Arthroscopic Treatment of Popliteal Cysts

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Abstract: Popliteal cysts, often referred to as Baker’s cysts, are a common occurrence in the adult knee. Although controversy exists as to the exact indications for treatment, these structures can cause extreme discomfort and morbidity, including pain from rupture and symptoms from neurovascular compromise. Prior to the development of the arthroscope, open treatment of popliteal cysts was not uncommon. Complications such as poor wound healing, cyst recurrence, and knee flexion contractures were reported after such treatment. Owing to the presence of a valve-type structure, also called the posterior transverse synovial infold, there is 1-way flow of synovial fluid into the cyst. Although seldom described, there is a reproducible and relatively straightforward arthroscopic treatment for this pathology. This technical report will describe the arthroscopic treatment of popliteal cysts and clarify the posterior knee anatomy that gives the surgeon the landmarks to perform safe and effective arthroscopic treatment of popliteal cysts.

The popliteal cyst is best defined as an enlargement of the gastrocnemius-semimembranosus bursa (Fig 1) that communicates with the knee joint via a valve-like structure, also called the posterior transverse synovial infold (PoTSI). This valve-like capsular fold allows these cysts to be successfully treated via arthroscopic surgery. Indications for popliteal cyst decompression include symptomatic/painful cysts (usually larger than 5 cm), cysts causing neurovascular compromise, cysts occurring with grade III or IV chondromalacia or synovial disease, and cysts not responding to conservative treatment. Previous surgical treatments of popliteal cysts via the open approach had the risk of complications such as fistula formation, recurrence, abscess, and saphenous nerve injury. These complications can be avoided using an arthroscopic approach through a posteromedial portal to decompress the popliteal cyst and take down the valvular capsular fold or PoTSI. Ko et al.2 have shown complete resolution or a significant decrease in size of all cysts and improved clinical outcomes in 94% of patients at a minimum of 6 months of follow-up with arthroscopic treatment. This study confirms the viability and value of arthroscopic treatment of popliteal cysts with minimal added surgical time.

Preoperative Planning

It is essential to obtain magnetic resonance imaging (MRI) of the knee to determine the exact location of the cyst. On the MRI, the opening of the cyst (Table 1) consistently lies between the medial head of the gastrocnemius and the semimembranosus tendon (Fig 2). In the more common distal cyst, the medial head of the gastrocnemius lies between the cyst and the neurovascular structures, thus protecting these structures from surgical injury. In more proximal cysts, however, the lateral wall of the cyst lies adjacent to these structures, which is vital to keep in mind during this procedure to avoid neurovascular injury.

Surgical Technique

With the patient supine, the operative leg is flexed over the end of the table and placed in a standard knee holder (Video 1). The nonoperative leg is placed in a well-leg holder to allow access to the medial and posterior aspects of the knee. Standard arthroscopic equipment is required, using a 4.0 mm arthroscope (Stryker, Kalamazoo, MI). Anteromedial and anterolateral portals are created, hugging the patellar tendon to allow easier access to the posteromedial...
compartment. With the arthroscope in the anteromedial portal, the trifurcation of the posterior cruciate ligament, medial femoral condyle, and medial tibial plateau is visualized (Fig 3A). Under direct visualization, a 5.6 mm arthroscopic sheath (Stryker) is passed via the anterolateral portal into the posteromedial compartment (Fig 3B). Occasionally, because of the shape of the medial femoral condyle or tibial spines, the posteromedial compartment is better accessed via the anteromedial portal. The arthroscope is then transferred into the second sheath to visualize the posteromedial compartment.

On entering the posteromedial compartment, the PoTSI is often apparent (Fig 4). It will be seen as a transverse fold overlying the medial aspect of the medial head of the gastrocnemius. Using a spinal needle from a posteromedial approach, the planned posteromedial portal is localized (Fig 5). A small nick is created in the skin, and a working canula with a blunt trocar is passed into the posteromedial portal. An arthroscopic shaver (Smith & Nephew, Memphis, TN) is then brought through the portal to begin resection of the PoTSI. The shaver is then followed by arthroscopic biting baskets (Smith & Nephew), as often the lesion is too thick for shaving alone. As the flap is taken down, the medial head of the gastrocnemius becomes more apparent (Fig 6). Medial to this, the opening to the popliteal cyst appears. The shaver is reintroduced to remove debris and complete the takedown of the PoTSI. Removal of the PoTSI is complete when an 8 to 10 mm opening is created between the popliteal cyst and the posterior capsule, allowing free flow of synovial fluid between the 2 compartments. With pressure exerted on the posteromedial knee over the popliteal cyst, the viscous synovial fluid within the popliteal cyst can often be expressed.

The arthroscopic canula (Smith & Nephew) is then placed in the posteromedial portal for direct visualization of the interior of the cyst. Passing the arthroscope posterior to the medial head of the gastrocnemius, the interior of the cyst is easily visualized (Fig 7). The interior of popliteal cysts varies, but there are usually septations present. In cases of chondromalacia, chondral flakes are frequently present, which also require irrigation until cleared. Although cyst excision is

### Table 1. Top 5 Technical Pearls for Arthroscopic Treatment of Popliteal Cysts

1. The surgeon must be familiar with the anatomy. Visualization of the cyst on preoperative magnetic resonance imaging is essential to know the location of the cyst relative to the semimembranosus tendon, medial head of the gastrocnemius tendon, and tibial nerve, vein, and artery.
2. Arthroscopically, the surgeon must locate the posterior transverse synovial infold at the medial head of the gastrocnemius tendon. This will lead to the opening to the cyst.
3. If, when passing through the notch to get to the posteromedial compartment of the knee, the scope sheath does not go easily, switch to visualizing through the anterolateral portal and pass the sheath through the anteromedial portal. A minimal medial femoral condyle “notchplasty” is occasionally required.
4. Using a second arthroscopic sheath is helpful to allow direct visualization of the passage of the additional scope sheath into the posteromedial compartment via the “trifurcation” of the medial femoral condyle, medial tibial plateau, and posterior cruciate ligament.
5. Creation of the posteromedial portal should be localized first with a spinal needle, then created with a nick in the skin only, followed by a blunt trocar to avoid injury to the saphenous nerve.
usually not necessary, instruments can be used within the cyst via a transcystic portal. The transcystic portal is created by direct visualization with a localizing needle (Fig 8) placed percutaneously from the most superficial location of the cyst, preplanned with the MRI scan (Fig 9). This portal is often directly posterior. Transillumination may be helpful to locate this portal and to avoid superficial calf veins. The cyst walls can be removed using a shaver via this portal. This portal is also used to remove larger loose bodies within the cyst (Fig 10). If the cyst extends proximal to the joint line, it often follows the course of the semimembranosus tendon proximally and then toward the midline of the popliteal fossa, often abutting the neurovascular bundle (Fig 11). This is essential to note if considering cystectomy and important to determine preoperatively through the MRI scan. Cystectomy is performed in the case of recurrent cysts or if the cyst lining appears to consist of diseased synovium, such as is occasionally seen in rheumatoid or other systemic arthropathies.

Portals are closed with nonabsorbable sutures. It is important to close the posteromedial and transcystic

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**Fig 2.** (A) Sagittal magnetic resonance imaging view of a right knee demonstrating a typical popliteal cyst. Popliteal cyst (C), medial tibial plateau (T), medial head of the gastrocnemius muscle (MHG), and distal medial femoral condyle (F). (B) Axial magnetic resonance imaging view of a right knee demonstrating a popliteal cyst (C). Note that the popliteal cyst lies in between the gastrocnemius and semimembranosus. The medial head of the gastrocnemius (MHG) and semimembranosus (S) are also labeled for anatomical landmarks.

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**Fig 3.** (A) Arthroscopic image of the trifurcation of the posterior cruciate ligament (PCL), medial femoral condyle (MFC), and medial tibial plateau (MTP) visualized from the anteromedial portal. This should be visualized prior to passing the arthroscopic sheath via the anterolateral portal into the posteromedial compartment. The arrow shows where one should aim to place the arthroscopic sheath into the posteromedial compartment. (B) Arthroscopic image of the arthroscopic sheath being placed into the posteromedial compartment via the anterolateral portal through the trifurcation of the PCL, MFC, and MTP. This step is vital to enter into the posteromedial compartment and visualize the posterior transverse synovial infold.
portals as these may lead to cutaneous fistulas if they do not properly heal. These portals also tend to gap open more than the standard anterior arthroscopic portals. A compression dressing is placed over the posteromedial knee, with care not to compromise the midportion of the popliteal fossa, in addition to the standard arthroscopic dressing.

**Fig 4.** Arthroscopic image taken with the arthroscope in the posteromedial compartment demonstrating the posterior transverse synovial infold (PoTSI), which is seen as a transverse fold overlying the medial head of the gastrocnemius. The medial femoral condyle (MFC) acts as a landmark for localization in the posteromedial compartment via the anterolateral portal.

**Fig 5.** Intraoperative photograph demonstrating needle localization of the posteromedial portal with the arthroscope in the anterolateral viewing portal. Knowledge and review of medial knee anatomy is important prior to surgery since the saphenous nerve is at risk with the creation of this portal. To try and limit this risk, a small nick is made in the skin and a canula with a blunt trocar is passed into the posteromedial portal.

**Fig 6.** Arthroscopic image demonstrating an arthroscopic shaver in the posteromedial portal beginning resection of the posterior transverse synovial infold (PoTSI). The shaver is often followed by arthroscopic biting baskets as the lesion can be too thick for shaving alone. As the flap is taken down, the medial head of the gastrocnemius (MHG) becomes more apparent. Medial to this, the opening to the popliteal cyst appears. The shaver is reintroduced to remove debris and complete the takedown of the PoTSI. Removal of the PoTSI is complete when an 8 to 10 mm opening is created between the popliteal cyst and the posterior capsule, allowing free flow of synovial fluid between the 2 compartments. The arthroscopic canula is then placed in the posteromedial portal for direct visualization of the interior of the cyst by passing the arthroscope posterior to the medial head of the gastrocnemius. (MFC, medial femoral condyle; MHG, medial head of the gastrocnemius muscle.)

**Fig 7.** Arthroscopic image demonstrating the interior of the cyst after insertion of the arthroscope posterior to the medial head of the gastrocnemius into the cyst via the posteromedial portal. The interior of popliteal cysts varies, but there are usually septations present. In cases of chondromalacia, chondral flakes are frequently present, which also require irrigation until cleared.
Popliteal cysts are relatively common in patients over 50 years old. Although there have been a few modifications of the description of these cysts, the popliteal cyst is best defined as an enlargement of the gastrocnemius-semimembranosus bursa, which communicates with the knee joint via a valve-like structure. It is the presence of this valve-like structure that allows the cysts to be successfully treated via arthroscopic surgery.

Previous surgical treatment of popliteal cysts via an open approach has been previously described and can cause complications such as fistula formation, recurrence, abscess, and saphenous nerve injury. Many of these complications can be avoided by use of an arthroscopic approach. Arthroscopic treatment of popliteal cysts was first described by Sansone and De Ponti. Their treatment consisted mainly of decompression of the cyst through a hole in the posterior capsule. At 1 year, all patients showed reduction in the size of the cyst, with 95% of patients displaying "optimal or good clinical results" at 2 years postoperatively.

Discussion

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This technique has been further refined by taking down the capsular fold that has been consistently identified in nearly all patients with popliteal cysts. Ahn et al. defined clearly the location of the valvular capsular fold at the medial aspect of the medial head of the gastrocnemius and described the technique they used to resect the fold. Also described by Ahn et al. is a “posteromedial cystic portal,” which provides access to the cyst itself. This portal is located just superior to the posteromedial portal and used for resection of cyst walls if indicated. Follow-up MRI at a minimum of 6 months showed complete disappearance or significant decrease in size in all cysts and improved clinical outcomes in 94% of patients, thus confirming the viability and value of arthroscopic treatment of popliteal cysts. This technical report confirms the viability and value of arthroscopic treatment of popliteal cysts.

Although this arthroscopic technique had good clinical outcomes in the treatment of popliteal cysts, there are risks and limitations associated with it. These include saphenous nerve injury during the creation of the posteromedial portal. The saphenous nerve pierces the fascia between the sartorius and gracilis and becomes subcutaneous on the medial aspect of the knee. The tibial nerve, popliteal artery, and popliteal vein injury are also at risk of injury during arthroscopic treatment of proximal popliteal cysts since the neurovascular bundle lies adjacent to the lateral wall of the cyst and is not protected by the medial head of the gastrocnemius as it is in distal cysts. The use of preoperative planning through MRI and a review of anatomy, however, should help avoid injury to any of these structures. The limitations of this technique are that it is only applicable to true popliteal cysts and is not applicable to other posterior cystic lesions such as hamstring ganglions. This can be discerned by using preoperative MRI scans to make sure that a posterior knee cyst is in fact a true popliteal cyst.

Conclusions

Arthroscopic treatment of popliteal cysts is a relatively straightforward procedure for treatment of symptomatic popliteal cysts. Cyst removal or decompression first requires location of the PoTSI at the medial edge of the medial head of the gastrocnemius tendon. The valve-like fold is then taken down through a posteromedial portal to allow free flow of fluid between the cyst and the intra-articular environment of the knee. Further work within the cyst requires placement of the arthroscope into the posteromedial portal and creation of a transcystic portal. Careful attention to the preoperative MRI and knowledge of anatomy can create a reproducible result with excellent patient satisfaction and low incidence of reoccurrence.

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