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Popliteal cysts and associated disorders of the knee

Critical review with MR imaging

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Summary. *We have studied retrospectively the epidemiological features of popliteal cysts in adults and the incidence of associated intra-articular disorders in a series of 1001 patients undergoing magnetic resonance imaging who had been randomly referred to our institution. Images of popliteal cysts were seen in 4.7% of this group which is lower than in other studies with different imaging techniques. A communication with the joint was invariably found. The cysts were associated with one, or more, disorders detected by MRI in 94%. The commonest lesions were meniscal (83%), frequently involving the posterior horn of the medial meniscus, chondral (43%), and anterior cruciate ligament tears. Our data suggest that intra-articular disorders may play an important role in the pathogenesis of popliteal cysts in adults.*

Résumé. *Nous avons examiné les caractéristiques épidémiologiques du kyste poplité chez l'adulte et la fréquence des pathologies intra-articulaires du genou associées à celui-ci dans une population de 1001 patients qui se sont adressés à notre hôpital pour exécuter une resonance magnétique nucléaire du genou. Les images qui montraient la présence d'un kyste poplité ont été réexaminées par 2 d'entre nous pour déterminer la présence d'autres pathologies intra-articulaires du genou. L'incidence du kyste poplité dans la population étudiée (4.7%) était moindre par rapport à ce qui a été décrit dans des études précédentes, où le diagnostique était posé par des techniques différentes. Nous avons toujour observé la présence d'une communication entre le kyste et la cavité articulaire. Nous avons constaté que le kyste poplité est associé à une autre pathologie intra-articulaire, mise en évidence par la resonance magnétique nucléaire, dans 94% des cas. Les pathologies plus fréquement associées sont: lésions méniscales (83%), intéressant généralement la corne postérieure du ménisque interne, lésions chondrales (43%), et rupture du ligament croisé antérieur (32%). Bien que la relation entre kyste et pathologie intra-articulaire du genou mérite d' être approfondi, nos données suggèrent, que la pathologie intra-articulaire puisse jouer un rôle fondamental dans la pathogenèse du kyste poplité de l'adulte.*

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Introduction

Swellings in the popliteal fossa are usually cystic, when rare conditions such as aneurysms, haematoma, deep vein thrombosis, abscesses and tumours are excluded [7, 8, 19]. The incidence of popliteal cysts increases with age. They rarely cause disabling symptoms [9, 10, 11], but are often associated with other disorders of the knee. This association is often underestimated, although it is important in understanding the pathogenesis of the cysts and in planning their treatment.

We have reviewed MRI examinations which were carried out in patients with symptoms in

Table 1. Incidence of popliteal cyst in the study population according to age (excluding the first and last decade because of the small numbers involved)

Age (yr)	No of subjects	No of subjects with popliteal cyst			incidence (%)
		Total	Men	Women	
0–10	3	1	1	0	–
11–20	150	1	1	10	0.66
21–30	314	5	3	2	1.59
31–40	181	8	6	2	4.41
41–50	136	14	11	3	10.60
51–60	132	11	5	6	8.33
61–70	62	4	2	2	6.45
71–80	21	2	0	2	9.52
81–90	2		0	1	–

order to assess the incidence of popliteal cysts and their association with other derangements of the knee. This form of imaging allows accurate information to be obtained about the diagnosis of such associations.

Patients and methods

A retrospective review was made of 1013 consecutive MR images of the knee obtained in 1989 to 1993 in patients referred to our hospital with symptoms suggesting an internal derangement of the joint. There 496 right and 517 left knees in 1001 patients; in 12 patients both knees were examined. There were 668 men and 333 women with a mean age of 36 years (range 6 to 89 years).

Toshiba MRT 50 A equipment with a 0.5 Tesla superconductive magnet was used for imaging. Proton density and T_2-weighted spin echo (TR = 2000 ms; TE = 25/100 ms), or gradient echo sequences (TR = 550 ms; FA = 990) were performed. All the images were reviewed by two of us (VS, GMP).

The usual diagnostic criteria were used to define a popliteal cyst [4, 19], including a popliteal mass characterised by a low to moderate signal in SE T_1 or proton-density weighted sequences. Other lesions, such as tumours, aneurysms, varices and pigmented villonodular synovitis, were recognised by their shape, site and signal intensity which showed them to be different from cysts and they were excluded from this study. When a popliteal cyst was identified, the images were reassessed to find out whether any other intra-articular lesions were present.

Statistical analysis of the results was performed with Student's *t*-test for unpaired data of the X^2 test, as appropriate.

Results

Of the 1001 patients, 46 (29 men and 17 women) had a popliteal cyst. The cyst was bilateral in one patient, making a total of 47 cysts, giving an incidence of 4.7%.

The mean age of the patients with cysts was significantly higher than that of the whole group

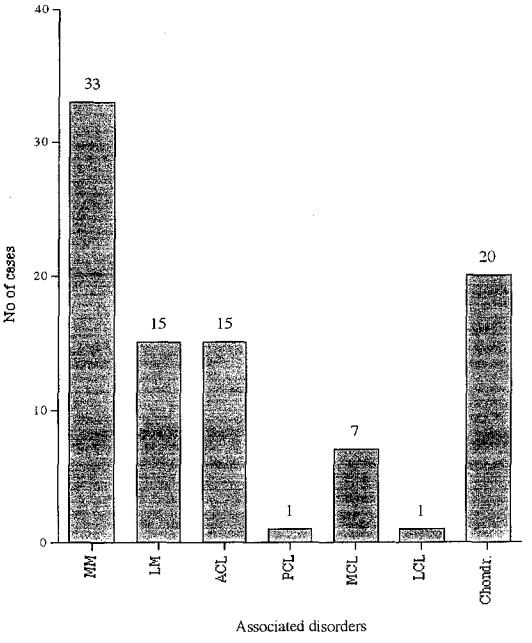

Fig. 1. Histogram showing the distribution of lesions associated with popliteal cysts: *MM*, medial meniscus; *LM*, lateral meniscus; *ACL*, anterior cruciate ligament; *PCL*, posterior cruciate ligament; *MCL*, medial collateral ligament; *LCL*, lateral collateral ligament; Chondr = chondral (grade 3 or 4)

Fig. 2. Axial T_2-weighted sequence (2000/100). There is a large hyperintense cystic structure extending posteriorly with a communication between the cyst and the joint

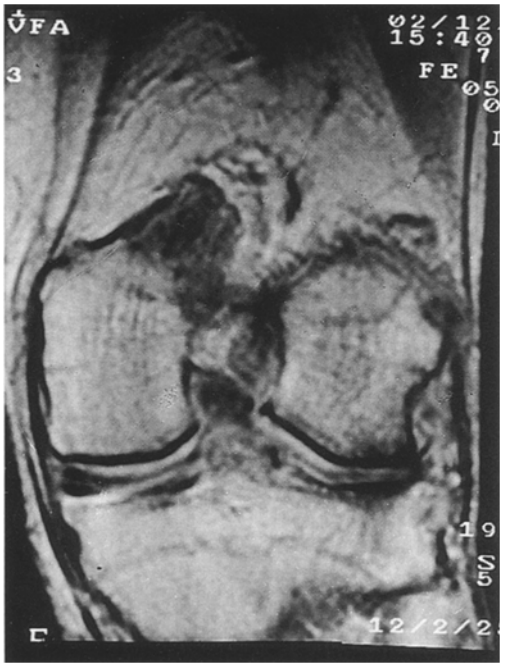

Fig. 3. Coronal gradient ultrasound scan [550/14(90°)]. The same case as in Fig. 2. A transverse tear of the medial meniscus is present as well as lateral femoro-tibial chondromalacia secondary to a tear of the lateral meniscus

(46±16 years compared with 36±16 years; $p = 0.0001$). The incidence increased gradually with age, reaching a maximum in the fifth decade (Table 1). In the only 2 patients under 20 years of age, the cyst did not have a connection with the joint. Separate analyses of the incidence of popliteal cysts in men and women showed that they occurred most often in the fifth decade in men and in the sixth in women (Table 1), although the different distribution was not statistically significant.

At least one associated intra-articular lesion was found in 44 of the 47 cysts (93.6%), meniscal tears being present in 39 (83.0%). The medial meniscus was injured in 24 patients (51.5%), the lateral in 6 (13.0%), and both menisci in 9 (19.5%). Thus the medial meniscus was damaged in 33 (70.2%), with the posterior horn being involved in all of them. The meniscal lesion was the only intra-articular disorder in 13 patients (27.7%). The association between meniscal tears and popliteal cysts in the whole group was highly significant ($\chi^2 = 4.81$, $p < 0.05$).

A torn anterior cruciate ligament was present in 15 cases (31.9%), complete in 7 and partial in 8. The latter was more frequent in older and the former in younger patients (mean age 62.8±16 compared with 41±9 years; $p = 0.0072$). The association between tears of this ligament and popliteal cysts was statistically significant ($\chi^2 = 4.81$, $p < 0.05$).

Twenty patients (42.6%) had a chondral injury graded 3 or 4 [18] which was localised in the femoral condyles or trochlea (19 cases), patella (7) and tibial plateau (1). These patients had a significantly higher mean age than those without chondral damage (53.5±15 compared with 40.0±15 years; $p < 0.05$). The association between the chondral lesions considered together and popliteal cysts was at the limits of statistical significance ($\chi^2 = 2.89$; $p < 0.08$).

Analysis of the possible combinations of intra-articular disorders associated with popliteal cysts showed that the most frequent was that of meniscal injury and tears of the anterior cruciate ligament (12 cases, 25.5%). Other intra-articular disorders were a tear of the medial collateral ligament in 7 and of the lateral ligament in 1, a partial lesion of the posterior ligament in 1 and a meniscal cyst in 1 case. Serology for rheumatoid arthritis was positive in 3 patients, including one with bilateral cysts. MRI did not show any abnormality in 3 patients, including 2 who were young and in whom the cysts did not communicate with the joint. Figure 1 shows the distribution of the associated lesions.

Four patients had other types of popliteal swellings with a popliteal aneurysm in 2, an adventitial cyst in 1 and a synovial sarcoma in 1. They were excluded.

Discussion

Various diagnostic imaging techniques such as arthrography, computed tomography and ultrasonography [7, 8, 13, 17, 20] have been used to investigate popliteal swellings, but none are comparable with MRI in accuracy, sensitivity and specificity in the diagnosis of internal derangements of the knee [1, 3]. This justified our retrospective study of a large series of MRI examinations to seek a correlation between popliteal cysts and intra-articular disorders. Figure 2 shows an example of a MRI scan and Fig. 3 an ultrasound scan.

The incidence of popliteal cysts in our series (4.7%) was lower than the range of 20% to 41% reported by other authors [14, 20]. The largest series recorded an incidence of 23% in young adults and 32% in the elderly [20]; another series showed a 16% incidence in a group with an average age of 29 years. Both these studies used double contrast arthrography which visualised the cyst by diffusion of contrast medium from the

joint. We believe that the physiology of the joint may be changed by injecting a substance which distends its cavity by producing a rise in intra-articular pressure. A semimembranosus bursa is often connected with the joint [9] and the injected fluid may distend the bursa artificially, so that some popliteal cysts detected by arthrography may represent an abnormal distension of the bursa [4, 7]. Furthermore, the size of cysts detected by arthrography is overestimated by 3 to 4 mm when these images are compared to ultrasound scans [13].

Our incidence is almost the same as that reported by Fielding et al (5%) in the only other MRI study carried out on a population comparable to ours in size and age distribution [4]. Our results confirm the strong association between popliteal cysts and other intra-articular lesions which was so high that it was unlikely to be due to chance. The association of a tear of the medial meniscus, particularly of the posterior horn, had already been observed [2], but few of the series involved such a large population [4]. Fielding et al.'s study reported a 71% incidence of the association, which was similar to our own [4]. If medial and lateral meniscal tears are considered together, the association was 83% in our patients.

A connection often forms between the joint and the semimembranosus bursa in medial meniscal tears since the septum dividing the two structures becomes thinner and more fragile where most lesions occur, that is in the posterior horn [12]. Anatomical studies have demonstrated a communication that opens in this area between popliteal cysts and the joint cavity [9, 12, 15].

The frequency of tears of the anterior cruciate ligament in our series (31.9%) was higher than that reported by other authors [4, 14, 20]. We suggest that a proportion of knees with popliteal cysts have had an injury to the meniscus and the ligament, as well as a rupture of the septum separating the bursa and joint. Partial tears of the anterior cruciate ligament were commoner in older persons and complete lesions in younger. A minor hyperextension injury in the elderly, might be sufficient to produce a partial ligamentous tear and rupture the capsule. In the younger group, more severe damage is needed to rupture the strong capsule and may also cause a complete ligamentous tear.

MRI does not detect minor chondral changes [6] but only deep ulceration with exposure of the underlying bone (grades 3 and 4 [18]), which explains the higher incidence of these lesions in the elderly, occurring in association with recurrent synovitis.

Our findings do not confirm that popliteal cysts are more common in men [5, 20] which has been attributed to the lesser incidence of internal derangements of the knee in women [20]. In our series two-thirds of the patients were men, unlike others which reported equal numbers of men and women, and although we found a greater absolute number of cysts in men, the incidence between the two sexes was similar. This agrees with the findings in a large series of arthrographic and postmortem studies which, unlike ours, did not include derangements of the knee [9]. We did not find a higher number of right-sided cysts as reported by others [16].

The increasing incidence of popliteal cysts with increasing age has also been reported [4, 9, 14, 20]. The rarity of the cysts in the first two decades was confirmed in our series which included only 2 cases at this age, and communication between cyst and joint was found in neither of them.

The cause of a popliteal cyst should be sought within the joint. The communication between cyst and joint which is invariably present in adults may be the fundamental factor in the development of the cyst and this may result from a sprain rupturing the septum between the two cavities. Recurrent synovitis due to meniscal, ligamentous or chondral injuries, or associated with chronic inflammatory disease, may be responsible for the persistence and enlargement of the cyst.

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