

Popliteal cysts: a reassessment using magnetic resonance imaging

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Abstract. The advent of magnetic resonance imaging (MRI) prompted the reevaluation of the incidence of popliteal cyst and its associated injuries. We reviewed more than 1000 consecutive MRI examinations of the knee performed on patients referred for evaluation of internal derangement. We report a 5% incidence of popliteal cyst, which is lower than has previously been determined. We believe that the reported higher incidence was due to arthrographic distention of normal, collapsed bursae. The strong association between popliteal cyst and tear of the medial meniscus is confirmed. We report for the first time to our knowledge the 13% association between popliteal cyst and complete tear of the anterior cruciate ligament.

Key words: Popliteal cyst – Magnetic resonance imaging

The exquisite demonstration of knee anatomy made possible by magnetic resonance imaging (MRI) prompted a reassessment of the incidence of and injuries associated with the normally innocuous popliteal cyst. Previous authors report that some 10%–41% of patients referred for evaluation of knee derangement will have this abnormality and that its incidence increases with age [1, 2, 7, 8, 14]. Wolfe and Colloff performed the largest series of examinations using double contrast arthrography as the imaging modality. They found a 23% incidence of popliteal cyst in young male Air Force recruits and a 32% incidence in an older population [14]. Nicholas et al. used the same imaging modality and found an incidence of 16% in a patient population whose average age was 29 years [7]. These and other studies have shown that the majority of popliteal cysts in adults are sequelae of other knee joint abnormalities including internal derangement, osteoarthritis, rheumatoid arthritis, and ju-

venile rheumatoid arthritis [8, 13]. In most patients who sustain injury, joint fluid passes from the knee joint posteriorly through an abnormal connection and fills in the gastrocnemio-semimembranosus bursa. Cadaver studies performed by Lindgren and Willen revealed a slit-like opening through the posterior wall of the joint capsule in 50% of individuals older than 50 years [6]. The occasional cysts found in children are idiopathic. Popliteal cysts are generally asymptomatic and require no treatment. They must, however, be distinguished from similar lesions that may require intervention including aneurysm, deep vein thrombosis, hematoma, lipoma, abscess, and tumor [3–5, 10–12]. Associated knee pathology should also be identified especially when surgery is planned. It is in this regard that MRI has proven to be extremely useful.

Materials and methods

We retrospectively reviewed 1127 consecutive MRI examinations of the knee performed between 1 January 1988 and 31 December 1989. The patient population consisted of approximately equal numbers of men and women randomly referred to the Somerset Diagnostic Center, Boston, MA, by community clinicians. Patients ranged in age from 3 to 83 years with an average age of 36.3 years. The majority were evaluated in order to detect internal knee derangement. Twelve patients were specifically referred for evaluation of a mass palpated in the popliteal fossa. No patients with juvenile rheumatoid arthritis were examined. Four patients with a history of knee surgery were excluded from the study because a total knee replacement had been performed. Ten patients were excluded because motion artifact made accurate evaluation of the MRI impossible. The study population consisted of 1103 patients. Both knees were imaged in ten patients, making a total of 1113 examinations. All MRI examinations were performed on a 0.3-T magnet (Fonar Corporation, Melville, NY). Standard sequences consisted of proton density weighted (TE = 28, TR = 1000) images obtained in the sagittal, coronal, and axial planes. All of the images were reviewed by one radiologist (P.D.F.) according to accepted criteria for identification of popliteal cysts [3, 8]. These included the presence of a well-circumscribed mass within the popliteal fossa with a demonstrated connection to the joint space and low to moderate signal intensity on proton density weighted images. When a mass lesion was not clearly identified on the initial images, it was further evalu-

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ated using T₂-weighted (TE = 60, TR = 2000) sequences in the axial plane. Other mass lesions, such as popliteal artery aneurysm, varices, and pigmented villonodular synovitis, were excluded on the basis of shape, location, and signal characteristics. Where available, surgical reports of those patients with popliteal fossa masses were reviewed and correlated with MRI findings.

Results

Of the 1113 examinations of the knee performed, 56 revealed a popliteal cyst, for an incidence of 5%. This group consisted of 22 women and 33 men ranging in age from 5 to 71 years. The average age of the patient population without popliteal cysts was 35.4 years, while that of the patient population with popliteal cysts was 51.6 years. A single female patient had bilateral cysts. In only 5 patients was a mass reportedly palpated in the popliteal fossa. Of the remaining 7 patients referred for evaluation of a palpable mass, 4 had no abnormality, and 3 had masses other than popliteal cysts. The incidence of popliteal cyst increased with age: more than

50% of the cysts occurred in patients older than 50 years. Only one cyst was found among the 5 patients younger than 10 years.

The majority of patients with popliteal cysts had underlying ligamentous and meniscal damage. Findings were confirmed at surgery in 46 patients. Including the single patient younger than 10 years, only 7 patients (13%) had otherwise normal knee joints. Some 40 patients (71%) had a tear of the medial meniscus (Fig. 1). All of these tears involved the posterior horn. A tear of the lateral meniscus was seen in 21 patients (38%), while 15 patients (27%) had tears of both menisci. Seven patients (13%) demonstrated a complete anterior cruciate ligament tear. Four patients (7%) had coexistent tears of the medial meniscus, lateral meniscus, and anterior cruciate ligament. No complete tears of the posterior cruciate ligament were identified. Partial tears of the anterior cruciate, posterior cruciate, medial collateral, and lateral collateral ligaments occurred in conjunction with other ligamentous and meniscal tears (Fig. 2).

Of those patients with popliteal cysts 43 (71%) had

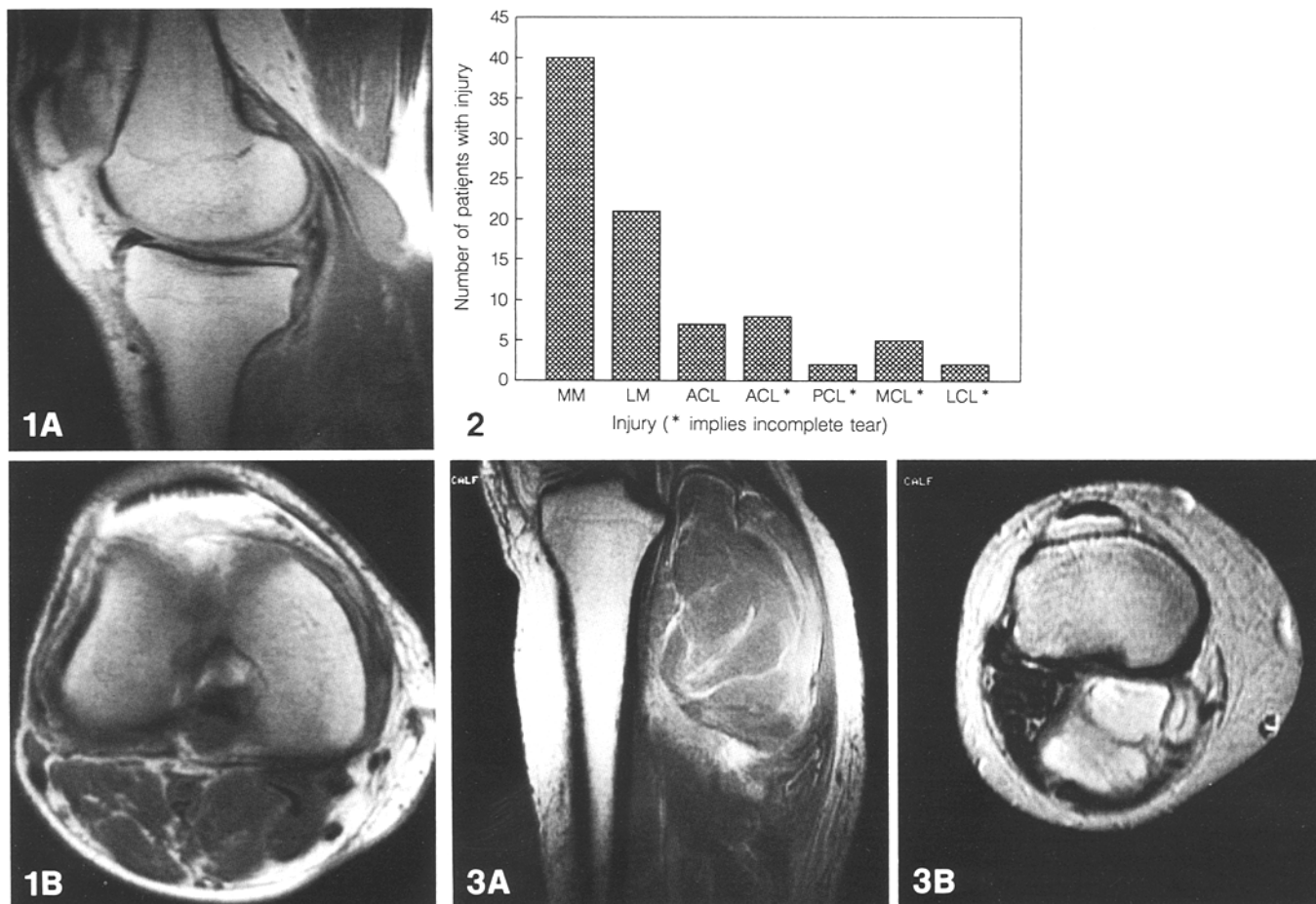


Fig. 1. A Proton density weighted sagittal (TE = 28, TR = 910) and B T₁-weighted axial (TE = 28, TR = 688) images of the knee depict a popliteal cyst within the gastrocnemio-semimembranosus bursa, joint effusion and a complex tear of the medial meniscus

Fig. 2. Injuries associated with popliteal cysts. Some 46 of the 56 cases (80%) were confirmed at surgery. MM, medial meniscus; LM, lateral meniscus; ACL, anterior cruciate ligament; PCL, pos-

terior cruciate ligament; MCL, medial collateral ligament; LCL lateral collateral ligament

Fig. 3. A Proton density weighted sagittal (TE = 30, TR = 1173) and B T₂-weighted axial (TE = 60, TR = 2000) images show a complex hemorrhagic popliteal cyst. This diagnosis was confirmed at surgery

suprapatellar joint effusions, and 12 patients (21%) had findings of joint space narrowing, spurring, or loss of cartilage signal consistent with osteoarthritis. There were no cases of rheumatoid arthritis. One meniscal cyst and one intraarticular calcified loose body were identified. One hemorrhagic cyst was found (Fig. 3). No cyst was associated with a deep vein thrombosis.

In the patient population without popliteal cysts, one case each of pigmented villonodular synovitis, popliteal artery aneurysm, and infected varices was identified on the MR images. All three masses were palpable. These findings were confirmed at surgery.

Discussion

The popliteal fossa has been evaluated with plain films, arthrography, computed tomography (CT) and ultrasound. None of these modalities compares to MRI for evaluation of the knee in its natural state. The largest reported series investigating popliteal cysts were carried out with double contrast arthrography, in which air and a water-soluble contrast agent were injected into the joint [1, 2, 7, 14]. This invasive technique is extremely accurate in demonstrating both the connection between the knee joint and bursae and the underlying pathology, but the injected contrast agents may artificially distend collapsed bursae [4]. CT and ultrasound can be used to evaluate the knee without introducing contrast agents. Ultrasound has the added benefit of employing no ionizing radiation. Both modalities are especially useful in locating cysts in atypical locations, but neither can determine the contents of a cystic structure or delineate ligamentous or meniscal pathology [4, 9–11]. MRI is as safe as ultrasound in identifying popliteal cysts and as accurate as arthrography in identifying associated injuries [9]. Its unique ability to image the knee joint in several planes, determine the integrity of all components, and accurately assess tissue differences make MRI the ideal modality for the evaluation of knee joint masses.

Our patient population is comparable to the subset of 202 patients described by Wolfe and Colloff. Our group consisted of an approximately equal number of men and women (average age 35.4 years); theirs was 48% male (average age 40 years) [14]. Both sets of patients were evaluated for knee derangement. We found a 5% incidence of popliteal cyst, which is far less than the 32% and 16% reported by Wolfe and Colloff and Nicholas et al., respectively [7, 14]. We believe that the higher incidences reported in their studies were due to the arthrographic distention of normal, collapsed bursae.

Numerous radiographic and anatomic studies have demonstrated that the majority of popliteal cysts occur in individuals older than 50 years and that a cyst is a rare finding in children [1, 2, 6, 7, 14]. Our observations support these results.

We found that 82% of cysts are associated with a meniscal tear, most commonly of the posterior horn of the medial meniscus. This is in agreement with the findings of Wolfe and Colloff and other authors [1, 2, 6–8, 14]. We found tears of the lateral meniscus in 38% of patients, a figure somewhat higher than the 10%–15% incidence reported in the literature [1, 2, 7, 14]. Our finding of a torn anterior cruciate ligament in 13% of those with popliteal cysts is the first report of this association to our knowledge.

In summary, the 5% incidence of popliteal cyst in the population of adults with suspected internal derangement of the knee is less than has been previously reported. The majority of popliteal cysts in this group occur in patients older than 50 years, are clinically asymptomatic, and are associated with a tear of the medial meniscus. We believe MRI to be the imaging modality of choice for their detection.

References

1. Bierbaum BE (1968) Double contrast knee arthrography. A safe and reliable aid to diagnosis of "internal derangement." *J Trauma* 8:165
2. Butt WP, McIntyre JL (1969) Double contrast arthrography of the knee. *Radiology* 92:487
3. Hartzman S, Reicher MA, Bassett LW, Duckwiler GR, Mandelbaum B, Gold RH (1987) MR imaging of the knee. Part II. Chronic disorders. *Radiology* 162:553
4. Herman G, Yeh HC, Lehr-Janus C, Berson BL (1981) Diagnosis of popliteal cyst: double contrast arthrography and sonography. *AJR* 137:369
5. Lee KR, Tines SC, Price HI, De Smet AA, Neff JR (1983) The computed tomographic findings of popliteal cysts. *Skeletal Radiol* 10:26
6. Lindgren PG, Willen R (1977) Gastrocnemio-semimembranosus bursa and its relation to the knee joint. *Acta Radiol [Diagn]* 18:497
7. Nicholas JA, Freidberger RH, Killoran PJ, Paul J (1970) Double-contrast arthrography of the knee. Its value in the management of two hundred and twenty-five knee derangements. *J Bone Joint Surg [Am]* 52:203
8. Reicher MA (1987) Spectrum of knee joint disorders. In: Mink JH, Reicher MA, Crues JV III (eds) *Magnetic resonance imaging of the knee*. Raven Press, New York, p 123
9. Reicher MA, Hartzman S, Bassett LW, Mandelbaum B, Duckwiler GR, Gold RH (1987) MR imaging of the knee. Part I. Traumatic disorders. *Radiology* 162:547
10. Richardson ML, Selby B, Montana M, Mack L (1988) Ultrasoundography of the knee. *Radiol Clin North Am* 26:63
11. Schwimmer M, Edelstein G, Heiken JP, Gilula LA (1985) Synovial cysts of the knee: CT evaluation. *Radiology* 154:175
12. Sundaram M, McGuire MH, Fletcher J, Wolverson M, Heiberg E, Shields JB (1986) Magnetic resonance imaging of lesions of synovial origin. *Skeletal Radiol* 15:110
13. Taylor AR (1969) Arthrography of the knee in rheumatoid arthritis. *Br J Radiol* 42:492
14. Wolfe RD, Colloff B (1972) Popliteal cysts. An arthrographic study and review of the literature. *J Bone Joint Surg [Am]* 54:1057