronal image and (C) and (D) show T2 fs coronal image. (fs, fat suppressed; MCL, medial collateral lig-ament; MRI, magnetic resonance imaging.)

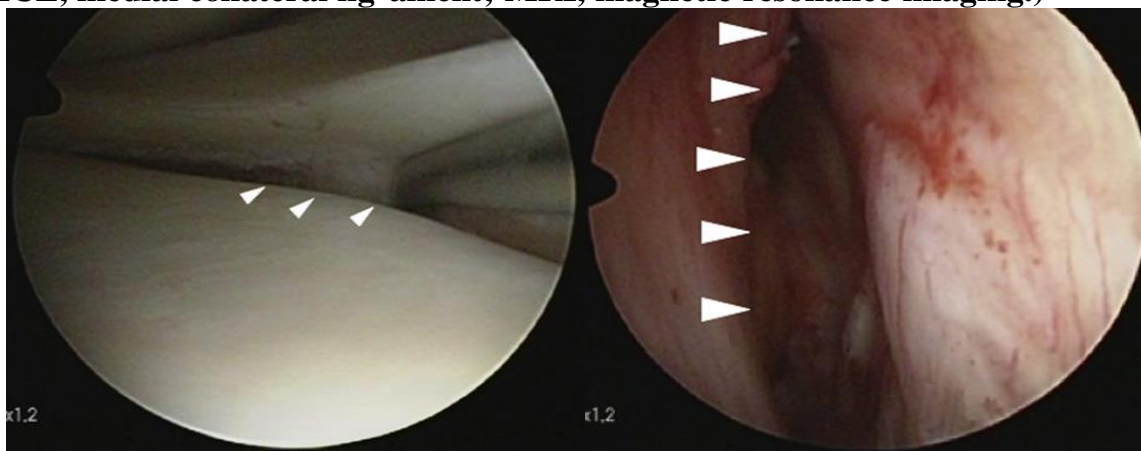


Fig 3. Arthroscopic view of the medial compartment in the right knee shows the drive-through sign (white arrowhead) with the patient in the supine position (camera via AL portal, probe via AM portal). (AL, anterolateral; AM, anteromedial.)and

Fig 4. Arthroscopic view of the capsular tear at the medial femoral epicondyle in the right knee with the patient in the supine position (camera via AL portal). White arrowheads show capsular and deep MCL tear. (AL, anterolateral; MCL, medial collateral ligament.)

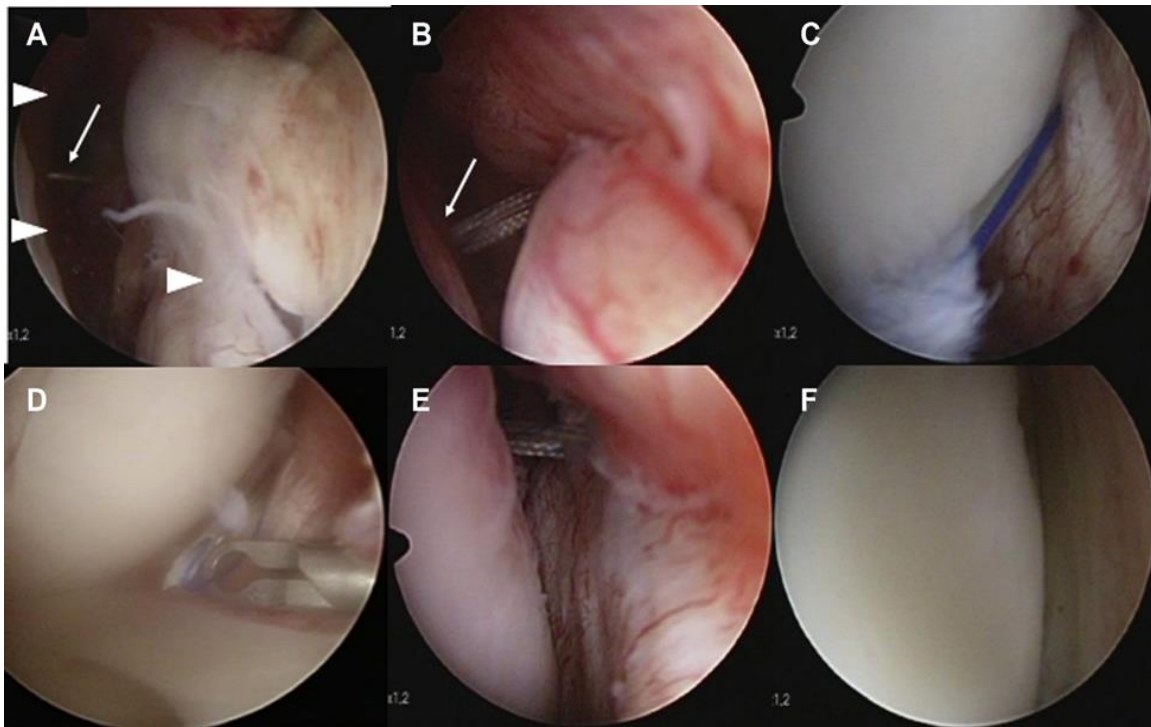
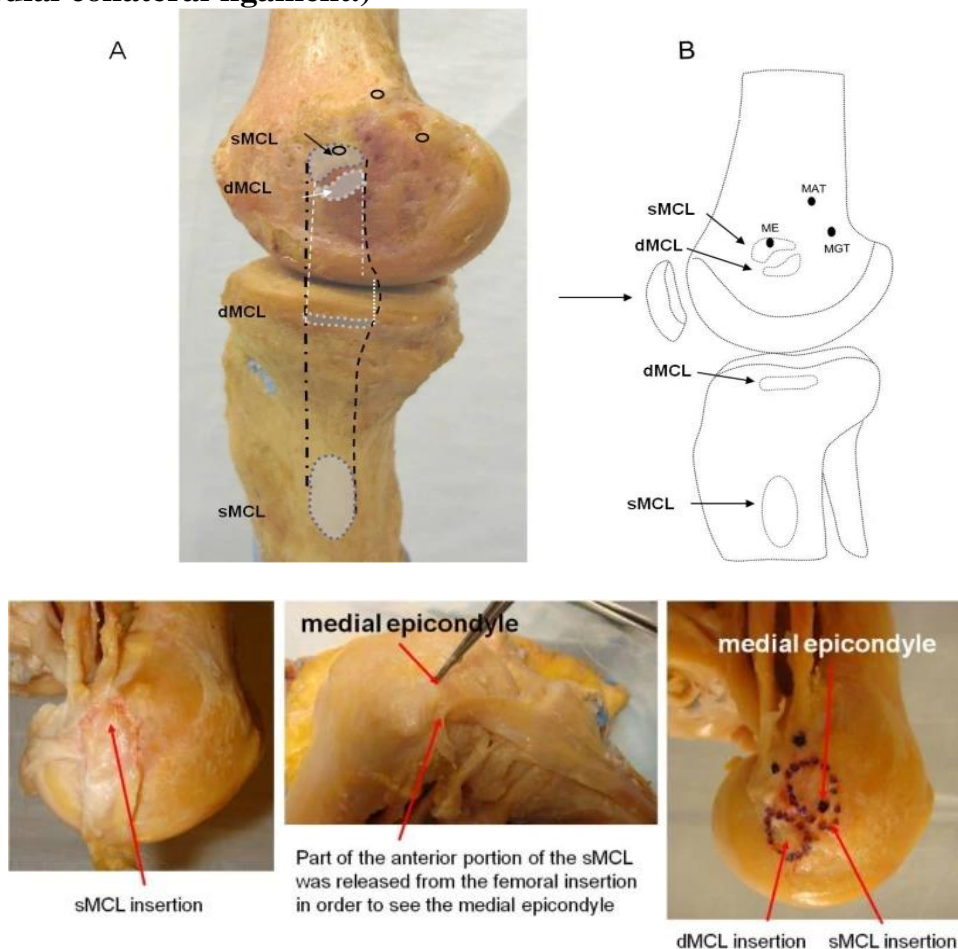


Fig 5. Arthroscopic MCL repair in the right knee with the patient in the supine position (camera via AL portal). (A) A 20-G needle penetrates at the medial femoral epicondyle and the medial portal is established at the medial femoral epicondyle. White arrow shows the 20-G needle and white arrowhead shows capsular tear. (B) A suture anchor is inserted at medial femoral epicondyle through the medial portal. White arrow shows the suture anchor. (C) A 20-G needle with PROLENE (ETHICON, Johnson & Johnson) penetrates the joint capsule and deep MCL. (D) Suture relay is performed through the far-ant anteromedial portal. (E) Knot tying is performed at 20° to 30° of flexion. (F) After knot tying, capsular and deep MCL tear is repaired. (AL, anterolateral; MCL, medial collateral ligament.)



Fig 6. Arthroscopic view of the medial compartment in the right knee with the patient in the supine position (camera via AL portal). Arthroscopy shows the

improvement of the drive-through sign after MCL repair. (AL, anterolateral; MCL, medial collateral ligament.)



Postoperative Management and Rehabilitation Protocol

The wound is inspected on second, 4th, 9th and 14th postoperative day. Sutures are removed on 14th postoperative day. A hinged knee brace is used for 4 weeks postsurgery. Isometric exercises of knee are started as soon as pain is tolerable. The primary purpose of rehabilitation is to obtain early ROM and normalized gait. Combined with other ligament injuries such as an ACL tear, is planned to acquire a normal ROM. In general, patients wear a brace with weight-bearing as tolerated, which is locked in extension until quadriceps control is regained. ROM exercise is begun 1 week after surgery. Under physiotherapist guidance. The aforementioned protocol is modified and individualized based on other injured associated structures in the knee.

Results and Observation

This is a Technical Note showing arthroscopic MCL repair with suture anchor. Our surgical technique is minimally invasive and allows patients to start functional rehabilitation. This surgical technique preserves native MCL, and it can be expected that proprioception and biomechanical properties of native MCL are preserved. Medial-side stabilizers of the knee consist of the superficial MCL, deep MCL (composed of the meniscotibial and meniscofemoral ligaments), and the posterior oblique ligament.⁶ Black et al.⁷ reported that rupture of these structures leads to medial meniscal destabilization and extrusion, making their stability of utmost importance during the rehabilitation phase of patient recovery. MCL tears are

common injuries, and most of them can be treated conservatively and healed without instability, even in cases of grade III MCL injury. Reider et al.⁸ reported positive outcomes of isolated MCL injuries in athletes with early functional rehabilitation. In addition, Halinen et al.⁹ reported in their randomized controlled trial that nonoperative and operative treatments of MCL injuries lead to equally positive results in cases with early ACL reconstruction. These reports support the conservative treatment for grade III MCL injury; however, there are some cases that show residual instability after conservative treatment. Recent studies showed that the MCL was important in restoring anterior stability with ACL and MCL injury. Zhu et al.¹⁰ reported that combined ACL and MCL reconstruction resulted in a better restoration of anterior stability compared with ACL reconstruction alone in a biomechanical study. Funchal et al.¹¹ reported that the “floating meniscus” sign was an indicator for surgical intervention in patients with combined ACL and grade II MCL injury. They described that the isolated ACL reconstruction group had a greater rate of ACL reconstruction failure and residual MCL laxity in cases of ACL and MCL injury with the “floating meniscus” sign.¹¹ Thus, treatment of grade III MCL injury remains controversial.¹² In case of failed conservative treatment, operative treatment is indicated.³ As primary MCL repair is usually performed within 7 to 10 days of injury, it is not recommended after failed conservative treatment and is best replaced with MCL reconstruction or augmentation repair,¹⁴ which has recently been performed with the Internal Brace (Arthrex, Naples, FL).¹⁵⁻¹⁷ Our surgical technique did not require graft harvesting and may not affect ACL reconstruction in cases of combined MCL and ACL injury. Thus, it may be a good intervention for combined MCL and ACL injury. Although positive outcomes of surgical treatment for avulsion fracture of femoral attachment of MCL have been reported,¹⁸ the report by Calcei et al.¹⁹ demonstrated a case that required operative treatment for painful nonunion avulsion fracture of the femoral attachment of the MCL. Thus, we also think these fractures should be treated operatively immediate after injury. In addition, there are 2 special MCL injuries that we believe are best treated using primary MCL repair. The first is the MCL tibial side avulsion injury, which is called a Stener-like lesion.^{20,21} Taketomi et al.²² reported the presence of a “wave sign” on MRI and recommended primary operative treatments. The “wave sign” is a characteristic finding on MRI in the case of a distal superficial MCL tear.²³ The second is proximal deep medial collateral ligament injury, which Narvani et al.²⁴ reported that no patients with injured deep MCL responded to conservative treatment and were, therefore, treated operatively.

Conclusions

Isolated medial side injuries of the knee are common and are treated with bracing and early motion with excellent functional results. The surgeon should be aware that several indications exist for acute repair and not all medial side injuries are amenable to conservative treatment. Chronic symptomatic medial instability should be reconstructed with anatomical techniques.

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