An arthroscopic Resection Technique for Popliteal Cysts
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Abstract: When treating a popliteal cyst in the knee joint, it is often necessary to simultaneously treat the intra-articular lesions so as to reduce the recurrence of the cyst after the operation. Herein, we propose an arthroscopic resection technique for popliteal cyst, in which the position of the popliteal cyst is indirectly located by finding out the location of the semimembranosus tendon during the operation, thereby completing the arthroscopic resection of the popliteal cyst. This method does not involve the posteromedial compartment of the knee joint. Arthroscopic treatment can be performed on the combined intra-articular lesions through anteromedial and anterolateral approaches before or after popliteal cyst resection.

Arthroscopic resection of a popliteal cyst or internal drainage can simultaneously treat intra-articular lesions and reduce the recurrence rate of a popliteal cyst compared with open surgery. However, locating the popliteal cyst is relatively challenging and may lead to complications, such as vascular injury. Popliteal cysts commonly occur in the space between the semimembranosus tendon and the medial head of the gastrocnemius muscle. Therefore, we proposed a double medial approach to treat the knee joint, in which the popliteal cyst is indirectly located by finding the location of the semimembranosus tendon during the operation, thereby allowing for the resection of the popliteal cyst.

Surgical Approach (With Video Illustration)

Surgery is divided into 4 steps.

Step 1
The patient is placed in the supine position. After the general anesthesia is administered, the knee is bent 90°, with hip flexion, abduction, and external rotation. The foot of the patient is then placed above the surgeon’s knees, after which the position for surgery is marked (note: the surgeon is sitting beside the operating table). The surgical position is as shown in Fig 1. The entry position is as shown in Fig 2.

Step 2
Two 5- to 8-mm incisions are made as shown in Fig 2. Vascular forceps is inserted according to approach 1 to determine the position of the posteromedial tibial plateau while keeping the position of the blood vessel fixed. Next, another vascular forceps is inserted following approach 2; the aforementioned operation is repeated to form an arthroscopic operation triangle. Then, the vascular forceps are used to expand the soft-tissue channel and create an operating cavity.

Step 3
The arthroscope is implanted through approach 2 or approach 1, and a motorized shaver is implanted through approach 1 or approach 2. A simple cleaning of the distal end of the posteromedial tibial plateau reveals the semimembranosus tendon, and the popliteal cyst can be found by expanding the soft-tissue space between the superior and posteromedial plateaus of the semimembranosus tendon. The cyst wall tissue is then removed. If the popliteal cyst has a larger tension, it can be directly sensed by the vascular forceps and the
motorized shaver can be directly placed beside the popliteal cyst for direct positioning during the operation. Then, the popliteal cyst wall tissue is excised (Figs 3, 4, and 5, Video 1).

**Step 4**

Before or after the excision of the wall tissue of popliteal cyst, treatment is performed on the intra-articular lesions through anteromedial and anterolateral approaches.

**Discussion**

It is generally believed that intra-articular lesions cause increase intra-articular effusion and lead to a popliteal cyst. It is also believed there is a one-way valve mechanism that communicates with the joint. For years, traditional open surgery has been the most commonly used method for removing a cyst. Yet, studies have suggested a high postoperative recurrence rate in patients with popliteal cysts who undergo open surgery.\(^3\,^5\) In contrast, arthroscopic treatment of intra-articular lesions, arthroscopic popliteal cyst resection or internal drainage, or open popliteal cyst resection have achieved satisfactory clinical results.\(^4\,^6\,^8\) Nonetheless, the latter approach is rarely used because it requires altering the surgical position of the patient, and secondary disinfection needs to be performed during the operation.

Compared with arthroscopic popliteal drainage, the arthroscopic popliteal cyst resection has a lower postoperative recurrence rate, but it significantly increases the operation time and postoperative complications.\(^4\,^6\) We propose the knee medial double approach for removal of popliteal cysts, which can be completed about 5 minutes, thus significantly reducing the operation time. At the same time, as the intraoperative perfusion time is greatly shortened, the incidence of postoperative complications is also lower and the recovery faster. Thus far, we have performed 25 popliteal cyst resections. We encountered no complications, such as infection, vascular and nerve damage, or hematoma formation, in any of the treated patients. We believe that if the scope is placed in the cyst cavity through the knee joint cavity, it needs to be detoured through the joint, which may cause a blind spot in the field of vision and failure to completely remove the cyst wall tissue, which may be a possible cause for the recurrence of popliteal cyst after the operation. With our technology, the scope is directly inserted into the cyst, thus allowing for complete removal of the cyst wall tissue and having a lower probability of inducing blood vessel damage.

Arthroscopic internal drainage of a popliteal cyst has been previously described by Takahashi and Nagano.\(^1\)
They suggested using open surgery for cases in which the angiography showed that the popliteal cyst was not connected with the joint cavity. In this study, 1 patient had no intra-articular lesion, and the cyst was resected this way. Follow-up showed no recurrence for nearly 1 year after the operation. We believe that this method has significant advantages compared with open resection or arthroscopic internal drainage or arthroscopic resection of the popliteal cyst through the articular cavity, especially when resecting primary popliteal cysts and gouty arthritis with popliteal cyst, because there is no damage to the integrity of the capsule. Nonetheless, future studies are needed to further verify whether the joint capsule needs to be opened for drainage during the operation. In the current study, we did not open and drain the joint capsule. In the short-term follow-up of the current cases, no recurrence was found.

Accurate and rapid positioning are the key steps during operation that can effectively reduce postoperative complications. Our technique indirectly locates the popliteal cyst by finding out the location of the semimembranosus tendon during the operation. If the cyst has a large tension and can be sensed by the vascular forceps, it also can be located directly during the operation. The positioning method is relatively accurate and fast. However, because the semimembranosus tendon is an extra-articular structure, it can easily confuse an inexperienced operator. In this case, it is necessary to repeatedly determine the position of the posteromedial tibial plateau to determine the position of the semimembranosus tendon in its inner and lower sides.

Our surgical method has exhibited the following advantages and disadvantages. (1) The operation is performed with a 30° arthroscope (Smith & Nephew), a shaver (Smith & Nephew), and 2 vascular forceps. No special equipment is required. (2) Due to the relatively simple structure and shallow position of the posteromedial knee joint, it is beneficial to locate the posteromedial tibial plateau during operation. (3) Because the tibial insertion of semimembranosus tendon is relatively fixed, it can be positioned at the distal end of the posteromedial tibial plateau accurately. Therefore, we
can find the popliteal cyst on the lateral side of the semimembranosus tendon. (4) The whole process of our operation is completed under direct vision, which is relatively safer. (5) Because the semimembranosus tendon is an extra-articular structure, it is easy to become lost for beginners. At this point, we need the posteromedial plateau as a reference mark.

The presented method offers accuracy in positioning and has a short learning curve. However, before the operation, it is crucial to accurately assess the location of the popliteal cyst by magnetic resonance imaging.

References
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