Posterior “Double Cannular Sliding Technique” for Resection of Posterior Septum of the Knee Joint

Nam Yong Choi, M.D., Ph.D., Hyung Kook Cheong, M.D., Hyun Seok Song, M.D., Ph.D., and Chan Woong Moon, M.D., Ph.D.

Abstract: We introduce the posterior double cannular sliding technique, which is an easy, fast, safe, and reproducible method for posterior septum resection of the knee joint. Several posterior compartment procedures have been developed. Procedures with anterior-posterior approaches (transnotch approach) and posterior-posterior approaches have become possible for arthroscopic total synovectomy and loose body removal. For resection of the posterior septum with posterior-posterior approaches, several authors have used various methods. However, although previous studies reported posterior septum resection in the posterior portal, or perforation of the posterior septum by blind vision or transnotch approach, specific postperforation techniques to resect the posterior septum have not been reported. Furthermore, methods of posterior septum resection remain difficult to perform using posterior portal arthroscopy, with difficulties in the approach and in achieving reproducible outcomes. Thus, we introduce the posterior double cannular sliding technique, which is a reproducible method that uses 2 transparent cannulas and a switching stick under direct visualization control with a transnotch approach, thereby minimizing the risk of potential neurovascular or posterior cruciate ligament injury for all procedures in posterior septum resection.

Arthroscopic surgery of the posterior compartment of the knee joint has evolved tremendously over the past several decades. With the emergence of anterior-posterior approaches (transnotch approach), visualization of the posterior compartments has greatly improved. However, visualization of the superior portion of the femoral condyle, and medial and lateral corners of the posteromedial and posterolateral compartments remains limited. To overcome this limitation, a few posterior-posterior approaches have been performed for the procedures of the posterior compartments while allowing visualization and instrumentation of the whole posterior compartments. Kim reported the first case of arthroscopic surgery on the whole area of the posterior compartment, which was made possible by creating a single compartment through resection of the posterior septum via the posterior-posterior triangulation method. The author found that after synovectomy of the posterior compartment via the anterior-posterior triangulation (transnotch approach), the synovium remained above the posterior femoral condyle, and the medial and lateral corners of the posteromedial and posterolateral compartments were inaccessible. The areas were accessible by the shaver that was inserted through the contralateral side of the posteromedial or posterolateral portal. This method was regarded as useful even for difficult cases such as loose bodies in the posterior compartment.

Ahn and Ha introduced a method called posterior transseptal portal, in which they created postero-medial and postero-lateral portals first, inserted the arthroscope in the postero-medial portal, and while pushing the posterior septum to the medial direction by using the
switching stick inserted in the posterolateral portal, excised the septum behind the posterior cruciate ligament (PCL) in a piecemeal fashion by using the shaver inserted via the transnotch approach.

Louisia et al.3 reported a modified technique called "posterior back-and-forth approach," in which the posterolateral portal is created by using an inside-out technique through the posteromedial portal. Kim et al.4 reported a method of creating the posteromedial portal by using an inside-out technique in the transnotch view through the posterolateral portal. However, these methods have a significant learning curve for mastering the technique because maintaining visualization and instrumentation in the posterior compartment is not easy and carries risks of injury to the PCL or posterior neurovascular structure.

We introduce a method called "posterior double cannular sliding technique," which is an easy, quick, and reproducible method that allows stable direct visualization in the transnotch view and direct visualization control over all the processes involved in the resection of the posterior septum by using 2 transparent cannulas and a switching stick.

**Surgical Technique**

Our technique involves a method that uses two 5.75-mm transparent cannulas (Arthrex, Naples, FL) and a switching stick for resecting the posterior septum (Video 1). The patient is placed in the supine position under general endotracheal anesthesia. The right lower limb is prepared in the routine manner, and the tourniquet is inflated. After skin incision, capsular enlargement is performed with a straight hemostat (B). A 5.75-mm cannula (Arthrex) is inserted in the same direction (C). After placing the arthroscope in the posterolateral compartment with the transnotch approach, a posterolateral portal is made in the same manner (D-F). (ALP, anterolateral portal; AMP, anteromedial portal; LFC, lateral femoral condyle; MFC, medial femoral condyle; PLC, posterolateral compartment; PMC, posteromedial compartment; V, viewing portal; W, working compartment.)
with the obturator, the obturator and sheath are inserted in the posteromedial compartment, during which time the knee angle is maintained at 30° to 60° and maintained at 90° after insertion.

First, the location of the posteromedial portal is confirmed arthroscopically by pressing a finger on the posteromedial soft spot, after which an 18-gauge spinal needle is inserted. After placing the 18-gauge spinal needle parallel to approximately 5 mm behind the posterior aspect of the medial femoral condyle, skin incision is performed on that spot (Fig 1A). Only the skin is incised with a blade, and then a straight hemostat

Fig 2. Resection of the lateral side of the posterior septum. Using a transnotch approach, the arthroscope reaches the posteromedial compartment through the anterolateral portal (A) of the right knee. The switching stick is inserted through the cannula in the posteromedial portal (B) with maintaining 90° flexion of the knee. The arthroscope is rotated in the 9 o'clock position without going beyond the posterior condyle (C). Then, the septum is gently perforated through in the direction parallel to the posterior wall using the switching stick (D, E). After the arthroscope is placed in the posterolateral compartment, the switching stick is passed through the cannula positioned in the posterolateral portal (F-H) with 90° flexion of the knee. The instrument (shaver or RF) is inserted into the posterolateral portal, whereas the switching stick is withdrawn in the posteromedial direction (I, J). Here, the assistant pushes both cannulas in the direction of the septum and fixes the position of the canulla (K), and then the switching stick is withdrawn up to the septum (L). The posterior septum of the posterolateral compartment is resected with a shaver (or RF), but an abrupt procedure may be limited due to the fixed cannulas (M-O). All of these procedures are controlled under direct visualization (P) with 90° flexion of the knee. Red arrow, direction of the sliding switching stick; blue arrow, direction of cannular movement; arrow head, medial side of the posterior septum; square, lateral side of the posterior septum; asterisk, intervening fatty layer of the posterior septum. (ALP, anterolateral portal; AMP, anteromedial portal; LAT, lateral; MED, medial; MFC, medial femoral condyle; PLC, posterolateral compartment; PLP, posterolateral portal; PMC, posteromedial compartment; PMP, posteromedial portal; RF, radiofrequency; V, viewing portal; W, working compartment.)
is inserted in the same direction as the spinal needle. After capsular enlargement (Fig 1B) and straight hemostat removal, a 5.75-mm transparent cannula (Arthrex) is inserted in the same direction (Fig 1C).

After locating the arthroscope in the postero-lateral compartment by using the arthroscopic transnotch approach (contralateral or ipsilateral), the posterolateral portal is created in the same way (Fig 1D-F).

Resection of the Lateral Side of the Posterior Septum

Once again, the arthroscope is placed in the posteromedial compartment by using the arthroscopic transnotch approach from the anterolateral portal (Fig 2A). The switching stick is inserted in the cannula of the posteromedial portal (Fig 2B). The arthroscope is placed in the 9 o’clock direction without going beyond the posterior condyle (Fig 2C). Then, the switching stick is gently passed through the septum in a direction parallel to the posterior condyle (Fig 2D and E).

After placing the arthroscope in the posterolateral compartment via the transnotch approach from the anteromedial portal, the switching stick that has been passed is inserted through the cannula of the posteromedial portal (Fig 2 F-H). While sliding the switching stick in the posteromedial direction, an instrument (shaver [Stryker] or radiofrequency [Arthrocare, Heredia, Costa Rica]) is inserted in the posterolateral portal (Fig 2 I and J). At this time, the assistant pushes both cannulas toward the posterior septum and fixes the cannular direction (Fig 2K), after which the switching stick is slid up to the septum (Fig 2L). For resection of the posterior septum of the posterolateral compartment with a shaver (or RF), an abrupt procedure may be limited by the fixed cannula located near the septum; thus, the desired septum resection can be performed gradually (Fig 2 M-O). All these procedures are performed under direct visualization (Fig 2P).

Resection of the Medial Side of the Posterior Septum

The switching stick is inserted again in the cannula of the posterolateral portal by sliding in the posterolateral direction (Fig 3 A-C). The arthroscope is placed again in the 90° flexion of the right knee. After positioning the arthroscope in the posteromedial compartment via anterolateral portal again, the switching stick is withdrawn to the posteromedial compartment and the instrument (shaver or RF) approaches the posteromedial portal (D) with 90° flexion of the right knee. After the assistant fixes the position of the cannula, the switching stick is withdrawn up to the septum and the posterior septum of the posteromedial compartment is resected with the instrument (shaver or RF) (E-G). All of these procedures are controlled under direct visualization (H) with 90° flexion of the knee. red arrow, direction of the sliding switching stick; blue arrow, direction of cannular movement; arrow head, medial side of the posterior septum; square, lateral side of the posterior septum; asterisk, intervening fatty layer of the posterior septum. (ALP, anterolateral portal; AMP, anteromedial portal; LAT, lateral; MED, medial; MFC, medial femoral condyle; PLC, posterolateral compartment; PLP, posterolateral portal; PMC, posteromedial compartment; PMP, posteromedial portal; RF, radiofrequency; V, viewing portal; W, working compartment.)
Establishment of Direct Posterior-Posterior Triangulation

The arthroscope and instrument are inserted respectively posteromedial and posterolateral portals to achieve direct posterior-posterior triangulation (Fig 4).

Discussion

In stably performing the posterior compartment procedure using the posterior “double cannular sliding technique,” we achieved stable direct visualization by using the transnotch view for all processes, including perforating, enlarging, and resecting the posterior septum and minimized the potential risk of posterior neurovascular injury or PCL injury by using 2 transparent cannulas and a switching stick for control.

An approach to the posterior compartment of the knee joint is difficult, and knee surgeons tend to be reluctant because of the risk of neurovascular injury. Ogilvie-Harris et al.5 recommended that the portal anatomy should be clearly defined when creating the posteromedial and posterolateral portals via the anterior-posterior approach (transnotch approach), while reporting that the knees should be flexed 90° to allow the neurovascular structures to move to the posterior of the portal, and that transillumination could help avoid trauma to the superficial vein and accompanying nerves. They also recommended that the instruments should always be used in the posterior-to-anterior direction to avoid damage to the popliteal vessels.

More recently, Pace and Wahl6 asserted that adequate safe zone existed between the PCL and the popliteal artery with the knee flexed 90° in 7 cases of a cadaveric study under simulated arthroscopy.

McGinnis et al.7 reported that a soft spot is an appropriate landmark to ensure safe portal entry and that posteromedial capsular fold can guide intra-articular portal placement under direct visualization.

For the posterior “double cannular sliding technique,” appropriate posteromedial and posterolateral portals should be created. The appropriate position can be

![Fig 4. Establishment of direct posterior-posterior triangulation. The arthroscope and instrument are inserted separately through the posteromedial and posterolateral portals, respectively, to form a direct posterior-posterior triangulation with 90° flexion of the right knee (A-C). Arrow head, medial side of the posterior septum; square, lateral side of the posterior septum; asterisk, intervening fatty layer of the posterior septum. (PLC, posterolateral compartment; PLP, posterolateral portal; PMC, posteromedial compartment; PMP, posteromedial portal; V, viewing portal; W, working compartment.)](image)
The aforementioned methods showed a different approach. In some cases, the posteromedial and posterolateral portals were created first. In other cases, the posterolateral portal was created by using the inside-out technique after creating the posteromedial portal, or the posteromedial portal was created by using the inside-out technique after creating the posterolateral portal.

Ogilvie-Harris et al. reported 5 cases of complication in 179 patients, all of which were related to the posteromedial portal. Kim et al. reported that the mean anterior-to-posterior dimension ratio of the posteromedial and posterolateral compartments is 1.5 ± 0.3, with the dimension of the posteromedial compartment being greater. In our method, we created the posteromedial and posterolateral portals first, but when the posterolateral portal was difficult to create, we first created the posteromedial portal and then created the posterolateral portal by using the inside-out technique with a switching stick.

During the posterior septum perforation, the arthroscope can be inserted in the posterolateral compartment and in the posteromedial compartment. A transnotch view can also be used. At other times, blind perforation is performed. In addition, although previous studies reported posterior septum resection in the posterior portal, perforation of the posterior septum by blind vision, or transnotch approach, specific post-perforation techniques for resection of the posterior septum have not been reported. Maintaining visualization and triangulation is difficult when using posterolateral portal arthroscopy. Posterior septum resection always carries risks of PCL and posterior neurovascular structure injury.

Furthermore, methods of posterior septum resection remain difficult to perform, particularly in terms of the approach and achieving reproducible results.

Our technique has several advantages (Tables 1 and 2).

With our method, the risk of neurovascular injury associated with blind perforation can be avoided via direct visualization. The risk of PCL injury from forced instrumentation can also be avoided because the instrument can move freely within a limited range during posterior septum resection. Moreover, as control from the anterior portal is possible during the resection of the posterior septum, the likelihood of malorientation or abrupt instrumentation is reduced. Our technique will be a useful option among the posterior-posterior approach methods.

References
1. Ahn JH, Ha CW. Posterior trans-septal portal for arthroscopic surgery of the knee joint. Arthroscopy 2000;16:774-779.

---

**Table 1. Pearls and Pitfalls of the Posterior Double Cannular Sliding Technique**

| Pearls |  |
|---|---|
| (1) When creating a posterior portal, the portal should be created such that the spinal needle enters parallel to 5 mm behind the posterior condyle. The posterior direction of the cannula can be reduced. |  |
| (2) A switching stick may be used to determine both the cannular directions to be fixed and the location of the posterior septum to be resected. |  |
| (3) When sliding the switching stick up to the septum, the septum can be resected safely by fixing both cannulas while pushing them toward the septum. |  |
| (4) When resecting the septum, the radius of the instrumentation can be widened gradually by adjusting the cannula, and the procedure can be performed more safely by protecting the posterior portion of the posterior septum by using the switching stick. |  |

| Pitfalls |  |
|---|---|
| (1) During the posterior compartment procedure, a knee flexion of 90° must be maintained. |  |
| (2) All instruments must always maintain a posterior-to-anterior direction. |  |
| (3) When possible, the outflow should be closed, with the tip of the shaver always facing the anterior direction, while the suction should be gentle. |  |

---

**Table 2. Advantages and Disadvantages of the Posterior Double Cannular Sliding Technique**

| Advantages |  |
|---|---|
| (1) As direct visualization is made from the transnotch view in the anterior portal for all processes, the possibility of malorientation or abrupt instrumentation can be reduced. |  |
| (2) More stable visualization is possible, as compared with posterior portal arthroscopy. |  |
| (3) By maintaining a fixed state of the cannula during posterior septum resection, abrupt instrumentation that can lead to posterior cruciate ligament or posterior neurovascular injury can be prevented. |  |
| (4) By adjusting the cannula, the radius of the instrumentation can be widened and the instrument is free to move within a limited range, allowing gradual resection. |  |

| Disadvantages |  |
|---|---|
| (1) Nearby structures are at risk of damage when the cannula is not securely fastened. |  |
2. Kim JM. Direct posterior-posterior triangulation of the knee joint. *Arthroscopy* 1997;13:262-264.

3. Louisia S, Charrois O, Beaufils P. Posterior “back and forth” approach in arthroscopic surgery on the posterior knee compartment. *Arthroscopy* 2003;19:321-325.

4. Kim SJ, Jung KA, Kwun JD, Kim JM. Arthroscopic synovectomy of the knee joint in rheumatoid arthritis: Surgical steps for complete synovectomy. *Arthroscopy* 2006;22:461.e1-461.e4.

5. Ogilvie-Harris DJ, Biggs DJ, Mackay M, Weisleder L. Posterior portals for arthroscopic surgery of the knee. *Arthroscopy* 1994;10:608-613.

6. Pace JL, Wahl CJ. Arthroscopy of the posterior knee compartment: Neurovascular anatomic relationships during arthroscopic transverse capsulotomy. *Arthroscopy* 2010;26:637-642.

7. McGinnis MD, Gonzalez R, Nyland J, Caborn DNM. The posteromedial knee arthroscopy portal: A cadaveric study defining a safety zone for portal placement. *Arthroscopy* 2011;27:1090-1095.

8. Kim SJ, Song HT, Moon HK, Chun YM, Chang WH. The safe establishment of a transseptal portal in the posterior knee. *Knee Surg Sports Traumatol Arthrosc* 2011;19:1320-1325.