Arthroscopic Partial Meniscectomy of a Posteriorly Flipped Superior Leaflet in a Horizontal Medial Meniscus Tear Using a Posterior Transseptal Portal

KI-MO JANG, MD; JIN HWAN AHN, MD, PhD; JOON HO WANG, MD, PhD

Abstract

This article describes a case of an arthroscopic partial meniscectomy of a posteriorly flipped superior leaflet in a horizontal medial meniscus tear using the posterior transseptal portal. An arthroscopic partial meniscectomy for bucket handle or flap tears in medial or lateral compartments using ordinary portals is a relatively common procedure in irreparable cases. However, the posterior compartment of the knee is not readily accessible through ordinary arthroscopic portals. Therefore, it has been considered a blind spot. Through the posterior transseptal portal, surgeons can achieve excellent arthroscopic visualization of the posterior compartment and easily perform arthroscopic procedures of the posterior compartment of the knee.

A 48-year-old woman presented with a 1-year history of pain in the medial aspect of the right knee joint. Preoperative magnetic resonance imaging revealed a thinning of the medial meniscus posterior horn in coronal images and a sharp-edged triangle arising from the medial meniscus posterior horn between the medial femoral condyle and medial meniscus posterior horn on sagittal images (flipped-over sign). During the arthroscopic procedure, we found that the flipped leaflet was displaced posteriorly and was not mobile between the medial femoral condyle and medial meniscus posterior horn.

Partial meniscectomy for a posteriorly displaced fragment can be performed successfully using the posterior transseptal portal. The posterior transseptal portal is useful for an arthroscopic partial meniscectomy of a posteriorly flipped leaflet in the posterior compartment of the knee.

Drs Jang and Wang are from the Department of Orthopaedic Surgery, Samsung Medical Center, and Dr Ahn is from the Department of Orthopedic Surgery, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, South Korea.

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Correspondence should be addressed to: Joon Ho Wang, MD, PhD, Department of Orthopaedic Surgery, Samsung Medical Center, 50 Iwon-Dong, Kangnam-Gu, Seoul, South Korea 135-710 (mdwang88@gmail.com).

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Torn menisci frequently require surgical repair or meniscectomy. Meniscal tears with associated displaced fragments, such as flap tears, can be difficult to recognize and accurately describe on magnetic resonance imaging (MRI), and displaced fragments can be challenging to identify intraoperatively. In addition, arthroscopic surgery for the flipped leaflet in the posterior compartment might be more difficult because of the inaccessibility of the posterior compartment.

The posterior transeptal portal makes it possible for an arthroscope or working instruments inserted through the posteromedial portal to reach the posterolateral compartment or vice versa. Excellent arthroscopic visualization of the posterior compartment and easier arthroscopic procedures for the posterior compartment of the knee joint are possible using the posterior transeptal portal.

This article describes the case of an arthroscopic partial meniscectomy of a posteriorly flipped superior leaflet in a horizontal tear of the medial meniscus using the posterior transeptal portal. To our knowledge, this is the first article of its kind in the English literature.

**CASE REPORT**

A 48-year-old woman presented with a 1-year history of pain and discomfort in the medial aspect of the right knee joint. The symptoms became aggravated approximately 6 months before presentation, particularly in the positions of full knee flexion and extension. Physical examination revealed a positive McMurray test and a 20° limitation of flexion compared with the unaffected side. Preoperative MRI revealed thinning of the medial meniscus posterior horn in coronal images and a sharp-edged triangle arising from the medial meniscus posterior horn between the medial femoral condyle and medial meniscus posterior horn in sagittal images (Figure 1). This was believed to be a type of meniscus flap tear, but it could not be confirmed because the morphology of the fragment was unusual.

The patient was placed in the supine position under general anesthesia, with the affected knee joint flexed 90°. A routine arthroscopic examination was performed using the standard anterior portals. The anterolateral and anteromedial portals were produced immediately adjacent to the lateral and medial borders of the patellar tendon and 1 cm above the joint line. Using these portals, the injured medial meniscus posterior horn was seen, but the superior leaflet was not visible (Figure 2). Therefore, other posterior portals were attempted.

First, a postero-medial portal was established under direct arthroscopic visualization. In the course of establishing the posteromedial portal, the posteromedial compartment was checked with standard 30° and 70° arthroscopes in the intercondylar notch between the posterior cruciate ligament (PCL) and medial femoral condyle. Although the displaced leaflet was noticed, the visual field was not sufficient. Using the transillumination technique, the precise location of the posteromedial portal was marked. The marked skin was incised and expanded with a straight hemostat. The posteromedial portal was established. The arthroscope was inserted through the posteromedial portal, and the probe was passed through the intercondylar notch. However, the visual field was limited, and the surgical procedures could not be performed (Figure 2).

We next produced a posterior transep- ternal portal. First, we established the posterolateral portal in a similar fashion to the posteromedial portal. To create the transeptal portal, a posteromedial approach of the arthroscope was performed, and the switching stick was inserted through the posterolateral portal to push the septum medially. A motorized shaver was inserted through the anteromedial portal and reached the posteromedial compartment through the intercondylar notch. Without disrupting the remnant PCL bundle, a small aperture was established at the center of the posterolateral septum behind the PCL using a motorized shaver. We performed a step-by-step excision of a small portion of the medial wall, fatty tissue, and the lateral wall of the posterior septum. The posterior transeptal portal was enlarged. The arthroscope was

**Figure 1**: Preoperative T2-weighted coronal magnetic resonance image showing thinning of the medial meniscus posterior horn (A). T2-weighted sagittal magnetic resonance image showing a sharp-edged triangle arising from the medial meniscus posterior horn between the medial femoral condyle and medial meniscus posterior horn (flipped-over sign) (B).

**Figure 2**: Arthroscopic photographs showing an inferior leaflet in a horizontal tear of the medial meniscus posterior horn. The superior leaflet is not visible through the anterior portal (A). The posteriorly displaced superior leaflet is noticed through the posteromedial portal, but the visual field is limited (B).
Case Report

Diagram of a partial meniscectomy of a knee joint.

Arthroscopic photographs taken through the posterior transseptal portal showing the posteriorly displaced superior leaflet in a horizontal tear of the medial meniscus posterior horn (A). Complete resection of the posteriorly displaced superior leaflet (B).

Figure 3:

Figure 4: Diagram of a partial meniscectomy of a knee joint.

Discussion

Horizontal tears of the meniscus normally occur by axial compression and shearing forces on the posterior horn, producing pain and recurrent swelling. In the case of an extension of the cleft, the leaflet can be flipped anteriorly or posteriorly. Our patient presented with mild pain, particularly during knee flexion at the onset of symptoms. Approximately 6 months later, the pain was aggravated in the positions of knee full flexion and extension. Therefore, it was assumed that the superior leaflet was flipped and impinged between the medial femoral condyle and posterior capsule.

Magnetic resonance imaging is an accurate method for detecting meniscal tears and locating displaced fragments. Evaluation of meniscal injuries accounts for most requests for knee MRIs. The preoperative evaluation of the meniscal lesion on MRI may play an important role in planning treatment. However, meniscal fragments might be difficult to detect on MRI. Meniscal tears associated with displaced fragments show a range of appearances. Our patient showed abnormal thinning of the medial meniscus posterior horn in coronal images and a sharp-edged triangle arising from the medial meniscus posterior horn between the medial femoral condyle and medial meniscus posterior horn. It was the superior leaflet of a horizontal tear and was flipped over to the posterior compartment. To our knowledge, no reports describe a posteriorly flipped leaflet of the medial meniscus. We propose the novel term flipped-over sign, which can be useful for detecting a flipped superior leaflet in the horizontal tear of a meniscus.

Until the posterior transseptal portal was introduced, the posterior compartment of the knee was considered a blind spot by many arthroscopists. The posteromedial and posterolateral compartments are separated by a posterior septum, which is confined by the PCL anteriorly, the posterior portion of the femoral intercondylar notch superiorly, and the posterior capsule posteriorly. The penetration of the posterior septum provides another window for a clear arthroscopic view, which allows manipulation of the instruments inserted into the posterior compartment. Various applications of the posterior transseptal portals have been proposed, including reconstruction of the PCL, removal of foreign bodies, repair of the posterior horn or root of the medial meniscus, and synovectomy of the posterior compartment. The middle genicular artery passes through the posterior septum to the cruciate ligaments, and concern might arise for potential injury of the vessel. Nevertheless, the safety of the penetration of the lower portion of the septum has been verified because the artery passes in the high portion of the septum. Recently, release of the posterior septum and capsule has been demonstrated to move the neurovascular bundle farther from the posterior aspect of the knee.

Previously, many arthroscopic surgeries were performed using the posterior transseptal portal, with no complications. In the current case, the partial meniscectomy could not have been performed successfully without this portal.
The flipped-over sign can be a clue for detecting a totally flipped leaflet in a horizontal tear of the meniscus. It is possible to perform an arthroscopic partial meniscectomy successfully using the posterior transseptal portal in the case of a posteriorly flipped superior leaflet in a horizontal medial meniscus tear, which is impossible using the standard anterior portals or posterior medial portal. The posterior transseptal portal is a useful and safe portal in arthroscopic surgery.

REFERENCES


