Technical Note

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 posteromedial 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 posteromedial compartment during different procedures is made simple, safe, and replicable with this technique of creating the posteromedial portal. This article describes a simple way to create the posteromedial portal using a radiofrequency device by a modified outside-in surgical technique.

A posteromedial portal in knee arthroscopic surgery is used for various indications, including arthroscopic posterior cruciate ligament (PCL) reconstruction,[1] PCL avulsion fracture fixation,[2] posterior medial meniscal repair,[3] medial ramp lesion repair, and synovectomy.[4] The posteromedial portal gives good access for visualization of the posteromedial compartment, posterior horn of the medial meniscus, and tibial PCL insertion and acts as a useful working portal.

The posteromedial 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 posteromedial 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 posteromedial compartment of the knee, over which the arthroscope was shuttled and advanced into the posteromedial compartment.[4]

McGinnis described using the posteromedial capsular folds to guide posteromedial portal placement in a cadaveric study. Kim et al. reported a technique of creating the posteromedial 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 posteromedial-portal arthroscopy.[5]

One technique described in the literature is the creation of a posteromedial portal by a transillumination technique, whereby the arthroscope is placed in the posteromedial compartment and the light source is rotated to transilluminate the posteromedial aspect of the knee. Lanham et al.[6] created a posteromedial portal using the medial epicondyle as an easily identifiable bony landmark and considered it a reliable technique.

Creation of an accessory posteromedial portal has been described in several reports. Unfortunately,

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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 undergoes 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

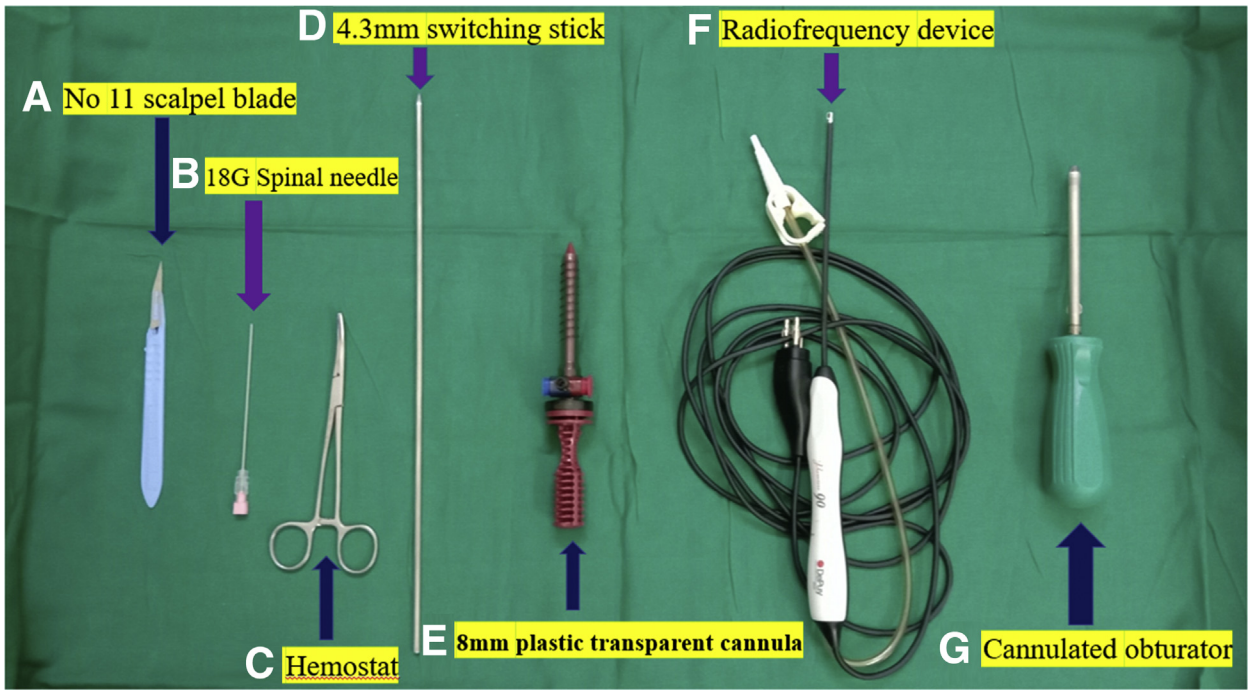

Fig 1. Key instruments required for modified posteromedial portal technique in knee arthroscopy. (A) No. 11 scalpel blade. (B) Eighteen-gauge (18G) spinal needle. (C) Hemostat. (D) Switching stick (4.3 mm). (E) Plastic transparent cannula (DRI-LOK disposable cannula, 8 mm × 75 mm, threaded, red). (F) Radiofrequency device (VAPR Premiere 90 suction electrode). (G) Cannulated obturator (Clear-Trac, 4.3 mm, green).

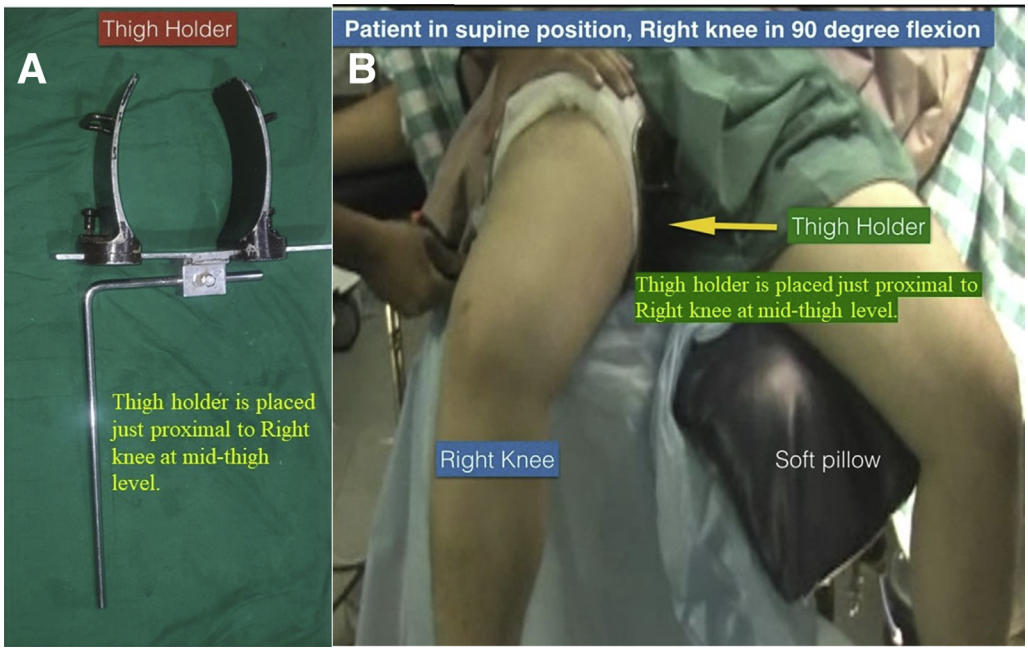

Fig 2. (A) A thigh holder is placed just proximal to the right knee at midthigh level. (B) With the patient in the supine position, the right limb is positioned over the thigh holder with the leg hanging down and the knee in 90° of flexion.

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.

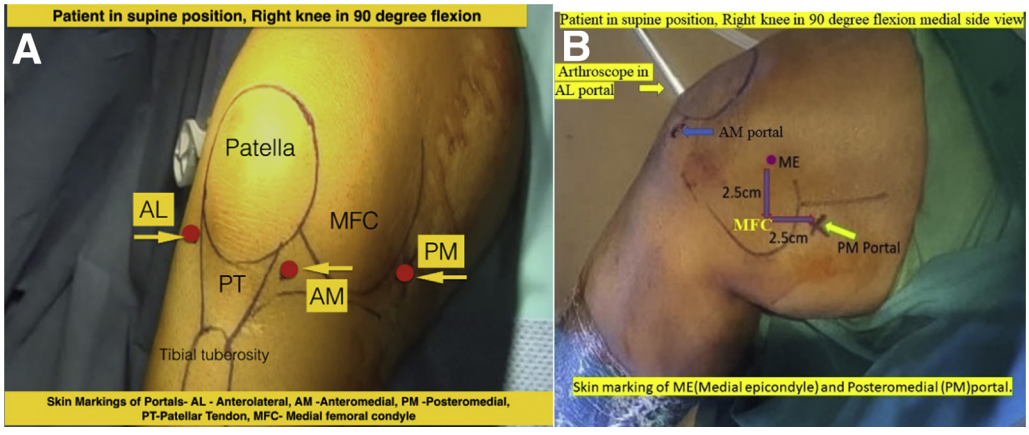

Fig 3. The patient is in the supine position, with the right knee in 90° of flexion. (A) Representative image showing skin marking of bony and soft-tissue landmarks in right knee, including patella, medial femoral condyle (MFC), tibial tuberosity, and patellar tendon (PT), as well as various portals, 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.

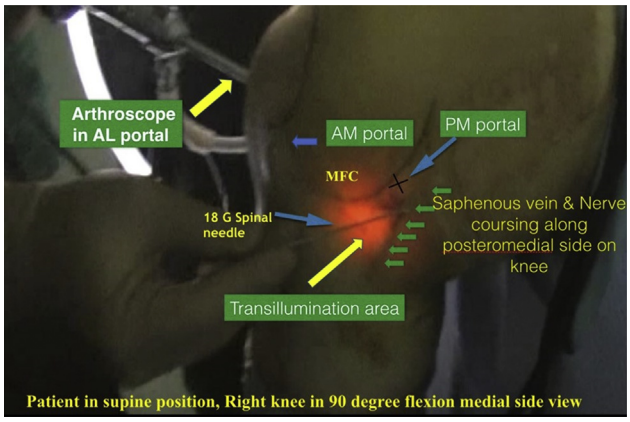

Fig 4. The patient is in the supine position, with the right knee in 90° of flexion. A medial view, with dimmed operating room lights, shows the transillumination technique being incorporated, which helps in visualizing the saphenous nerve and vein and thereby staying anterior to and away from them while making the posteromedial (PM) portal, preventing injury to the neurovascular structures. (AL, anterolateral; AM, anteromedial; G, gauge.)

Posteromedial-Compartment Entry. The posteromedial compartment is accessed by the modified Gillquist technique, in which the arthroscope in the anterolateral portal is introduced into the posteromedial compartment through the intercondylar notch medial to the PCL and lateral to the medial femoral condyle with the knee in 90° of flexion.

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[6] 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.[7]

An 18-gauge spinal needle is inserted at the posteromedial skin marking site (Fig 5A). Under arthroscopic

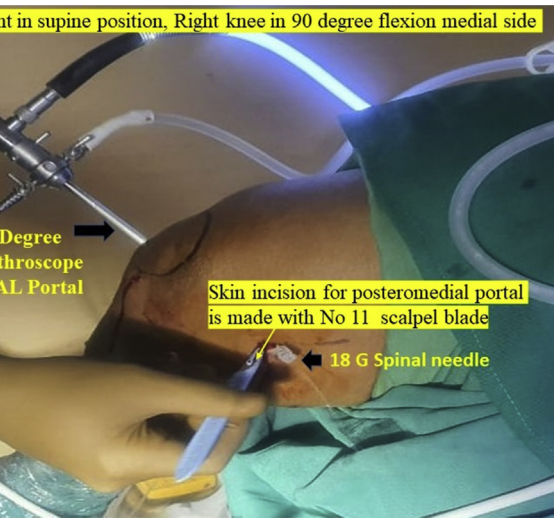

Fig 6. The patient is in the supine position, with the right knee in 90° of flexion. A medial view shows the skin incision for the posteromedial portal being made with a No. 11 scalpel blade. (AL, anterolateral; G, gauge.)

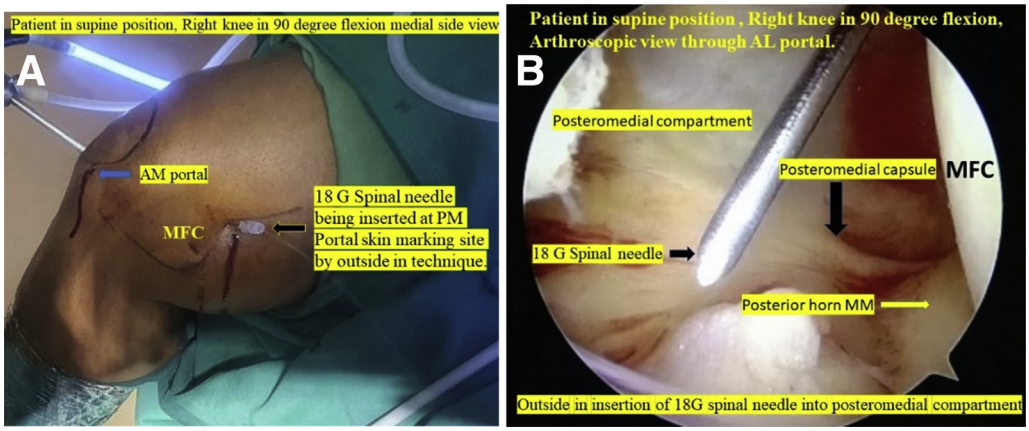

Fig 5. The patient is in the supine position, with the right knee in 90° of flexion. (A) A medial view shows the 18-gauge (18 G) spinal needle being inserted at the posteromedial (PM) skin marking site by an outside-in technique. (B) An arthroscopic view through the anterolateral (AL) portal shows outside-in insertion of the 18-gauge spinal needle into the PM compartment. (AM, anteromedial; MFC, medial femoral condyle; MM, medial meniscus.)

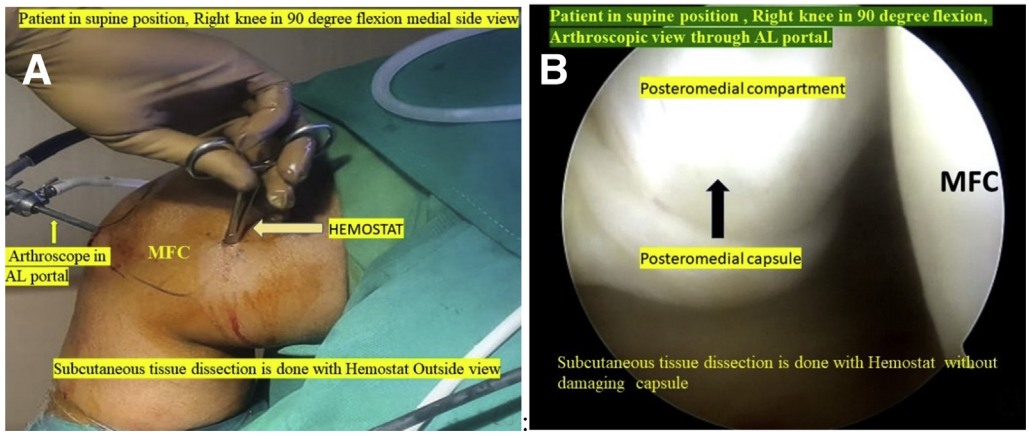

Fig 7. The patient is in the supine position, with the right knee in 90° of flexion. (A) Outside view of **s**ubcutaneous tissue dissection with hemostat. (B) Arthroscopic view through anterolateral (AL) portal showing subcutaneous tissue dissection with hemostat without damaging capsule. (MFC, medial femoral condyle.)

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.

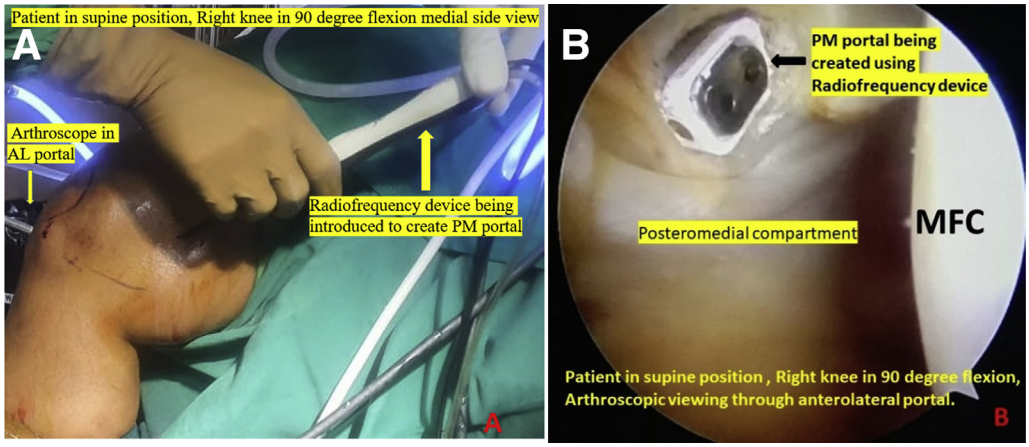

Fig 8. The patient is in the supine position, with the right knee in 90° of flexion. (A) A medial view shows the radiofrequency device (VAPR Premiere 90 suction electrode) being introduced to create the posteromedial (PM) portal. (B) An arthroscopic view through the anterolateral (AL) portal shows the PM portal being created using the radiofrequency device. (MFC, medial femoral condyle.)

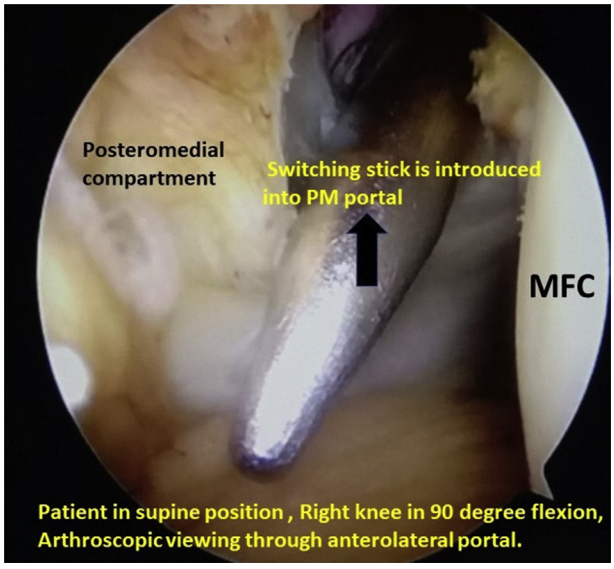

Fig 9. The patient is in the supine position, with the right knee in 90° of flexion. An arthroscopic view through the anterolateral portal shows the switching stick (4.3 mm) being introduced into the posteromedial (PM) portal. (MFC, medial femoral condyle.)

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 × 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.[7]

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

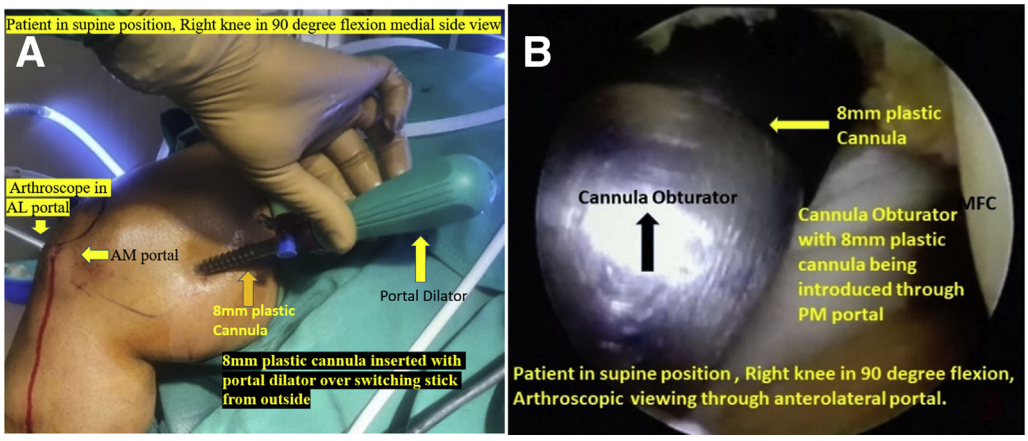

Fig 10. The patient is in the supine position, with the right knee in 90° of flexion. (A) A medial view shows the 8-mm plastic transparent cannula (DRI-LOK disposable cannula, 8 mm × 75 mm, threaded, red) being inserted with the cannulated obturator (Clear-Trac, 4.3 mm, green) over the switching stick (4.3 mm) from outside. (B) An arthroscopic view through the anterolateral (AL) portal shows the cannulated obturator with the 8-mm plastic transparent cannula. (AM, anteromedial; MFC, medial femoral condyle; PM, posteromedial.)

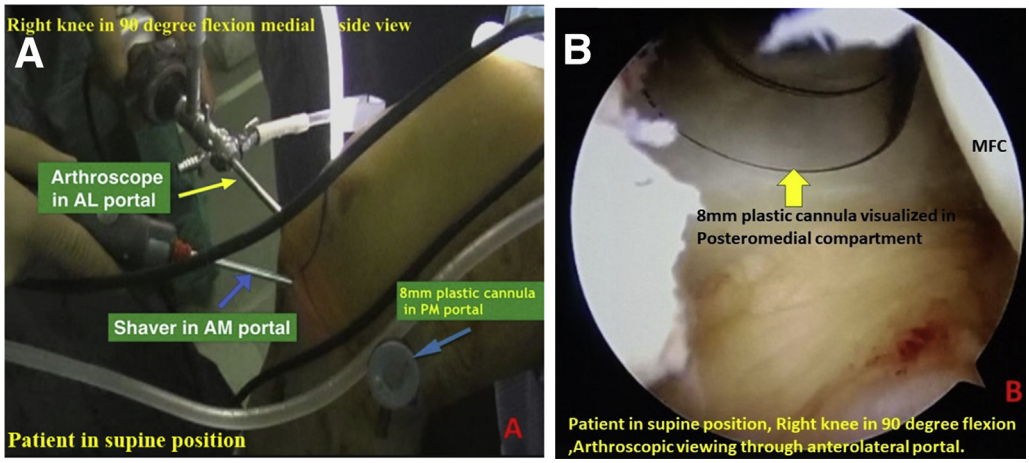

Fig 11. The patient is in the supine position, with the right knee in 90° of flexion. (A) A medial view shows the 8-mm plastic transparent cannula (DRI-LOK disposable cannula, 8 mm × 75 mm, threaded, red) in the posteromedial (PM) portal from outside. (B) An arthroscopic view through the anterolateral (AL) portal shows the 8-mm plastic cannula visualized in the PM compartment. (AM, anteromedial; MFC, medial femoral condyle.)

superficial vein and accompanying nerves.[7] 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.[8] 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.[9] 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.[10] 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
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.
The described technique is a simple technique that can be easily reproduced by surgeons worldwide.
The technique is safe and effective.
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.
Disadvantages
Use of the RF device adds to the cost of surgery.
Use of the RF device can cause thermal injury to the adjacent soft-tissue structures.
Skin burns can occur when using the RF device if not carefully handled.

PCL, posterior cruciate ligament; PM, posteromedial; RF, radiofrequency.

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

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 find this difficult in some cases in which the capsule is too tenacious. In this article, we describe our modification to the standard technique.

The posteromedial portal is a very important working and visualization portal in complex surgical procedures involving the PCL and posterior horn of the medial meniscus. Our modified surgical technique for making a posteromedial portal using a radiofrequency device creates an easily accessible posteromedial portal with no neurovascular injury in patients. The tibial plateau, PCL insertion onto the tibia, and posterior horn of the medial meniscus are precisely visualized and easily probed through this portal. This is a simple technique that can be easily reproduced by surgeons worldwide and is effective with no struggle in making the portal, and it reduces the overall time required to obtain access to the posteromedial corner. This 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 posteromedial compartment. Precision, when making the cut in the capsule, is better with the radiofrequency device because we can judge intraoperatively and choose the best entry point for the posteromedial portal. Less bleeding occurs through the portal because of the use of the radiofrequency device. Tissue handling is minimal with this technique.

Multiple techniques have been described to enhance the safety of posteromedial portal formation. There is risk involved when using a radiofrequency device because it can cause thermal injury to the adjacent soft-tissue structures, and a limitation of our technique is that the use of this device adds to the cost of surgery. This technique has several advantages (Tables 1 and 2).

Creating a posteromedial portal in knee arthroscopy is challenging and technically demanding. We have described a simple modification to the standard outside-in technique to make the posteromedial portal using a radiofrequency device. We conclude that the use of a radiofrequency device for posteromedial portal placement is a reliable, safe, quick, and reproducible technique.

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