Modified Surgical Technique of Making Posteromedial Portal in Knee Arthroscopy Using a Radiofrequency Device

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Abstract: In knee arthroscopy, a posteromedial portal is used for various indications including arthroscopic posterior cruciate ligament reconstruction, posterior cruciate ligament avulsion fracture fixation, posterior medial meniscal repair, medial ramp lesion repair, and synovectomy. Making the posteromedial portal is challenging for young and even experienced surgeons. Creating the posteromedical portal in knee arthroscopy is challenging and technically demanding for surgeons because of the thick muscular cover, proximity of the neurovascular bundle, tenacious tough capsule, and excessive fat deposition in the posteromedial knee and thigh region. Access for viewing the posteromedical compartment during different procedures is made simple, safe, and replicable with this technique of creating the posteromedical portal. This article describes a simple way to create the posteromedical portal using a radiofrequency device by a modified outside-in surgical technique.

A posteromedical portal in knee arthroscopic surgery is used for various indications, including arthroscopic posterior cruciate ligament (PCL) reconstruction, PCL avulsion fracture fixation, posterior medial meniscal repair, medial ramp lesion repair, and synovectomy. The posteromedical portal gives good access for visualization of the posteromedical compartment, posterior horn of the medial meniscus, and tibial PCL insertion and acts as a useful working portal. The posteromedical portal in knee arthroscopy was first described by Burman in 1931; its use has since evolved from a means of improving diagnostic utility to an important portal for instrumentation and access to various posteromedical structures. Zi Yang Chia modified the Gillquist maneuver with just the aid of a simple switching stick. Under arthroscopic visualization, the switching stick was passed through an anterolateral portal for a safer and easily reproducible approach to reach the posteromedical compartment of the knee, over which the arthroscope was shuttled and advanced into the posteromedical compartment.

McGinnis described using the posteromedical capsular folds to guide posteromedical portal placement in a cadaveric study. Kim et al. reported a technique of creating the posteromedical portal by using an inside-out technique in the trans-notch view from the posterolateral portal. In the literature, injury to the saphenous neurovascular bundle has been described as a known complication of posteromedical-portal arthroscopy.

One technique described in the literature is the creation of a posteromedical portal by a transillumination technique, whereby the arthroscope is placed in the posteromedical compartment and the light source is rotated to transilluminate the posteromedical aspect of the knee. Lanham et al. created a posteromedical portal using the medial epicondyle as an easily identifiable bony landmark and considered it a reliable technique. Creation of an accessory posteromedical portal has been described in several reports. Unfortunately,
particularly in obese and muscular patients, entering the posteromedial compartment becomes challenging. Creating a posteromedial portal in knee arthroscopy is challenging because of the thick muscular cover, proximity of the neurovascular bundle, tenacious tough capsule, and excessive fat deposition in the posteromedial knee and thigh region, making portal creation demanding for the surgeon.

For beginner surgeons, it may impose a challenge to make the posteromedial-portal entry while accessing the posteromedial compartment during complex PCL surgical procedures. Hence, we describe our modification using a radiofrequency device while using a standard technique to make the posteromedial portal (Video 1). This technique is simple, time saving, safe, and reproducible. The radiofrequency device is used to pierce the posteromedial capsule under arthroscopic visualization, thereby avoiding injury to the neurovascular structures.

**Surgical Technique**

**Preoperative Evaluation**

The correct indications for the described procedure are patients with PCL tears, PCL avulsion fractures, or medial meniscus posterior tears that require surgical intervention and access to the posteromedial compartment. The patients undergo a thorough evaluation via history and physical examination. Radiographic imaging and magnetic resonance imaging are performed to diagnose the pathology. Informed consent was obtained from the patients regarding the following technique, and patient privacy was maintained.

**Key Instruments Required for Posteromedial Portal Creation**

In addition to the routine arthroscopy setup, the following instruments are required for this surgical technique (Fig 1): 18-gauge spinal needle, No. 11 scalpel blade, hemostat, radiofrequency device (VAPR Premiere 90 suction electrode; DePuy Mitek, Raynham, MA), switching stick (4.3 mm; Smith & Nephew, Andover, MA), 8-mm plastic transparent cannula (DRI-LOK disposable cannula, 8 mm × 75 mm, threaded, red; Stryker, San Jose, CA), and reusable cannulated obturator (Clear-Trac, 4.3 mm, green; Smith & Nephew).

**Position**

Under spinal anesthesia, the patient is placed supine on the operating table with the operative leg hanging in a 90° of flexion position. A thigh holder is placed just proximal to the knee at midthigh level (Fig 2). A tourniquet is applied just above midthigh level. With this position, the knee can be accessed 270° mediolaterally, which is very important. The operative side is prepared with an aseptic sterile technique, the right lower limb is exsanguinated, and the tourniquet is inflated. (The posteromedial portal technique is shown

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**Fig 1.** Key instruments required for modified posteromedial portal technique in knee arthroscopy. (A) No. 11 scalpel blade. (B) Eighteen-gauge (18G) spinal needle. (C) Hemostat. (D) Switching stick (4.3 mm). (E) Plastic transparent cannula (DRI-LOK disposable cannula, 8 mm × 75 mm, threaded, red). (F) Radiofrequency device (VAPR Premiere 90 suction electrode). (G) Cannulated obturator (Clear-Trac, 4.3 mm, green).
in a right knee in Figs 2-11.) A 30° arthroscope (Smith & Nephew) is used. The knee is kept in 90° of flexion so that the neurovascular bundle falls posteriorly.

**Surgical Steps**

**Skin Marking.** Skin marking of the following bony and soft-tissue landmarks of the knee is performed: patella, patellar tendon, tibial tuberosity, medial joint line, lateral joint line, anterolateral portal, anteromedial portal, posteromedial portal, and medial epicondyle (Fig 3A).

**Creation of Standard Portals.** Standard anteromedial and anterolateral portals are made with a No. 11 scalpel blade.

**Diagnostic Knee Arthroscopy.** Diagnostic arthroscopy is performed. The integrity of the anterior cruciate ligament and PCL is checked in 90° of flexion. The medial meniscus is visualized and probed with the knee in valgus and external rotation. The lateral meniscus is visualized and probed with the knee in the figure-of-4 position and the foot in internal rotation. The integrity of the femoral condyles, tibial plateau, and undersurface of the patellar cartilage is checked by visualization and probing. In the presented case, the PCL was torn and lax and the “sloppy” anterior cruciate ligament sign was present. After completion of anterior-compartment diagnostic arthroscopy, the diagnosis of the pathologic condition is confirmed.

**Fig 2.** (A) A thigh holder is placed just proximal to the right knee at midthigh level. (B) With the patient in the supine position, the right limb is positioned over the thigh holder with the leg hanging down and the knee in 90° of flexion.

**Fig 3.** The patient is in the supine position, with the right knee in 90° of flexion. (A) Representative image showing skin marking of bony and soft-tissue landmarks in right knee, including patella, medial femoral condyle (MFC), tibial tuberosity, and patellar tendon (PT), as well as various portals, including anterolateral (AL), anteromedial (AM), and posteromedial (PM) portals. (B) Medial view of right knee showing skin marking of MFC, medial epicondyle (ME), and PM portal.
Posteromedial-Compartment Entry. The posteromedial compartment is accessed by the modified Gillquist technique, in which the arthroscope in the anterolateral (PM) portal, preventing injury to the neurovascular structures.

Modified Surgical Technique of Making Posteromedial Portal in Knee Arthroscopy Using Radiofrequency Device. We follow the standard technique described in the literature to identify the entry point for the posteromedial portal. Skin marking is performed to identify the medial epicondyle and the tentative entry point for the posteromedial portal. The posteromedial entry point is defined as roughly 2.5 cm inferior and 2.5 cm posterior to the medial epicondyle with the knee in 90° of flexion (Fig 3B). This point coincides with the soft spot between the medial head of the gastrocnemius, medial collateral ligament, and semimembranosus tendon, which is roughly 1.5 to 2 cm above the joint line. A transillumination technique (Fig 4) is also incorporated, which helps in visualizing the saphenous nerve and vein and thereby staying anterior to and away from them while making the posteromedial portal, preventing injury to the neurovascular structures.

An 18-gauge spinal needle is inserted at the posteromedial skin marking site (Fig 5A). Under arthroscopic...
vision, with an outside-in technique, an 18-gauge spinal needle is passed through the marked point into the posteromedial compartment (Fig 5B). Precaution is taken so that the needle placement is not too low near the joint line; rather, it should come approximately 2 cm above the joint line from the posterior-to-anterior direction for better visualization and easier work on the PCL footprint.

A superficial 1-cm longitudinal skin incision is made with a No. 11 knife blade (Fig 6). A hemostat (Fig 7A) is used to bluntly dissect through the subcutaneous tissue until the capsule is reached without damaging it under arthroscopic guidance (Fig 7B). This dissection creates a plane for smooth passage of a radiofrequency device.

A 90° suction radiofrequency device (VAPR Premiere 90 suction electrode) with a 3.3-mm tip size, 3.75-mm shaft diameter, and cutting mode with 240 W is introduced from outside through an incision under arthroscopic visualization until it touches the capsule (Fig 8A). To avoid thermal injury to the surrounding neurovascular structures, due care is taken not to prematurely perform coblation until the device touches the capsule.

Under arthroscopic visualization, the radiofrequency device tip (VAPR Premiere 90 suction electrode), which is coming into contact with the capsule, is confirmed by the bulge of the posteromedial capsule, and the maximum point of the bulge of the capsule is chosen as the precise entry point for coblation. Care should be taken not to perform coblation of the capsular tissue with the radiofrequency device continuously. By intermittent coblation, the length and depth of capsular tissue can be perceived, which is of paramount importance.

Then, a capsular cut is made with the radiofrequency device tip intermittently in cutting mode with 240 W. Care is taken to confirm the orientation of the radiofrequency device tip while introducing it up to the capsule in the posteromedial corner such that the cutting end of the radiofrequency device’s mouth faces the capsular side and away from the saphenous nerve and popliteal neurovascular bundle.
A capsular cut of 7 to 8 mm is made with the radiofrequency device tip (Fig 8B) such that an 8-mm plastic transparent cannula (DRI-LOK disposable cannula, 8 mm x 75 mm, threaded, red) snugly fits in the posteromedial portal. A cut greater than 8 mm should be avoided because it will lead to easy backing out of the 8-mm plastic transparent cannula.

After creation of the posteromedial portal by radiofrequency device guidance, a switching stick (4.3 mm) (Fig 9) is introduced through the posteromedial portal. The 8-mm plastic transparent cannula is mounted on a reusable cannulated obturator (Clear-Trac, 4.3 mm, green) (Fig 10A, outside view; Fig 10B, arthroscopic view) and is then introduced over the switching stick (4.3 mm) by the railroad technique. Once the 8-mm plastic transparent cannula over the reusable cannulated obturator is visualized in the posteromedial compartment, the reusable cannulated obturator is carefully withdrawn after the 8-mm plastic transparent cannula has been secured in the posteromedial portal (Fig 11A).

Final Visualization of 8-mm Plastic Transparent Cannula in Posteromedial Compartment. The switching stick (4.3 mm) is removed, and the 8-mm plastic transparent cannula can be visualized arthroscopically (Fig 11B). The posteromedial cannula is now ready for use as a visualization or working portal.

Discussion

The literature has stressed the importance of safety while making a posteromedial portal, especially with reference to injury to the saphenous nerve. The sartorial branch of the saphenous nerve runs with the long saphenous vein. The saphenous nerve and vessels move more posteriorly in 90° of knee flexion, thereby avoiding injury. Moreover, 90° of knee flexion resulted in a greater distance (17-29 mm) between the PCL and popliteal artery. Ogilvie-Harris et al. recommended that the portal anatomy be clearly defined while creating the posteromedial and posterolateral portals via the anterior-posterior approach, while reporting that the knee should be flexed 90° to allow the neurovascular bundle to move posterior to the portal, and reported that transillumination could help avoid trauma to the...
superficial vein and accompanying nerves. They also recommended that the instruments always be used in the posterior to anterior direction to avoid damage to the neurovascular bundle.

Ogilvie-Harris et al. reported 5 cases of complication in 179 patients, all of which were related to the posteromedial portal. Posteromedial portal placement can cause injury to the sartorial branch of the saphenous nerve and vein, which probably occurs inadvertently if the surgical blade is placed blindly. In our technique, we do not follow a blind method: We first make a skin incision using a No. 11 blade without piercing into the deeper structures, followed by blunt dissection with the help of artery forceps, making sure that the posteromedial capsule is not damaged. Then, with the radiofrequency device on the posteromedial capsule, under arthroscopic visualization, this radiofrequency device is introduced from outside (outside-in technique) through the incision such that the soft-tissue and capsular cut is made without damaging the neurovascular structures.

Jan et al. reported 2 cases of saphenous vein puncture (1.7%) during posteromedial portal placement in which transillumination was deficient; they observed that the portal was a few millimeters too anterior and proximal. However, they concluded that this did not have any postoperative impact. Sanders et al. clinically followed up 179 patients managed with a posteromedial portal and found no major complications, but 3 cases of residual hypoesthesia in the saphenous nerve territory (1.7%) and 2 cases of greater saphenous vein puncture were noted.

In the literature, instrument breakage is one of the complications reported to pose a serious threat. Accidental breakage of a scalpel blade while making a portal has been documented. Gambardella and Tibone reported a complication in which the blade was missing from the knife handle within the knee joint. Although the incidence of this complication is low, additional surgery, such as arthrotomy, is required once it occurs, which will have an impact on the treatment and recovery of the patient.

Sochart et al. reported 2 cases of a No. 16 blade disengaging from its handle and remaining within the joint. This can occur because of the fragile design and

Table 1. Advantages and Disadvantages of PM Portal Technique Using RF Device in Knee Arthroscopy

| Advantages                                                                 | Disadvantages                                                                 |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| The PM portal is a very important working and visualization portal in complex surgical procedures involving the PCL and posterior horn of the medial meniscus. | Use of the RF device adds to the cost of surgery. |
| The described technique is a simple technique that can be easily reproduced by surgeons worldwide. | Use of the RF device can cause thermal injury to the adjacent soft-tissue structures. |
| The technique is safe and effective.                                       | Skin burns can occur when using the RF device if not carefully handled.      |
| No struggle occurs in making the portal.                                   |                                                                             |
| The orientation of the RF device tip, which faces the capsular side, prevents injury to the neurovascular bundle. |                                                                             |
| The overall time required to obtain access to the PM compartment is reduced. |                                                                             |
| The technique is performed under arthroscopic visualization, hence having less chance of neurovascular bundle damage. |                                                                             |

PCL, posterior cruciate ligament; PM, posteromedial; RF, radiofrequency.
the limited space for maneuvering inside the knee joint, and when the instrument breaks, it may become hidden in the unreachable posterior knee compartment. Some surgeons prefer to use a scalpel blade to incise the capsule. We advise not to use a scalpel blade blindly in the posteromedial compartment, which can cause damage to the neural structures.

The standard technique advocates the use of a hemostat or switching stick to pierce the capsule. We can judge intraoperatively and choose the best entry point for the PM portal.

Less bleeding occurs through the portal because of the use of the RF device.

Tissue handling is minimal with this technique.

Intermittent coblation helps in assessing the length and depth of capsular tissue, which is of paramount importance.

RF device. Tissue handling is minimal with this technique.

A larger capsular cut (i.e., >8 mm) can cause loosening of the 8-mm plastic transparent cannula and excessive extravasation of fluid into the subcutaneous tissue.

Premature coblation can cause thermal injury to the surrounding neurovascular structures.

**Table 2. Pearls and Pitfalls of PM Portal Technique Using RF Device in Knee Arthroscopy**

| Pearls |
|---|
| The described technique is relatively safer in view of the proximity to the neurovascular bundle because it is under the surgeon’s control and it is performed under direct arthroscopic visualization of the PM compartment. |
| Precision of the entry point is better with the RF device because we can judge intraoperatively and choose the best entry point for the PM portal. |
| Less bleeding occurs through the portal because of the use of the RF device. |
| Tissue handling is minimal with this technique. |

| Pitfalls |
|---|
| A larger capsular cut (i.e., >8 mm) can cause loosening of the 8-mm plastic transparent cannula and excessive extravasation of fluid into the subcutaneous tissue. |
| Premature coblation can cause thermal injury to the surrounding neurovascular structures. |

PM, posteromedial; RF, radiofrequency.

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