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# POPLITEAL CYSTS (BAKER'S CYSTS) IN ADULTS. I.

## *Clinical and Roentgenological Results of Operative Excision*

WOLFGANG RAUSCHNING & PER GUNNAR LINDGREN

Departments of Orthopaedic Surgery and Diagnostic Radiology,
University Hospital, Uppsala, Sweden

Forty patients were re-examined between 6 months and 15 years (mean 4 years) after excision of a popliteal cyst. Forty-six operations had been performed, including one bilateral cyst and five recurrent cysts. The history was reviewed with respect to the preoperative symptoms, clinical and roentgenological signs, the operative and histopathological findings and the postoperative course. Fifteen operations were followed by wound healing complications or tense swelling of the calf simulating deep venous thrombosis. At clinical follow-up a recurrent cyst was found in 63 per cent of the knees. A simplified follow-up arthrography was performed in all knees, and revealed a cyst-like cavity in all but one knee. The majority of the recurrent cysts displayed irregularities of the wall that had not been seen in the preoperative arthrograms.

Despite this high rate of recurrence most of the patients had fewer symptoms from the popliteal space at the time of follow-up than before the operation.

As associated knee disorders were present in the majority of patients, popliteal cysts (Baker's cysts) should be regarded and, if possible, treated as secondary to the basic pathological condition of the joint. Only if the knee disorder is not curable and if the symptoms from the popliteal region are troublesome should excision of the cyst and tight closure of the communication with the joint be considered.

*Key words:* popliteal cyst; Baker's cyst; postoperative results; associated knee disorders; follow-up arthrography; recurrent cyst formation

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More than 200 popliteal cysts are operated upon annually in Sweden (Lindgren 1978). It is the experience of many surgeons that popliteal cysts frequently reappear after operation (Harvey & Corcos 1960, Childress 1970, Vahvanen 1973), while others consider the excision more beneficial (Haggart 1943, Meyerding & van Demark 1943, Burleson et al. 1956). Since we have observed several recurrences following routine excisions of popliteal cysts, we considered it of interest to re-examine a series of patients in this respect.

The first part of this retrospective investigation consists of a preoperative survey concerning the type of trauma, symptoms and clinical signs from the popliteal space and associated knee disorders, and also the findings at operation and the postoperative course. The second part comprises a clinical follow-up examination and a simplified arthrographic investigation of all patients.

The aim of this study was to compare the clinical and roentgenological features before the operation and at follow-up, and to analyse

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*Table 1. Grading of symptoms from the knee joint. A patient was assigned to the category for which he or she fulfilled three or more parameters*

| | | |
|---|---|---|
| 0 | No swelling | |
| | No pain | |
| | No instability or weakness | |
| | No limitation of movement | |
| | No limitation of work or participation in sports | |
| I | Slight swelling | following strenuous exercise |
| | Slight discomfort | |
| | Some giving-way or weakness, muscular atrophy < 1 cm | |
| | Negligible limitation of movement < 10° | |
| | No hard labour, no elite sports | |
| II | Moderate swelling | |
| | Pain following moderate exertion | |
| | Slight or moderate instability, locking, muscular atrophy 1–2 cm | |
| | Limitation of movement 10–20° | |
| | No physical work, limited participation in sports | |
| III | Considerable and tense swelling | |
| | Severe pain interfering with activities of daily life, pain at rest | |
| | Disabling instability, contractures, muscular atrophy > 2 cm | |
| | Limitation of movement > 20° | |
| | Stopped working because of knee derangement, no sport | |

the postoperative complications. The mode of recurrent cyst formation and the operative technique are discussed.

## PATIENTS AND METHODS

During the period 1961–1976, 48 patients were operated on for a popliteal cyst (in five cases for a recurrence) at the Department of Orthopaedic and General Surgery in Uppsala and in two Uppsala County hospitals.* Forty of these patients were available for the investigation. As one patient had bilateral cysts the material consisted of 41 knees – 17 right and 24 left.

Thirty-three of the patients were males and seven females. Their age at the time of operation varied from 13 to 76 years (mean 46.8 years). At re-examination the ages ranged from 17 to 77 years (mean 50.8 years). The average interval between the operation and the follow-up was 4 years (range 6 months to 15 years).

*Samariterhemmets sjukhus and Enköpings sjukhus

### *Case histories*

The case records were reviewed with special attention to any history of knee trauma or previous knee operations, and to the symptoms from the knee joint and the popliteal space. The preoperative *joint symptoms* were graded as shown in Table 1, according to swelling, pain, instability, limitation of movement, and ability to work and participate in sports. The *popliteal symptoms* were divided into four categories: "0" when there was no swelling or pain, "I" when some swelling occurred only during or following strenuous use of the joint, causing slight discomfort, "II" when swelling occurred during or after normal activities, causing tenderness on full knee flexion and extension but not limiting the range of movement, "III" when there was a constant tense swelling of the popliteal cyst, causing considerable tenderness and pain which limited the range of movement.

### *Histopathological examination and preoperative arthrography*

Seventeen cysts had been examined histologically and these were re-examined by a pathologist with regard to the presence and type of inflammatory changes and fibrosis in the cyst walls.

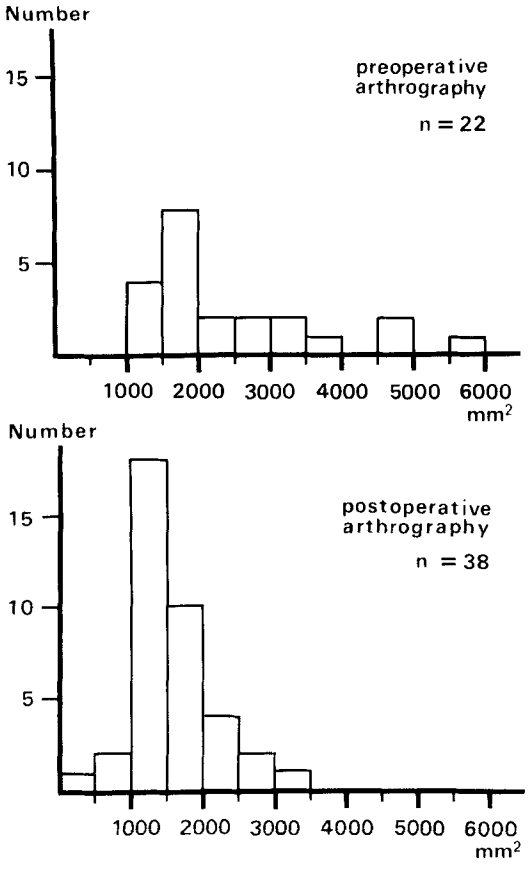


*Figure 1. Radiographic size of the communicating popliteal cavities before operation and at follow-up (see Methods).*

In 22 knees arthrography had been performed prior to operation. On these radiographs the contrast-filled gastrocnemius-semimembranosus bursa was examined. In the lateral view the shape and wall configuration of the bursa were studied and its length and sagittal width were measured. The product of these dimensions was used as an indication of the size of the bursa (Lindgren 1978).

*Clinical and radiographic follow-up*

In all cases clinical examination of the popliteal region was performed, and the knee joint was also examined for any associated disorders. The patients were asked about preoperative symptoms from the knee joint and popliteal region, and about the postoperative course and the present symptoms, which were classified in the same way as described above. If relevant, additions were made to the case records. In cases where a distinct localization was possible, the pre- and postoperative symptoms were assigned to the medial or lateral aspect of the knee, the patello-femoral region and the popliteal space. When the symptoms were diffuse or difficult to localize they were referred to the whole joint (Table 2).

At follow-up all knees were examined radiographically. 10–15 ml of Urografin 45 per cent was injected into the joint. After the injection the knee was flexed without the use of force or resistance to about 90° and the movement of the contrast medium was studied by fluoroscopy with the patient lying on his side. One or two radiographs were taken in this lateral projection. Whenever a contrast-filled cavity communicating with the joint was observed in the popliteal space, it was compared with the bursa in the preoperative arthrogram with respect to size (Figure 1), configuration and outline.

## RESULTS

*Preoperative – case history, symptoms and arthrography*

In 34 knees there had been symptoms from the popliteal space (for less than 6 months in 9 cases, 6 months to less than 2 years in 17 cases and more than 2 years in 8 cases), and in 7 knees there had been symptoms from the joint but none from the popliteal space. Effusion was observed in 9 knee joints; this was uncertain or not commented upon in 4 joints and no effusion was found in 28 joints. A cystic swelling in the popliteal region was noted in 24 knees; there were no cysts in 10 knees and in 7 knees the physical signs were uncertain or not recorded.

The 22 preoperative radiographs showed communicating gastrocnemio-semimembranosus bursæ of varying sizes (Figure 1). Eleven had a smooth wall (Figure 2) and the other 11 were lobulated to a varying extent.

Twelve patients had a history of trauma preceding the onset of the popliteal symptoms. Anterior synovectomy had been performed on 2 patients (2 years and 4 weeks,

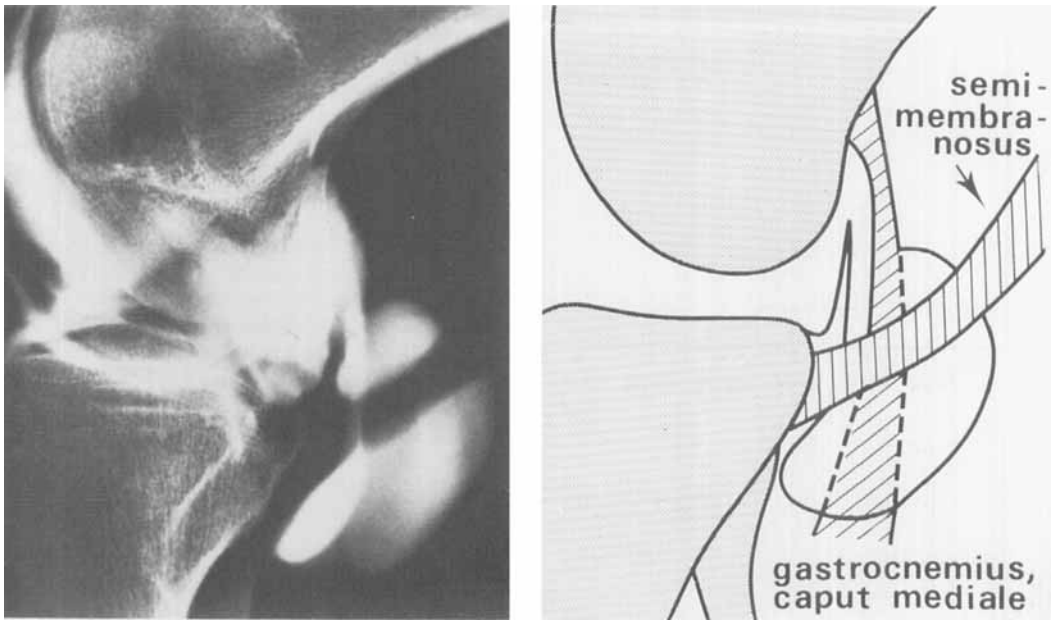


*Figure 2. A normal communicating gastrocnemio-semimembranosus bursa on a lateral arthrogram. Note the impressions from the gastrocnemius and semimembranosus tendons. The part of the bursa lying beneath the gastrocnemius in this projection may falsely be interpreted as a narrow canal into the joint.*

respectively, before excision of the popliteal cyst). In 2 knees the medial meniscus had been excised 20 years and 5 weeks, respectively, prior to the cyst excision in the same knee. The symptoms from the knee joint and popliteal space at the time of admission to the hospital are shown in Table 2.

*Operative and histopathological findings*

Twenty-two surgeons performed the operations, using Z- or S-shaped incisions in 23 cases, and curved, longitudinal, oblique or transverse in the remainder. Twelve cysts were described as large, while the rest were about the same size as the normal gastroc-

*Table 2. Grading of symptoms referable to the compartments of the 41 knee joints on admission to hospital and at follow-up*

| | On admission to hospital | | | | At follow-up | | | |
|---|---|---|---|---|---|---|---|---|
| | Grading of symptoms | | | | | | | |
| Joint compartments | 0 | I | II | III | 0 | I | II | III |
| Patello-femoral | 38 | 1 | 2 | — | 33 | 6 | 2 | — |
| Medial | 37 | 3 | 1 | — | 36 | 5 | — | — |
| Lateral | 41 | — | — | — | 41 | — | — | — |
| Total joint | 24 | 14 | 3 | — | 28 | 11 | 2 | — |
| Popliteal space | 7 | 27 | 7 | — | 29 | 11 | 1 | — |

nemio-semimembranosus bursa. A thick cyst wall and fibrosis were found in 10 cases, 4 cysts were lobulated, 3 contained fibrin and one contained an organized haematoma (here villonodular synovitis had been found at a preceding synovectomy). Communication with the knee joint cavity was found at operation in 28 knees, in 6 of which the opening was described as very broad. In 6 operations no communication was observed and in 7 cases no comment in this respect was made. In 25 of the operations the site of communication (often referred to by the surgeon as a "pedicle") was reported to be closed, and in the remaining 16 closure was stated to be not possible or had not been attempted. In about half of the knees this closure was achieved by a ligature or suture-ligature, and in the rest by suturing the gap in the capsule. In most cases catgut was used. Four knees were immobilized in a plaster splint for 2 weeks.

Of the 17 histological specimens 5 showed slight fibrosis and 10 marked fibrosis with thickening of the bursal wall. In 3 cysts the walls were normal, in 7 there was moderate inflammation and in a further 7 there was marked chronic unspecific inflammation; in one of these 7 cases with rheumatoid arthritis fibrinoid necrosis was seen, and in one case of villonodular synovitis massive proliferation of fibroblasts and histiocytes and deposition of haemosiderin were noted. In 8 of the inflamed cysts there was evidence of chondrodetritic synovitis (Hulteń & Gellerstedt 1941) with resorption of cartilage debris within the bursal wall. None of the 4 recurrent cysts in this series had been submitted for histopathological examination.

*Postoperative course*

During the postoperative course, 9 patients had fever. Of these, 3 had considerable induration of the wound and in 6 patients a fistula or abscess developed, with purulent discharge, necessitating a total of 6 debridement procedures. No arthritis developed. Swelling and tenderness of the calf occurred in 6 patients, one of whom was treated with anticoagulants. One patient complained of hypaesthesia at the medial aspect of the calf and in one knee a long-standing flexion contracture developed. The average length of stay in hospital was 9.6 days (range 3–28 days). The time from operation to return to full-time work or normal activities was about 5 weeks – in 14 patients more than 6 weeks. Eleven patients noted a recurrent swelling at the site of the primary cyst, mostly a short time after the operation.

*Results of the clinical follow-up*

In the popliteal region of 29 knees the preoperative symptoms had disappeared, whereas in 12 there was no improvement. The symptoms from the knee joint were essentially unchanged (Table 2). In 7 knee joints marked effusion was found. In 21 knees a recurrent popliteal cyst was seen and felt, in 5 such a cyst was palpable but not visible, and in 11 knees the physical findings were dubious. Ten cysts were tense and tender. In 10 knee joints there was some limitation of movement. The severity of the inflammatory changes seen at histopathological examination did not influence either the intensity of pre- or postoperative symptoms or the frequency of cyst recurrence as observed at physical examination. Broad pigmented scars were seen in 12 knees, especially after wound infection, and 3 patients had sensory loss adjacent to the scar.

Intra-articular disorders associated with the popliteal cysts were diagnosed in 28 of the 41 knee joints. Advanced osteoarthritis was noted in 17 knees (6 knees displayed a varus deformity and 3 patello-femoral osteoarthritis). Rheumatoid arthritis was found in 5 knees. Other knee joint derangements were: One rupture of the lateral meniscus, one rupture of the anterior cruciate ligament and the medial capsule, 3 cases of severe chondromalacia of the patella and one villonodular synovitis.

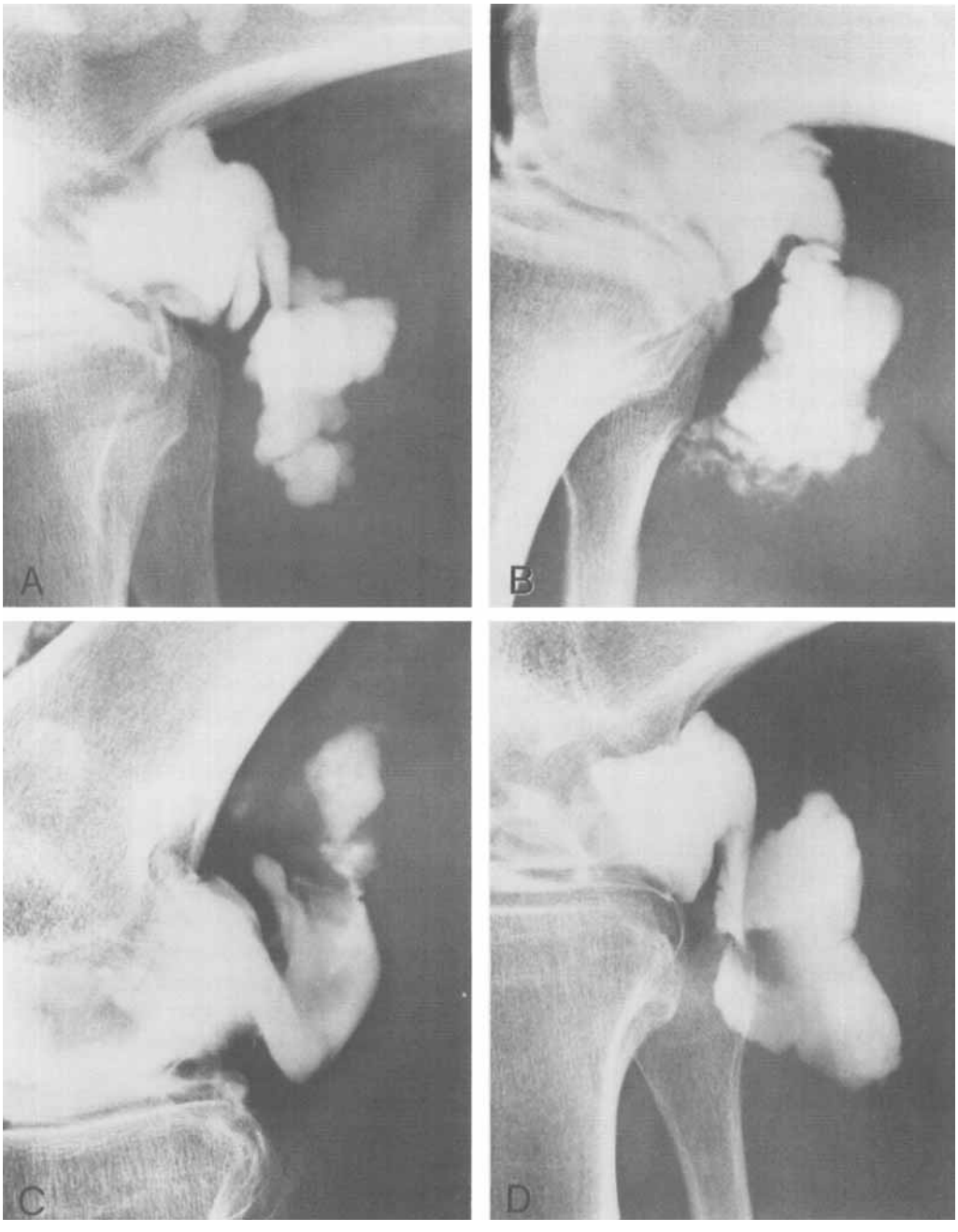


*Figure 3(A–D). Recurrent communicating cavities at the site of the preoperative bursæ at follow-up arthrography:*
*A. Marked lobulation of the cavity wall.*
*B. Blurred outline in the lower portion.*
*C. Irregularity, diverticula formation and some leakage of contrast medium at the upper margin.*
*D. Slightly lobulated wall resembling a normal gastrocnemio-semimembranosus bursa (cf. Figure 2).*

*Results of follow-up arthrography*

In 40 of the 41 follow-up arthrograms the knee joint was seen to communicate with a cavity at the site of the primary bursa. Two of these cavities could not be measured, for technical reasons. Nineteen recurrent cavities could be compared with the primary cysts. Ten were smaller and 9 were about the same size (Figure 1). Eight of the 10 patients in whom the cavity had diminished had milder symptoms at the time of re-examination. The majority of the recurrent cavities displayed an uneven wall contour; moderate irregularity of the wall was noted in 15 cavities and marked irregularity in another 15 (Figure 3, A–C). Only 10 were slightly lobulated thus resembling the shape of the normally occurring bursa (Figure 3 D). In the recurrent cavities, impressions of the gastrocnemius and semimembranosus tendons were consistently observed, as are seen in gastrocnemio-semimembranosus bursae (Figure 2).

## DISCUSSION

Popliteal cysts are usually regarded as secondary to intra-articular knee disease causing effusion (Baker 1877). It might thus be expected that cure of the intra-articular disorder will abolish the symptoms from the cyst (Gristina & Wilson 1964, Childress 1970).

In one of our patients a meniscectomy was performed at the cyst operation. Another patient had undergone synovectomy and a third patient meniscectomy 1 month prior to excision of the cyst. The other 38 knees seen at the follow-up had undergone no surgery apart from the operation on the cyst.

Except for one case, follow-up arthrography disclosed a communicating cavity at the site of the primary cyst. Roentgenologically all cysts in which the capsule had been closed, recurred. This would lead us to expect renewed symptoms from the popliteal space. The results of this study, however, revealed a marked reduction of the popliteal symptoms at follow-up. The majority of patients obviously benefited from the excision of the cyst.

It is not known how the walls of the recurrent cavities develop. Radical excision of the whole cyst is reputedly difficult. Presumably, remnants will be left in the deep portion, which by outgrowth of synovial lining cells could form a new cyst.

If the capsular opening is not tightly closed, increased intra-articular pressure due to postoperative effusion will pump synovial fluid out of the joint. This might stimulate the mesenchymal cells of the interstitial tissue to become transformed into synovial lining cells to form an encapsulating barrier. The morphological findings at the arthrographic follow-up support the view that the recurrent cavities grow stepwise by repeated wall rupture and encapsulation, thus forming a wall structure with numerous diverticulæ (Figure 3). This uneven wall contour might also be due to postoperative changes such as scar formation. A histopathological investigation of recurrent popliteal cysts would render further information on this matter.

Synovial fluid outside the joint is known to have tissue-irritating properties, which might account for the high rate of wound-healing complications. It has been reported that an escape of synovial fluid to the deep compartments of the calf causes symptoms simulating deep vein thrombosis (Dixon & Grant 1964, Good 1964, Hughes & Pridie 1970). This would explain the postoperative calf swelling and tenderness in 6 of the patients in this series.

The high rate of recurrence may be due to the following factors: Firstly, the commonly used incision over the most prominent part of the swelling provides a poor view of the communication due to the overlapping gastrocnemius and semimembranosus muscles. Secondly, closure of the communication is difficult, owing to the absence of a pedicle. Recent dissection studies have shown that the communication consists of a transverse slit located at the site where the gastrocnemius

tendon merges with the capsule (Lindgren & Willén 1977). Thirdly, catgut can hardly withstand the high fluid pressures occurring in joints with effusion during normal activities (Grant & Dixon 1963, Dixon & Grant 1964, Jayson & Dixon 1970) and the considerable tearing forces from the tendons in this region. A tight closure of the capsule with non-absorbable material may improve the results.

## CONCLUSION

In the reviewed series of 41 popliteal cyst excisions the rate of postoperative morbidity, wound healing complications and calf swelling was high. At clinical re-examination 63 per cent of the patients had a recurrent cyst, but most of them reported relief of popliteal symptoms. The follow-up arthrograms revealed communicating cyst-like cavities in all cases but one, although in the majority of operations closure of the capsule had been attempted.

In view of the fact that Baker's cysts* are regarded as secondary to an intra-articular lesion (Doppman 1965), their presence should initiate a thorough knee examination in which arthroscopy (Casscells 1971) may add valuable diagnostic information to the clinical and arthrographic findings. Only if the associated derangement of the knee joint is not curable and if the symptoms from the popliteal region are troublesome should atraumatic excision of the cyst and tight closure of the communication be considered.

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*The eponym "Baker's cyst" should only be used when a communicating gastrocnemio-semimembranosus bursa seen at arthrography causes clinical symptoms.

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Correspondence to: Wolfgang Rauschning, M.D., Department of Orthopaedic Surgery, University Hospital, S–750 14 Uppsala, Sweden.