



Percutaneous Partial Outside-In Release of Medial Collateral Ligament for Arthroscopic Medial Meniscus Surgery With Tight Medial Compartment by Finding a “Magic Point”

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Abstract: The medial meniscus is one of the more commonly injured structures as compared with the lateral meniscus. In patients with tight medial joint space, it is difficult to visualize the posterior horn and posterior root of medial meniscus and even more difficult to use instrumentation for surgical procedures. Normally, the mean medial joint space (4.74 ± 0.75 mm) is less than the mean lateral joint space width (5.63 ± 0.86). Forceful instrumentation in a tight and a narrow medial joint compartment may cause damage to the articular cartilage, which may increase chances of arthritis in future. To increase the opening of the medial compartment after valgus extension stress position of the knee, different techniques of medial collateral ligament release have been described in the literature. However, the majority of articles describe a multiple-puncture method to the medial collateral ligament called the “pie-crusting” method, not explaining the exact point or precise location of release. Here, we describe a simple and reliable method of medial collateral ligament release by finding the exact release point, a “magic point” to increase the medial joint compartment width to facilitate better visualization and instrumentation for surgical procedures.

Meniscus injury is a very common clinical condition that an arthroscopic surgeon encounters in his or her outpatient department, and arthroscopic surgical procedures of meniscus are one of the most common surgeries of the knee.¹ Proper visualization of the anatomical structures is very important for correct diagnosis and treatment. It is extremely difficult to obtain a complete visual of posterior horn and root of the medial meniscus in varus knee.^{2,3} Forceful

instrumentation in a tight knee causes iatrogenic injury to the articular cartilage, which negatively affects the outcome and may predispose to arthritis of the joint.⁴ Using excessive force to open the medial joint may cause iatrogenic rupture of medial collateral ligament (MCL) and/or femur condyle fracture, further complicating the management.⁵ In the early 2000s, Agneskirchner and Lobenhoffer⁶ and Bosch⁷ proposed a minimally invasive technique for opening the medial compartment by percutaneous pie crusting of the capsuloligamentous structures of the posteromedial area with an 18-G needle. A review of the literature revealed the target of point for release is the posterior third of superficial MCL proximal to the medial meniscus,^{8,9} posterior part of the deep MCL,⁵ and posterior oblique ligament. However, no article specifies the precise location of percutaneous medial release. Multiple attempts for MCL release may endanger the surrounding structures, e.g., saphenous nerve and vein. Our technique is precise and reliable, and, as we found the exact point of ligament release, we do not need to perform multiple punctures. A single puncture is enough to adequately increase the medial joint space for working.

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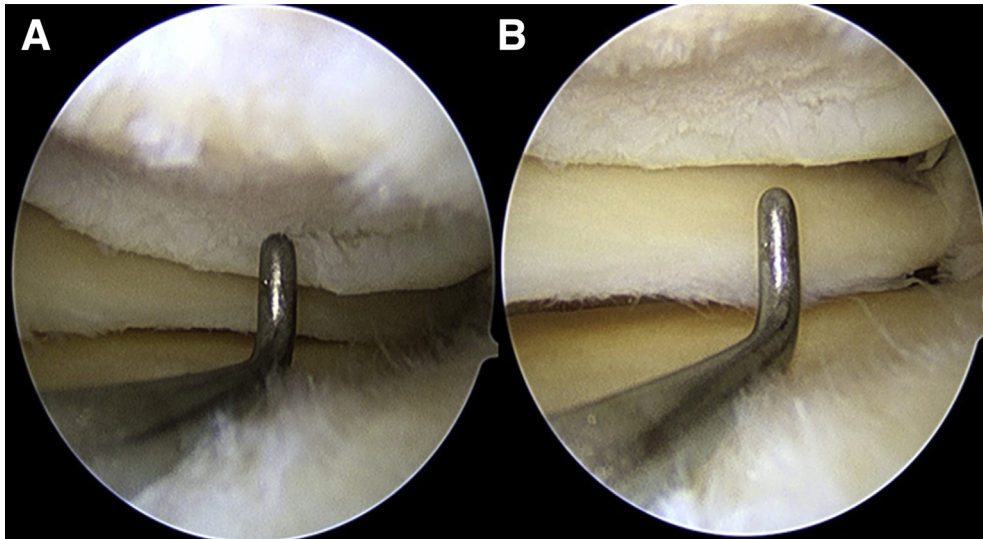


Fig 1. A 4-mm probe is passed through anteromedial portal (A) showing the narrowed medial joint compartment with the inability to pass the probe deep in the medial joint space and (B) showing the significant increase in the medial joint space after the percutaneous MCL release and probe can be passed easily. Camera in the standard anterolateral viewing portal. Right knee, standard valgus-extension position is shown. (MCL, medial collateral ligament.)

Surgical Technique

Patient Position (With Video Illustration)

Under spinal anesthesia with an adductor canal block, the patient is placed in the supine position on the operation table. The operating knee hangs at 90° from the caudal end of the table with a bolster under the proximal thigh (Video 1). A pneumatic nonsterile tourniquet is applied proximally over the thigh as possible over the soft cotton padding. We routinely inflate the tourniquet to 300 mm Hg. A lateral side post is applied at the level of tourniquet to stabilize the limb while applying valgus force.

Portal Placement

A high anterolateral portal is made just lateral to the patellar tendon and just below the lower pole of patella.

With the knee in 90° flexion, the arthroscope (4 mm, 30°) is introduced and the joint is inspected. The second anteromedial portal is established under direct vision using a spinal needle. One should be very careful not to injure the medial meniscus. Then, ensure the medial joint space knee is extended and control valgus force is applied.

Arthroscopic Medial Joint Assessment and Diagnosis

With the camera in the anterolateral portal, a probe is introduced through the anteromedial portal with the limb in extension—valgus and external rotation position. Diagnostic arthroscopy is carried out. If the medial joint compartment is tight and inadequate exposure of the meniscal posterior horn and root is seen, then MCL release is carried out (Figs 1-3).

Fig 2. The patient is in the supine position with the knee in standard valgus-extension position and arthroscope is in standard anterolateral viewing portal of right knee (A) showing the inability to reach the meniscus with 4.2-mm shaver blade before MCL release and (B) showing increased medial joint space with shaver blade reaching the posterior part of meniscus with ease after the percutaneous MCL release. (MCL, medial collateral ligament.)

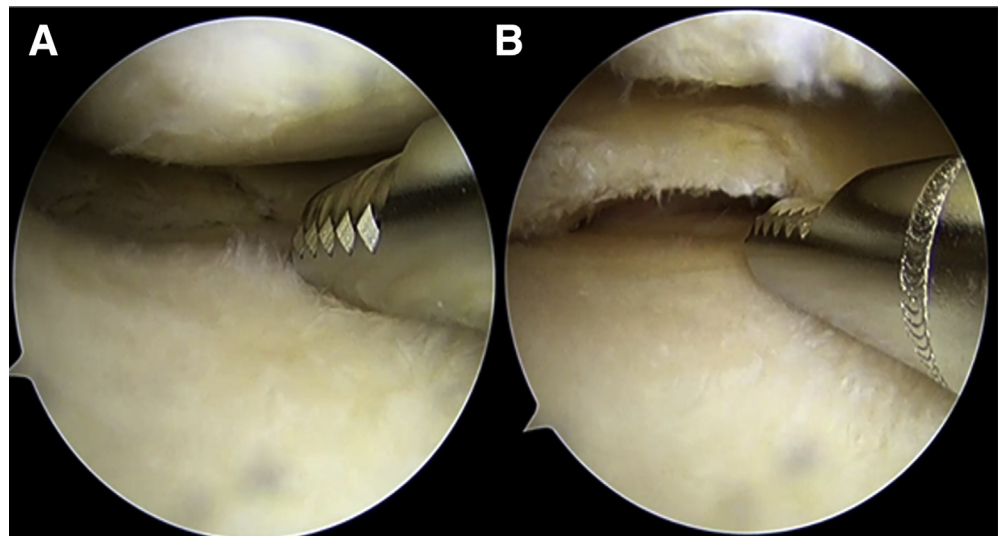
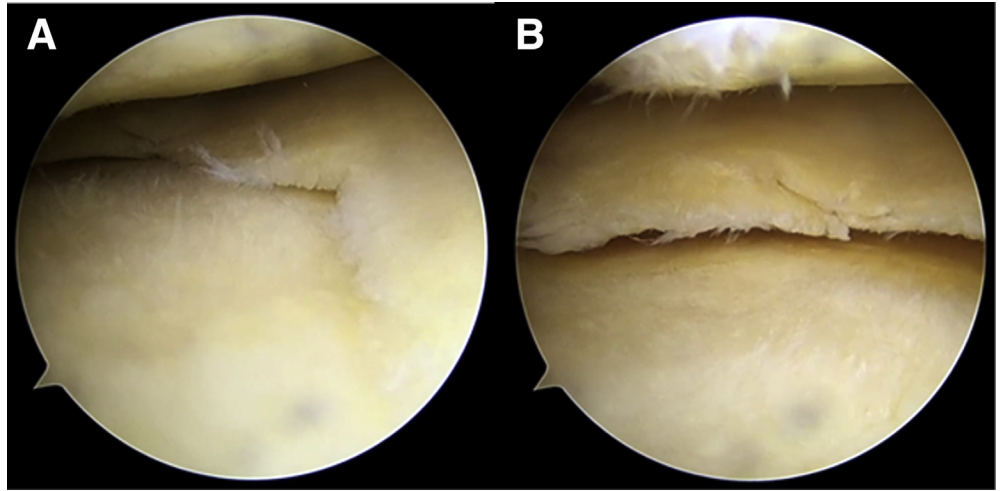


Fig 3. The patient is in the supine position with knee in standard valgus-extension position and arthroscope is in anterolateral viewing portal. A and B compare the medial joint space before and after the percutaneous magic point MCL release with an 18-gauge needle, respectively. (MCL, medial collateral ligament.)



Our Method of Percutaneous MCL Release

First, we mark the landmarks on the medial side of the knee, such as the adductor tubercle, medial epicondyle, and joint line (Fig 4 and Video 1). With the limb in full extension, palpate the posterior tibial shaft cortex until just before it flares up to form the posterior plateau and draw a straight line extending from posterior tibial cortex to the adductor tubercle. We call this line the TU (Thammasat University) line (Video 1). Based on cadaveric analysis, we found that this magic point is 2.8 cm distal to the adductor tubercle, 1.8 cm distal to the medial epicondyle, and 1.2 cm above the medial joint line on the TU line (Fig 5). The limb is in extension with the foot resting on the operating surgeon’s waist, who is administering the controlled valgus force with assistance externally rotating the leg (Fig 6). The release point of the posteromedial ligament capsular complex is identified as mentioned previously and carefully pierced with an 18-G needle just once. We routinely identify the saphenous vein and nerve to avoid injury. The magic point is anterior to the saphenous vein (Fig 7). We need to puncture this point just once to adequately open the medial joint.

Discussion

The medial meniscus is one of the most common structures of knee requiring arthroscopic attention. Oftentimes, medial meniscus injury is associated with other knee injuries like ACL tear, etc. In the typical individual, the medial joint space is narrower than the lateral, which is more evident in varus knee. Normally, the mean medial joint space (4.74 ± 0.75 mm) is less than the mean lateral joint space width (5.63 ± 0.86).¹⁰ In a tight medial joint, it is difficult to visualize and perform instrumentation arthroscopically. Inadequate exposure often leads to diagnostic error and insufficient

treatment, leading to continuation of symptoms and may require revision surgery. Forceful instrumentation in tight medial compartment results in iatrogenic articular cartilage injury, further resulting in arthritis in already-damaged knee. The superficial MCL acts as the prime stabilizer of the medial side of the knee.^{5,11-13} Biomechanical studies have shown that the greatest strains in the MCL have been recorded in the posterior region of the ligament proximal to the joint line with the knee in extension during valgus loading.^{13,14} Therefore, this area is thought to be the primary restraint to medial knee opening during valgus force in arthroscopy.

Although Park et al.³ used a similar posteromedial release technique and reported that the released structure was the deep MCL, many techniques have been described in the literature to increase the medial

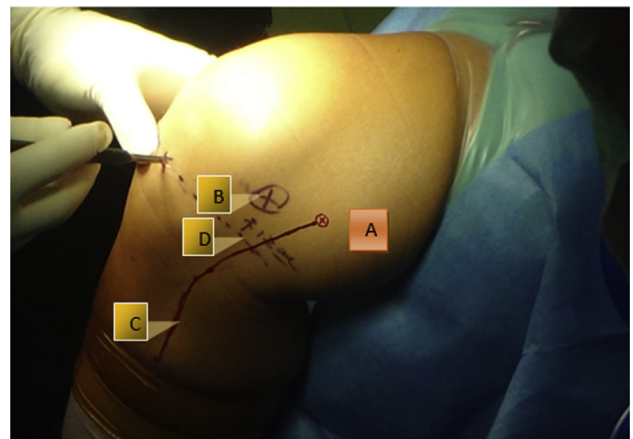


Fig 4. The patient is in the supine position with the knee hanging at 90° from the edge of table. Surface markings with sterile pen on right knee showing (A) the adductor tubercle, (B) medial epicondyle, (C) TU line, and (D) joint line on the medial aspect. (TU, Thammasat University.)

A

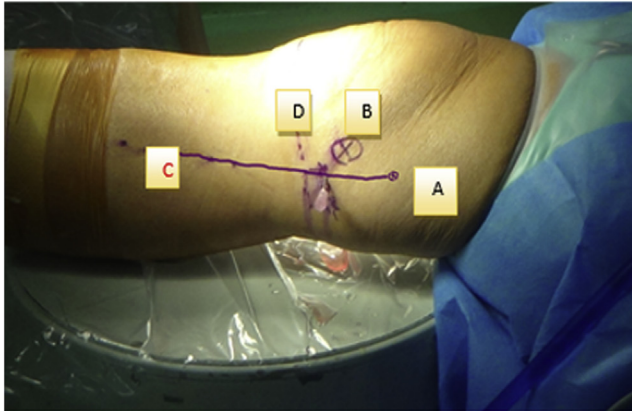


Fig 5. (A) The patient is in supine position with knee in full extension with the 18-gauge needle showing the magic point of MCL release on the TU line over the right knee with external skin markings showing the exact position of the magic point in relation with adductor tubercle, joint line, and medial epicondyle. The photograph was taken from the left-hand side of the patient. (B) The patient is in supine position with right knee in full extension. Fluoroscopic view of the “magic point” in anteroposterior and lateral view of knee shows the exact site of 18-gauge needle puncture on medial femoral condyle. (MCL, medial collateral ligament; TU, Thammasat University.)

B

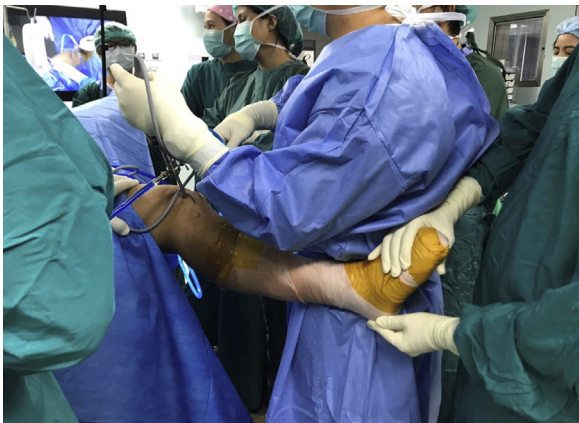
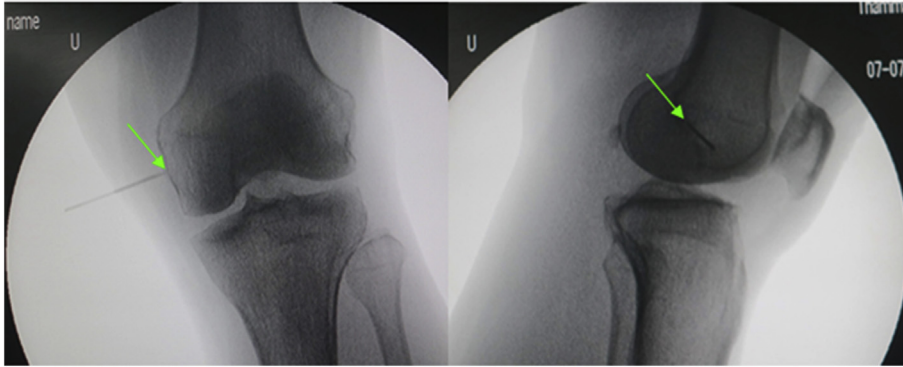


Fig 6. External view. The patient’s left limb is on the surgeon’s waist, providing control of the valgus force, with assistance simultaneously performed by an assistant, who is externally rotating the leg. The patient’s limb in standard valgus-extension position.

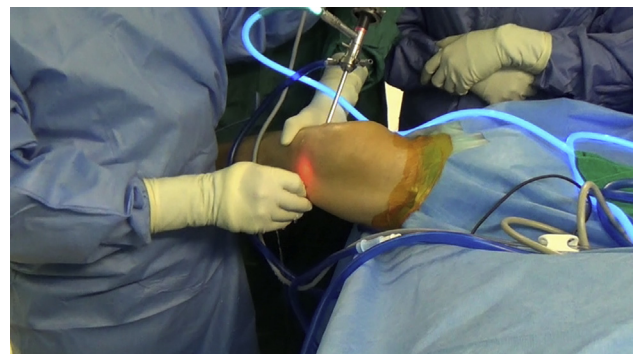


Fig 7. The patient is in the supine position with the right knee in standard valgus-extension position. The arthroscope in the anterolateral viewing portal is transilluminating the skin on the medial side of knee to identify saphenous structures such as saphenous vein using an illumination method before percutaneously puncturing the MCL, hence reducing the chances of injury to these structures. (MCL, medial collateral ligament.)

Table 1. Pearls and Pitfalls With Percutaneous Outside-In MCL Release by Finding the Magic Point During Arthroscopic Medial Meniscus Surgery

Pearls	Pitfalls
Draw a straight line from the posterior tibial cortex to the adductor tubercle.	Iatrogenic injury to articular cartilage, rarely medial meniscus and saphenous structures.
A single, bold puncture is needed approximately 1.2 cm above the joint line on this line.	Complete release of the MCL with multiple punctures.
Visible or palpable click or cracking sound occurs, indicating the release of MCL.	
Measure the medial joint space before and after the release.	
Less chance of meniscus injury, as the magic point is well above the joint line.	

MCL, medial collateral ligament

joint space and to prevent the aforementioned complications. Spahn¹⁴ applied intra-articular medial capsule and medial collateral ligament release as suggested by Leon et al.¹⁵ to treat varus arthritic knee, whereas others have suggested using the posteromedial portal for direct inspection of lesions of the posterior horn of the medial meniscus^{2,16-18} and accessing the inframeniscal portal for instrument assessment. The aforementioned methods are technically difficult and may have follow-up morbidities; hence, they are not popular among arthroscopy surgeons.

In 2004, Agneskirchner and Lobenhoffer⁶ first explained a technique of percutaneous pie crusting that is useful but may carry the possibility of iatrogenic injury to MCL, saphenous vein, and nerve. Fakioglu et al.⁸ analyzed the clinical outcome of 18 patients in whom they performed percutaneous partial medial collateral release for arthroscopic partial meniscectomy. In their study, they reported that controlled release of the MCL in tight knees allowed easier handling in posterior medial meniscus tears and a better understanding of tear configurations, thereby avoiding iatrogenic chondral lesions in addition to improved postoperative Lysholm knee score. Claret et al.¹⁹ reported similar results to the study of Fakioglu et al. and also proved that controlled percutaneous elongation of the MCL in arthroscopic meniscectomy of the medial meniscus is a safe and effective technique that reduces iatrogenic injury to the cartilage and does not produce any residual valgus instability of the knee.

In the aforementioned articles, the authors use the percutaneous pie-crusting method, in which surgeon creates multiple percutaneous punctures using a needle, for which we found following drawbacks. There is no reliable landmark for the MCL release and is a blind procedure requiring multiple punctures to obtain adequate joint opening. It puts the medial joint structures in danger of iatrogenic injuries, e.g., medial meniscus, saphenous vein, and nerve. It is time-consuming and may lead to inadequate MCL release and compromised joint space.

Beginner surgeons may find it difficult and risky. Our method of finding a "magic point" is reliable, as its anatomical position can be accurately located, as explained in the section "Surgical Technique." Our technique requires a single puncture to get the adequate joint opening. Our method does not have any residual valgus laxity on follow-up. The pearls and pitfalls of this procedure are shown in Table 1, and the advantages and disadvantages are shown in Table 2.

Conclusions

Our technique of "magic point" is simple, reliable, and very useful during arthroscopic surgery for patients with a narrow medial joint space of the knee. It does not affect the valgus laxity as well as clinical outcome. Also, with our technique, there is virtually no chance of injury to the medial meniscus and saphenous structures.

Table 2. Advantages and Disadvantages of Percutaneous Partial Outside-In Release of MCL by Finding the Magic Point in Arthroscopic Medial Meniscus Surgery

Advantages	Disadvantages
Simple and effective technique allowing easy access for the diagnosis and treatment of medial meniscus pathologies	Beginners may find it difficult to locate the magic point
Rarely saphenous nerve and vein injury occur	Over-release due to multiple punctures
Very few complications and less chance of residual MCL laxity	
Reduces the iatrogenic injury to the articular cartilage.	

MCL, medial collateral ligament.

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