

Arthroscopic Treatment of Popliteal Cyst and Associated Intra-articular Knee Disorders in Adults

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Summary: We describe a surgical arthroscopic treatment for popliteal cyst in a series of 30 patients, with a mean follow-up of 32 months. The treatment consists of a cure for the intra-articular pathology of the knee associated with popliteal cysts, and the contemporaneous correction of the valvular mechanism responsible for the formation and reoccurrence of popliteal cyst. The popliteal cyst in adults was found to be almost invariably associated with other knee disorders. In all of the cases studied, a connection between joint space and cyst was found. Arthroscopy allowed the treatment of almost all of the associated knee disorders and the removal of anatomic structures imposing the one-way passage of fluid from the joint space into the cyst. Two years after the treatment, we observed optimal or good clinical results in 95% of the patients treated. **Key Words:** Arthroscopy—Popliteal cyst.

Although popliteal cysts in adults have been recognized since the first studies of Adams¹ and Baker,² their causation, and treatment are still subject to debate. The observation that there is often a reoccurrence of the cyst following its surgical removal³⁻⁵ has led to the conclusion that the associated intra-articular pathologies of the knee need to be treated.⁶

Studies of the pathogenesis of popliteal cysts have shown that they are connected to the knee joint by means of a valvular opening.^{7,8} The presence of a valve, along with the existence of an effusion, create a one directional flow of the synovial fluid from the articular cavity to the cyst, and is one of the fundamental factors responsible for the appearance and persistence of the cyst.

In this study, we propose an arthroscopic treatment for popliteal cysts that results in the elimination of the associated intra-articular pathology and the correction

of the valvular mechanism responsible for the persistence of the cyst. This eliminates the need for surgical removal of popliteal cyst.

MATERIALS AND METHODS

Thirty patients (18 men and 12 women) with popliteal cysts were treated. The average age was 56 ± 11 years (range, 35 to 72 years). The popliteal cysts were unilateral and located in the right knee in 16 cases, and in the left knee in 14 cases.

The diagnosis of a popliteal cyst was based on the findings of the objective evaluation and by different imaging techniques (sonography in 19 cases, magnetic resonance imaging in 7, computed tomography in 2, arthrography in 2). By using sonography on all of the patients before performing the surgery, it was possible to determine the dimension of the cyst and its reduction following compression. The patients were also screened for rheumatoid and other systemic diseases.

In the study cases, the main complaint was not always related to the presence of the popliteal cyst. Sometimes the symptoms related to the intra-articular disorders were prevalent, but in that case the cyst was the cause of minor symptoms anyway.

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All the patients underwent conservative treatment before or after referring to us (ice and rest in 5, immobilisation in 9, physiotherapy in 15, nonsteroidal anti-inflammatory medication in 9, steroid intra-articular injections in 6) but it revealed quite ineffective.

The patients underwent arthroscopic surgery under regional anesthesia.⁹ The three traditional portals, superomedial, anterolateral and anteromedial, were used. In 7 cases, where the visibility of the posterior horn of the medial meniscus was difficult, a supplemental posteromedial portal was used.

The average follow-up was 32 months (minimum, 24; maximum, 48). In the clinical evaluation of the results we followed the guidelines proposed by Rauschnig and Lindgren.⁵ The parameters taken into consideration were the subjective symptomatology related to the presence of popliteal cyst (pain and a posterior sense of tension in the popliteal fossa), and the clinical importance of posterior swelling and/or reduction of range of motion. Each patient was classified according to the following scale:

- Grade 0, absence of swelling and pain, no limitation of range of motion;
- Grade 1, light swelling and/or a sense of posterior tension after intense activity, minimal limitation of range of motion;
- Grade 2, swelling and pain after normal activity, range of motion limitation less than 20°
- Grade 3, swelling and pain even when resting, range of motion limitation more than 20°.

In all cases, a postoperative sonography examination was performed within 1 to 3 months following surgery, and was repeated 1 year after the surgery had been performed. The sonography examination was used to look for the presence of a residual cystic cavity, and if found, to determine its dimension and reduction following compression.

SURGICAL TECHNIQUE AND RESULTS

In all of the cases examined there was intra-articular pathology of the knee associated with popliteal cysts. The types and distribution of the associated pathologies are reported in Table 1. In a majority of the cases a meniscus tear was found (n = 27, 90%). The lesion usually involved the medial meniscus (27 cases, 90%), and less frequently, both menisci (5 cases, 17%). In 3 cases the medial meniscus was normal; 2 of these presented chondral lesions of various degrees, and the third presented serious rheumatoid synovitis.

TABLE 1. Disorders Associated With the Presence of a Popliteal Cyst in the Study Population (n = 30) as Shown by Knee Arthroscopy

Associated Pathology	No. of Cases
Medial meniscus tear	27
Lateral meniscus tear	5
Cruciate ligaments rupture	2
Synovitis	17
Chondral lesion	20

The medial meniscus lesion was isolated in 10 cases (33%). It was associated with other traumatic lesions in 7 cases (23%) (in 2 cases it was associated with lesions of the cruciate ligaments, in 5 cases with lateral meniscus tears) or with degenerative alterations of the articular cartilage in 13 cases (43%). The medial meniscus lesion always involved the posterior horn, often extending into the body of the meniscus. It was generally a complex type. The horizontal cleavage component almost invariably extended deep toward the capsule.

The medial meniscus tears were treated with a selective meniscectomy, at the end of which, in 27 of 30 cases, there appeared an oval opening located between the body and the posterior horn that extended to the articular capsule. A blunt instrument could be easily introduced into the opening, and just a slight amount of pressure was needed to overcome the capsular plane. Proceeding cautiously, it was possible to manually feel the point of the instrument under the skin, to the posteromedial site, in correlation to the swollen cyst. In cases where the cyst is not quite as evident, as in the three cases in which the medial meniscus was intact for example, we injected a dye (blue methylene) through the skin, into the cyst. In this way the site of the opening, which is sometimes obliterated by a thin and pliant fibrous septum, is well evidenced (Fig 1).

At this point, all of the structures that appeared to obstruct the capsular orifice had been removed (fibrous septa, bands, meniscus flaps). The procedure itself was performed using motorized instrumentation through the anteromedial portal. Once having passed the capsule, we are careful to avoid turning the cutting edge of the instrument to the lateral side in order to prevent contact with the vascular structure of the popliteal region. At the end of the procedure, there was a capsular opening of about 4 to 5 mm in diameter (Fig 2).

In the six cases with significant degenerative chondral lesions, a joint debridement associated with chondroplasty and abrasions or multiple drillings of

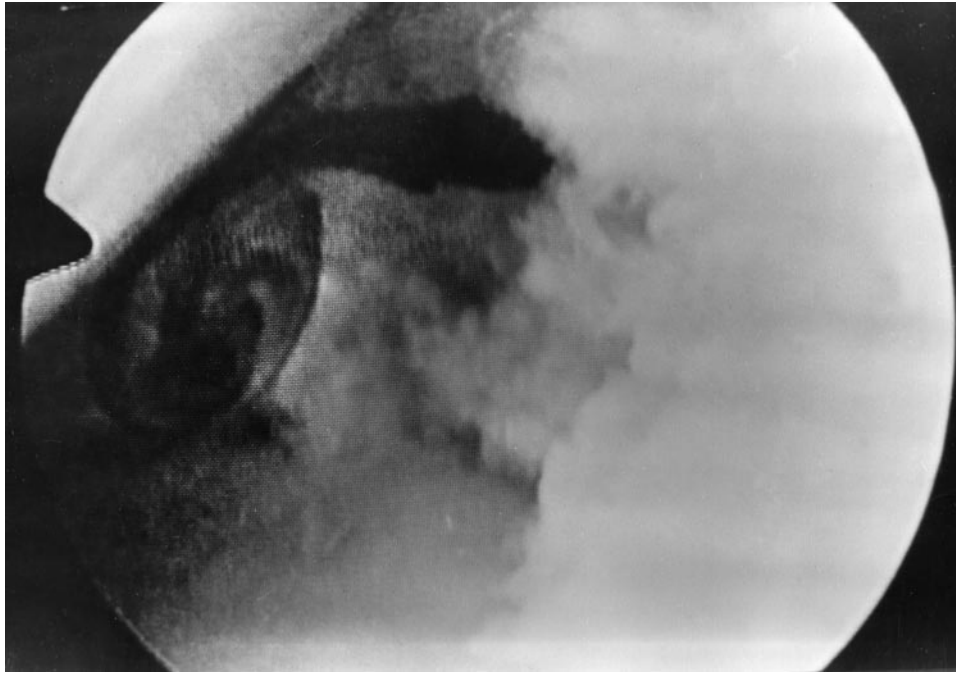
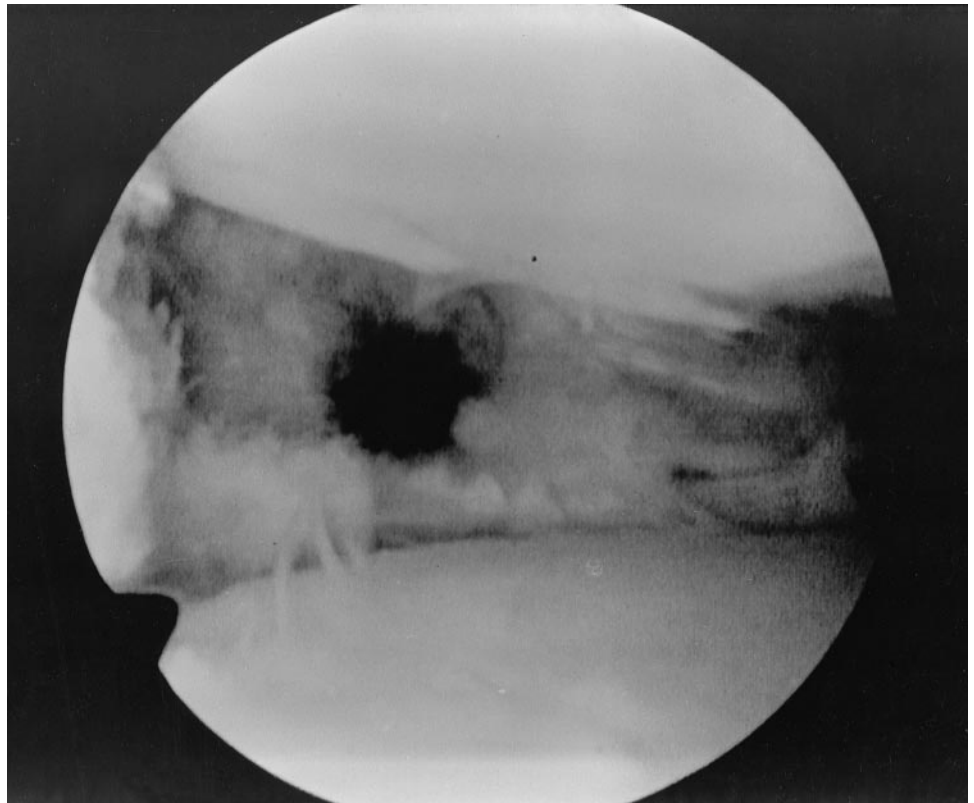


FIGURE 1. The capsular opening of the connection between popliteal cyst and joint space from the articular side is evidenced by a dye (blue methylene) previously injected into the cyst.

the subchondral bone was performed. For the patient afflicted by rheumatoid arthritis, a radical synovectomy was performed. When it was possible, the arthroscope was introduced into the capsular orifice to

inspect the cyst connection that did not seem to have a wall of its own, but appeared instead to give access to a cavity defined by the myotendinous structures of the popliteal region.

FIGURE 2. The opening of the connection between popliteal cyst and joint space as it appears from the articular side after removal of the posterior horn of the medial meniscus and of all of the structures that might act as a valve.



One year after surgery, the majority of patients had results that were excellent or good (Table 2). Only one patient complained of pain after normal daily activity and persistent swelling at the popliteal site. This patient had already undergone a previous conventional surgical procedure to remove popliteal cyst and had experienced a reoccurrence after 1 month. He presented a history of knee arthritis and frequent hydrarthrosis.

In all of the cases, sonographic examinations showed a reduction in the dimension of the cysts (Fig 3). At the first postoperative sonography check-up, there was a reduction in the liquid content. A thickening of the cystic cavity walls was observed, which presented more intangible limits in respect to the preoperative findings. Twelve months after the operation there was a final reduction or disappearance of the liquid content, and sonographic examination of the cyst showed results similar to that of a normal gastrocnemio-semimembranosus bursa. Communication with the articular cavity was maintained, as shown by the slight enlargement of the cyst (when present) after executing the procedures that determine an increase in the intra-articular pressure, and the resulting passage of synovial fluid in the cyst. These procedures included the contraction of the femoral quadriceps and the manual squeezing of the suprapatellar pouch. Only in the one case mentioned above was there a persistent swelling in the popliteal fossa.

DISCUSSION

Many techniques have been suggested for the surgical treatment of popliteal cysts. The frequency of recurrence after simple surgical removal of the cyst^{3-5,10} suggested a change in the therapeutic strategy. It has been noted, in fact, that popliteal cysts are almost always associated with another articular pathology of the knee.^{7,10} The lack of treatment of this pathology probably creates the conditions for the recurrence of the cyst.

Our results confirmed the strong association between popliteal cysts and intra-articular pathology.⁶

TABLE 2. Clinical Evaluation of Results of Surgery According to Criteria of Rauschnig and Lindgren⁵

Criteria	Before Treatment (No. of Cases)	After Treatment (No. of Cases)
Grade 0	0	19
Grade 1	3	10
Grade 2	18	1
Grade 3	9	0

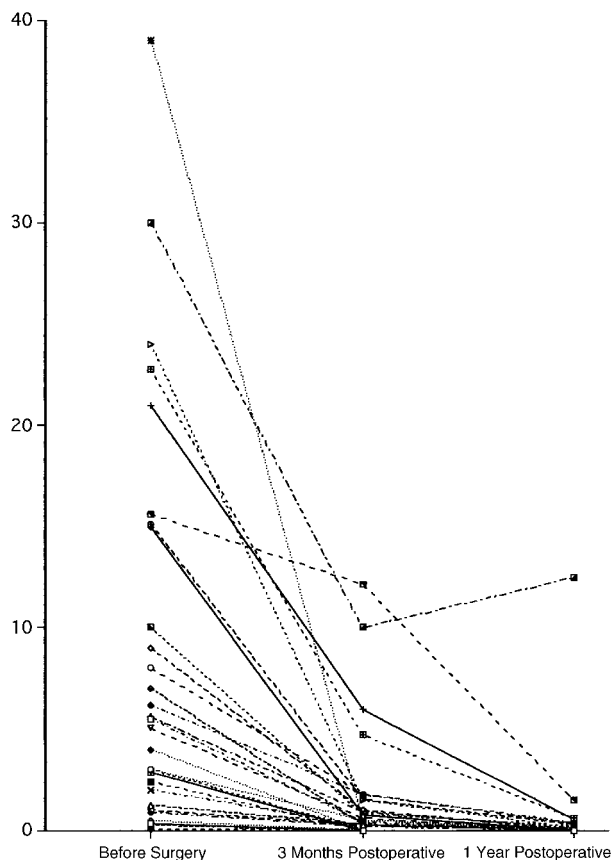


FIGURE 3. Volume (cm³) of popliteal cysts before surgery and at follow-up at 1 to 3 months and at 1 year after surgery as determined by sonography. The cyst volume reduction trend is evident in all cases except one (see text).

The intra-articular pathology most frequently associated with popliteal cysts is a tear of the medial meniscus, particularly the posterior horn,^{7,10} but few studies show the incidence in a large population.⁶ A lesion in the posterior horn of the medial meniscus can provoke the opening of a connection between the joint cavity and the gastrocnemio-semimembranosus bursa as the septum between these two structures is thinner and more fragile just behind the posterior horn.¹¹ Anatomic studies have found a link between popliteal cysts and the joint cavity that opens in this area.^{8,11,12} Through this opening, the synovial fluid reaches the gastrocnemio-semimembranosus bursa where it is trapped, leading to the formation of the cyst.

The prevalent therapeutic direction today is to treat the associated intra-articular pathology in the least invasive manner possible. Some studies^{7,12} have described the existence of a valvular mechanism that permits the continuous passage of fluid from the

articular cavity to the cyst, but does not allow it to re-enter the joint space. If not corrected, this mechanism could determine the persistency of the cyst or its recurrence after surgical excision. We maintain that the surgical treatment of popliteal cysts must include not only the elimination of the articular pathology of the knee associated with the cyst, but also the elimination of the unidirectional flow of the fluid. Some authors have confronted this problem by proposing a closure of the channel between the articulation and the cysts by a simple capsular suturing,^{13,14} or its reinforcement, using the tendons of the gastrocnemius and semimembranosus muscles,¹⁰ or with a pedicle graft from the tendon of the medial head to the gastrocnemius.¹³ But these techniques present some problems. In particular it becomes difficult to expose the capsular gap because the gastrocnemius and semimembranosus are superimposed, and this may impede the execution of an accurate capsular suturing. In addition, over a period of time it may become impossible for the articular capsule to resist the notable pressure of the intra-articular fluid that bears down its posterior portion during the normal flexion-extension movements of the knee.¹²

The arthroscopic approach that we propose allows for an accurate articular balance and proper treatment of the majority of the articular pathologies associated with popliteal cyst. Nevertheless, it is important to emphasize that correcting the cause of the effusion is a condition sine qua non for a successful treatment. We are of the opinion that no type of surgical treatment for popliteal cysts will be successful if the effusion persists. In our case studies, it was possible to show the path of communication between the cyst and joint space, and to intervene on the articular side of this channel. Therefore, it is possible to remove from within the articulation those anatomic structures that may function as a valve, such as the meniscus flaps or capsular septa. The enlargement of the capsular orifice does not weaken the articular structure, either for the site or for the minimum dimension and, in our experience, we observed no complications.

In our opinion, the closing of the channel between the cysts and the articular cavity is not necessary. In

fact, it has been shown that in 50% of normal adult subjects there exists a communication between joint space and the gastrocnemio-semimembranosus bursa, without there being a popliteal cyst.¹¹ This is the major reason we maintain that it is not necessary to surgically remove the cyst. What is important is to re-establish normal bidirectional communication between the cysts and the articular cavity by restoring the paraphysiological situation of the gastrocnemio-semimembranosus bursa communicating with the knee joint.

REFERENCES

1. Adams R. Chronic rheumatic arthritis of the knee joint. *Dublin J Med Sci* 1840;17:520-522.
2. Baker WM. On the formation of the synovial cysts in the leg in connection with disease of the knee joint. *St Barth Hosp Rep* 1877;13:245-261.
3. Harvey JP, Corcos J. Large cysts in lower leg originating in the knee occurring in patients with rheumatoid arthritis. *Arthr Rheum* 1960;3:218-228.
4. Vahvanen V. Popliteal cysts. A follow-up study on 42 operatively treated patients. *Acta Orthop Scand* 1973;44:303-310.
5. Rauschnig W, Lindgren PG. Popliteal cysts (Baker's cysts) in adults. I: Clinical and roentgenological results of operative excision. *Acta Orthop Scand* 1979;50:583-591.
6. Sansone V, De Ponti A, Minio Paluello G, Del Maschio A. Popliteal cysts and intra-articular disorders of the knee: critical reexamination based on magnetic resonance imaging. *Int Orthop* 1995;19:275-279.
7. Jayson MIV, Dixon A St J. Valvular mechanism in juxta-articular cysts. *Ann Rheum Dis* 1970;29:415-420.
8. Rauschnig W. Anatomy and function of the communication between the knee joint and popliteal bursae. *Ann Rheum Dis* 1980;39:354-358.
9. Sansone V, Fanelli G, De Ponti A, Agostoni M. Regional Anesthesia for knee surgery. Proceedings of the 6th Congress of the European Society of Sports Traumatology Knee Surgery and Arthroscopy (ESSKA), Berlin, Germany, 1994;41.
10. Childress HM. Popliteal cysts associated with undiagnosed posterior lesion of the medial meniscus. The significance of age in diagnosis and treatment. *J Bone Joint Surg Am* 1970;54:1487-1492.
11. Lindgren PG, Willen R. Gastrocnemio-semimembranosus bursa and its relations to the knee joint. *Acta Radiol Diagnosis* 1977;18:497-512.
12. Lindgren PE. Gastrocnemio-semimembranosus bursa and its relation to the knee joint. III Pressure measurements in joint and bursa. *Acta Radiol Diagn* 1978;19:377-388.
13. Rauschnig W. Popliteal cyst (Baker's cyst) in adults. II: Capsuloplasty with and without a pedicle graft. *Acta Orthop Scand* 1980;51:547-555.
14. Hughston JC, Baker CL, Mello W. Popliteal cyst: A surgical approach. *Orthopedics* 1991;14:147-150.