Complicated Baker's Cysts and Its Mimics in the Popliteal Fossa: Emphasis on MR Differential Diagnosis

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Citation

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Abstract

PURPOSE: To compare the magnetic resonance (MR) imaging findings of complicated Baker'scysts and popliteal cystic masses that mimic them. MATERIALS AND METHODS: MR imaging of twelve cases of complicated Baker's cyst and eleven cases of other popliteal cystic lesions mimicking them, were collected and compared. Complicated Baker's cyst was defined as Baker's cyst having atypical MR findings, e.g. changes of wall, changes in the signal intensity of the content, and the presence of free bodies. For comparison, MR findings including the presence of beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus tendon, heterogeneity of the intracystic fluid, the presence of joint effusion, and associated internal derangement,were evaluated and statistically compared using Fisher's exact test. RESULTS: Institutional review board approval was obtained; informed patient consent was not required for this retrospective study. The presence of beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus tendon, was seen in all 12 cases of complicated Baker's cyst but in none of the 11 cases of other popliteal cystic lesions (p=0.0001). Combined joint effusion and associated internal derangements were more frequently found in complicated Baker's cyst (58% and 58%) than in other popliteal cystic lesions mimicking them (27% and 18%), but this differences were not statistically significant. The presence of intracystic septations and morphology of the cyst wall were not remarkably different in both. CONCLUSION: The presence of beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus tendon is the only statistically significant MR finding for the differential diagnosis of complicated Baker's cysts from popliteal cystic lesions mimicking them. Also, the presence of joint effusion and combined internal derangements may be helpful MR findings for diagnosing complicated Baker's cysts. Despite their rare occurrence, radiologists should be aware of the MR characteristics of complicated Baker's cyst in order to prevent confusion between complicated Baker's cysts and other popliteal cystic lesions mimicking them.

INTRODUCTION

Popliteal masses are frequently encountered in clinical settings. Baker’s cysts occur most frequently and are easy to diagnose using imaging techniques such as MRI. Most Baker’s cysts typically present as thin-walled cystic masses between the medial head of the gastrocnemius and the tendon of semimembranosus [1, 2]. Occasionally, underlying arthropathy or complications of the cyst may affect the morphology of a Baker’s cyst. As a result, complicated Baker’s cysts may have an unusual signal intensity of cystic fluid, prominent wall thickening or intracystic debris that may make their diagnosis difficult. Various benign and malignant popliteal masses, except for Baker’s cyst, also occur in the popliteal region; these include meniscal cysts, ganglion, sarcomas, vascular tumors, and other types of masses [3]. Rarely occurred popliteal masses including popliteal cystic tumors appear as cystic lesions that may be similar to complicated Baker’s cysts on MR imaging and may lead to delayed diagnosis or to their incorrect diagnosis as Baker’s cysts. Because of their rare occurrence, only several case reports of popliteal cystic mass mimicking Baker’s cysts have been reported [3-5]. In this article, we describe and compare the MR findings of complicated Baker’s cysts and popliteal cystic lesions mimicking them in order to reduce possible misinterpretation in practice.

MATERIALS AND METHODS

We retrospectively collected a total of 23 cases of popliteal cystic lesions, including complicated Baker’s cysts and other popliteal cystic lesions mimicking Baker’s cysts. Popliteal vascular lesions, such as popliteal vein varix or saccular aneurysm of the popliteal artery, are not included in our study because most popliteal vascular masses can be correctly diagnosed by identification of the connection with the popliteal vessels [6]. Our study followed the Declaration

of Helsinki principles [7]. The ethics committee at our institution does not require its approval or informed consent for retrospective studies. We defined complicated Baker's cyst as Baker's cyst having atypical MR findings, e.g. changes of wall, changes in the signal intensity of the content, presence of free bodies, and 12 cases of complicated Baker's cyst were collected. For comparison with complicated Baker 's cyst, 11 cases of popliteal cystic lesions mimicking Baker 's cysts were collected and included two cases of pyomyositis, six cases of extra-articular ganglion, a pigmented villonodular synovitis, and a hemangiopericytoma and a cystic schwannoma. All of these lesions were predominantly cystic popliteal masses.

MR IMAGING

All MR images were obtained with a 1.5-T MR imaging unit (Signa, software version 8.2.5; GE Medical Systems, Milwaukee, WI), and Magnetic resonance imaging was performed with 1.5-T scanner (Gyroscan ; Philips, Eindhoven, The Netherlands) using a standard transmit-receive knee coil provided by the manufacturer. Imaging sequences in the axial and sagittal or coronal planes included T1-weighted spin-echo (TR 450–650 ms, TE 15–30 ms), proton density-weighted, and T2-weighted (TR 1800–2400 ms, TE 12–40 ms/60–90 ms) sequences. The slice thickness varied from 4 to 10 mm. In all cases, T1-weighted images were obtained again after intravenous administration of 0.1 mmol/kg of body weight of gadopentetate dimeglumine (Magnevist, Schering, Berlin, Germany) for analysis of the enhancement pattern of the popliteal cystic mass. The MR parameters included a 10- to 20-cm field of view, a 2-mm interslice gap, and a 192×256 matrix.

IMAGE EVALUATION

Previous case reports have described misinterpreted popliteal cystic lesions that could potentially mimic complicated Baker's cyst [3-5]. The purpose of our study is to describe and compare MR findings of complicated Baker's cyst and popliteal cystic lesions mimicking complicated Baker's cyst. Therefore, our study involved the evaluation of each of the following: (a) location of the cystic lesions (presence of beak like cyst extension between the medial head of the gastrocnemius and the tendon of semimembranosus); (b) heterogeneity of intracystic fluid; (c) presence of intracystic septations; (d) presence of combined joint effusion; and (e) associated internal derangement of the knee joint. The above findings were evaluated and compared in complicated Baker's cysts and in other popliteal cystic lesions mimic them by two authors (J.Y.K. and S.S.H). The final diagnosis in all of our patients was established by knee arthroscopy or surgery after MR imaging. The Fisher's exact test was performed to determine whether there was a statistically significant association of the MR findings of complicated Baker's cysts and other popliteal cystic lesions mimicking them.

RESULTS

The 23 patients included in this study had a mean age of 43 years (age range, 15-63 years); 30% (n = 7) were male, and 76% (n = 16) were female. The average age was 49 years (age range, 36-63 years) in the patients with complicated Baker's cyst and 36 years (age range, 15-61 years) in the patients with other popliteal cystic lesions mimicking complicated Baker's cyst, thus indicating no remarkable difference between the two. Table 1 shows the underlying arthritis in patients with complicated Baker's cysts.

Figure 1

Table 1. Associated arthropathy of 12 patients with complicated Baker's cyst

Associated arthropathy		No.
Osteoarthritis		3
Tuberculous arthritis		3
Rheumatoid arthritis		2
None	Traumatic hemarthrosis	1
	Baker's cyst with infection	3
Total		12

Eight of these twelve patients had associated underlying various types of arthritis, i.e. osteoarthritis (n=3), tuberculous arthritis (n=3), rheumatoid arthritis (n=2), and hemarthrosis (n=1). The remaining three patients were Baker's cysts with infection. The eleven patients with other popliteal cystic lesions mimicking complicated Baker's cyst had no remarkable associated arthropathy of knee joint. Retrospective analysis of the MR findings of complicated Baker's cysts and its mimics in the popliteal fossa are summarized in Table 2.

Figure 2

TABLE 2. MR characteristics of complicated Baker's cysts and other popliteal cystic lesions mimicking complicated Baker's cysts

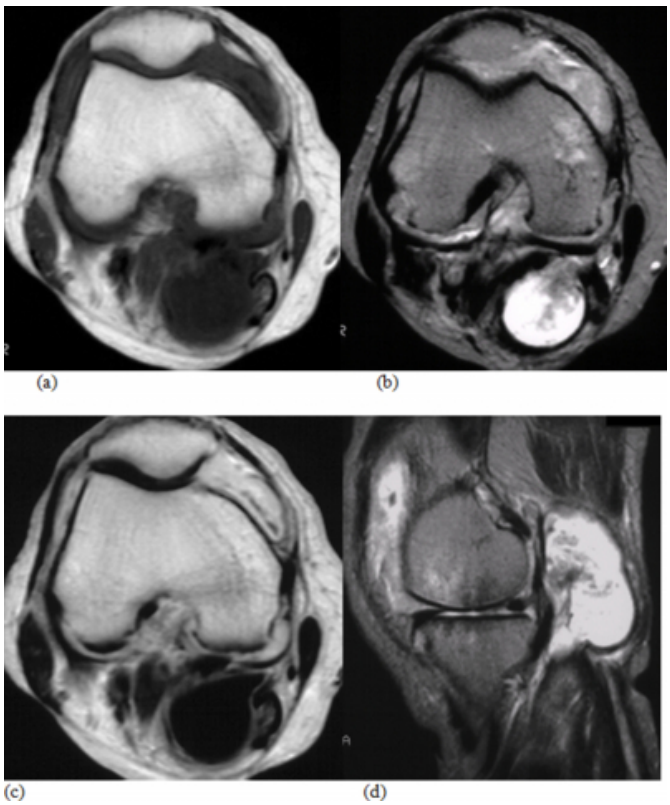
MR findings		Complicated Baker's cyst (n=12)	Other cystic lesions (n=11)	*p*
Beak like cyst extension of cyst between medial head of gastrocnemius and semimembranosus tendons		12(100%)	0(0%)	0.0001
Intracystic fluid	Homogeneous	8(67%)	9(81%)	0.64
	Heterogeneous	4(33%)	2(18%)	0.64
Intracystic septations		5(42%)	8(73%)	0.41
Intracystic nodules or debris		9 (75%)	5(45%)	0.21
Joint effusion		7(58%)	3(27%)	0.21
Combined internal derangement		7(58%)	2(18%)	0.09

All 23 patients with popliteal cystic lesions revealed cyst or predominantly cystic masses with prominent wall enhancement. The beak like cyst extension between the medial head of gastrocnemius and semimembranosus tendon was identified in all 12 patients with complicated Baker's cysts (Fig. 1 ~ 3) and no cases in 11 cases of other popliteal cystic lesions mimic them

(p=0.0001)(Fig. 4). MR signal intensity of the intracystic fluid showed heterogeneous fluid 33% (4/12) of complicated Baker's cyst and 18% of other popliteal cystic lesions mimic complicated Baker's cyst and there is no remarkable difference in both groups (p=0.64).

Figure 3

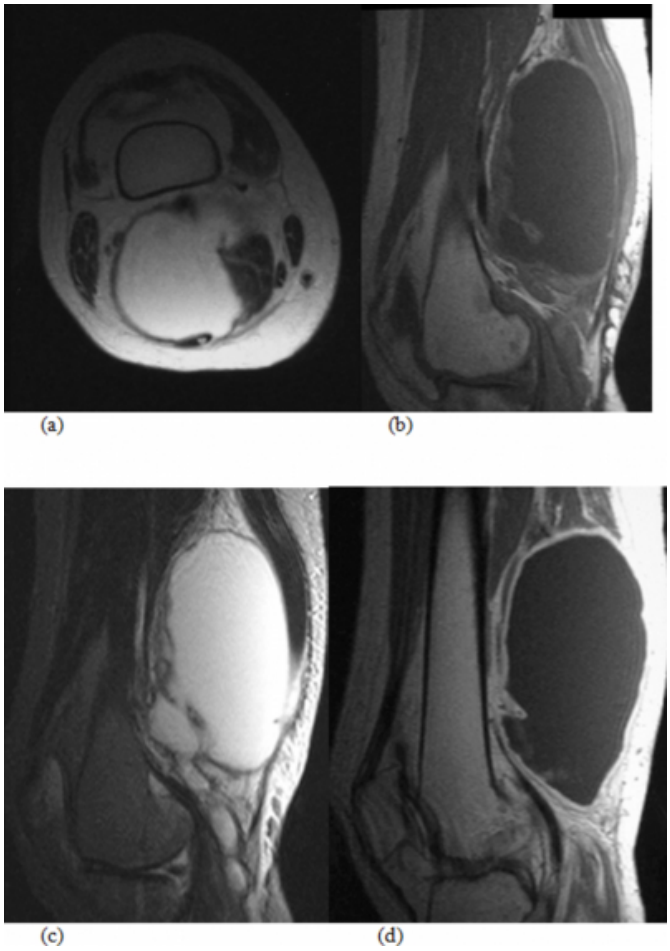
Fig. 1. Complicated Baker's cyst in a 61-year-old man with infectious arthritis and lateral meniscal tear.



Axial T1- (A) and T2-weighted (B) MR image reveals a well-defined cystic mass with beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus muscle. Also noted is intracystic debris with low signal intensity on the axial (A) and sagittal (D) T2-weighted images as well as joint effusion. On axial T1-weighted image after administration of Gd-DTPA(C), mild enhancement of the cyst wall is noted.

Figure 4

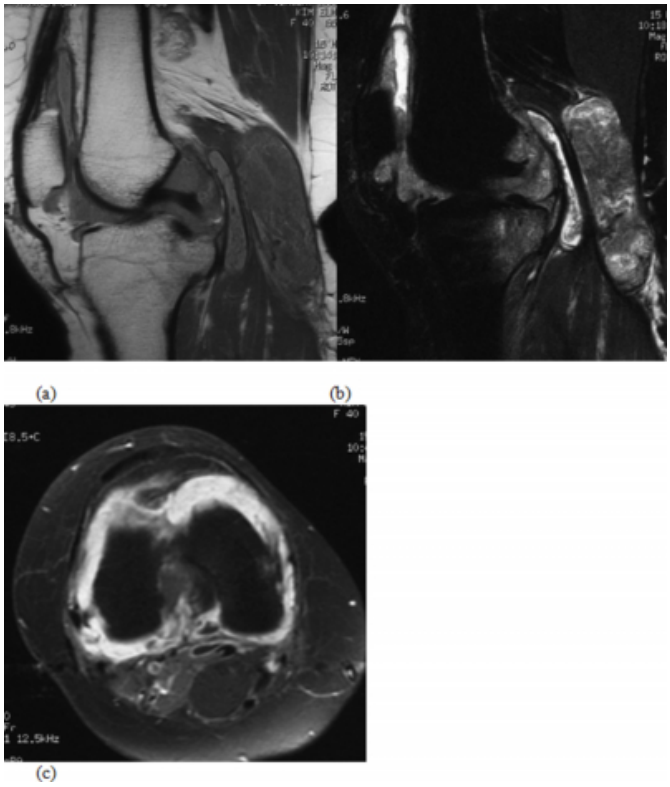
Fig. 2. Complicated Baker ’s cyst in a 46-year-old woman with tuberculous arthritis.



Axial T2 weighted image (A) shows well defined cystic mass with Beak like cyst extension into the space between the medial head of the gastrocnemius and the semimembranosus muscle. Sagittal T1 (B) and T2-weighted (C) MR images show a relatively thick-walled cyst containing internal septations on the popliteal fossa and a small amount of joint effusion. The thick cyst wall is well enhanced on a contrast enhanced sagittal T1-weighted image (D).

Figure 5

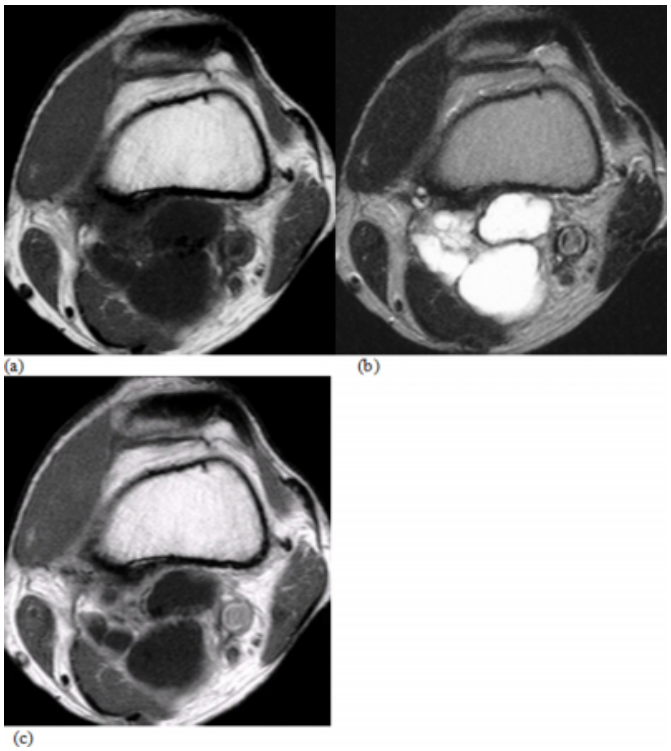
Fig. 3. Complicated Baker ’s cyst in a 42-year-old woman with rheumatoid arthritis.



Sagittal T1-weighted (A) and T2-weighted (B) images show a large lobulated popliteal cystic mass filled with multiple tiny hypointense rice bodies. Gadolinium enhanced Axial T1-weighted images (C) show the beak-like cyst extension into the space between the medial head of gastrocnemius muscle and the semimembranosus tendon muscle.

Figure 6

Fig. 4. Ganglion cyst in a 53-year-old woman.

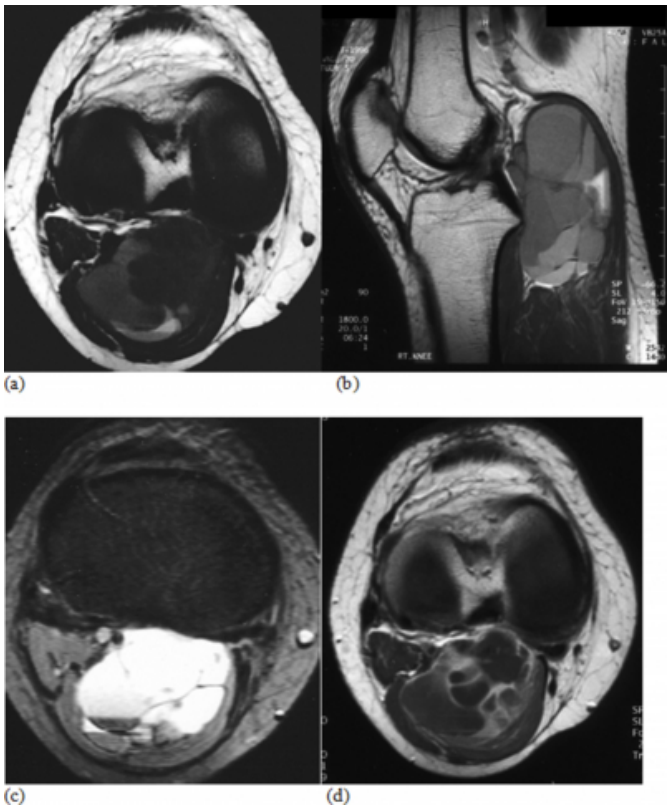


Axial T1 (A) and T2-weighted (B) MR images show a lobulated popliteal cystic mass with no extension of cyst into the space between the medial head of the gastrocnemius and the semimembranosus tendon. Thick internal septations within the cyst are enhanced on the contrast enhanced axial T1-weighted image (C).

Interestingly, two cases of other popliteal cystic lesions (pigmented villonodular synovitis and hemangiopericytoma) showed low signals within the cyst on both T1- and T2-weighted images that were correlated with intracystic old hemorrhage. Also, intracystic fluid-fluid levels were characteristically seen in two cases of other popliteal cystic lesions (hemangiopericytoma and cystic schwannoma) (Fig. 5 and 6).

Figure 7

Fig. 5. Hemangiopericytoma in a 32-year-old woman



Axial (A) and sagittal (B) T1-weighted images show a multi-chambered cystic mass filled with low to intermediate signal intensity fluid caused by intracystic hemorrhage. Fluid-fluid levels within the intracystic fluid are seen within the cystic mass on axial T2-weighted images (C). The intracystic septum and the solid portion of tumor are enhanced on the contrast enhanced axial T1-weighted images (D).

Figure 8

Fig. 6. Pigmented villonodular synovitis in a 28-year-old woman.

A multi-septated cystic lesion with no cyst extension into the gastrocnemiosemimembranosus bursa, is noted on axial (A) and sagittal (B) T2-weighted images. On the both sagittal T2 (B) and T1-weighted (C) images, characteristic dark signal intensity clumps are noted within the cystic mass and represent hemosiderin deposition.

The presence of intracystic septations was identified more frequently in other popliteal cystic lesions (67%, 8/12) of than complicated Baker's cysts (42%) and intracystic nodule or debris was found in 75% (9/12) of complicated Baker's cysts and in 45% (5/11) of other popliteal cystic lesions. There was no statistically significant difference of incidence of intracystic septations and intracystic nodule or debris in both groups (p=0.41 and p=0.21). 58% (7/12) of complicated Baker's cyst and 27% (3/11) of other popliteal cystic lesions were accompanied by joint effusion (p=0.21), and associated internal derangements were detected in 58% (7/12) of complicated Baker's cyst and in 18% (2/11) of other popliteal cystic lesions (p=0.09). The presence of joint effusion and combined internal derangement were more frequently found in patients with complicated Baker's cyst than in those with other popliteal cystic lesions mimic them, but their incidence is not statistically different. Internal derangements in patient with complicated Baker's cysts included medial meniscal tear (n=5), lateral meniscal tear (n=1), and combined medial and lateral meniscal tear (n=1). One case of medial meniscal tear (n=1) and combined medial and lateral meniscal tear (n=1) are combined with other popliteal cystic lesions mimic complicated Baker's cysts.

DISCUSSION

The popliteal region is posterior to the distal third of the femur, the knee joint, and the proximal part of the tibia. Boundaries of the popliteal fossa are formed superolaterally by the biceps femoris muscle, superomedially by the semimembranosus and semitendinosus muscles, and inferolaterally and inferomedially by the lateral and medial heads of the gastrocnemius muscle [8]. Various masses in and around the popliteal fossa are frequently encountered. Commonly considered popliteal masses include Baker's cyst, meniscal cyst, ganglion cysts, bursitis, nerve sheath ganglion, myxofibroma, lipoma, xanthomas, synovial sarcoma, and vascular tumors [3]. Popliteal synovial cysts (Baker's cysts) are the most commonly occurring mass in the popliteal fossa. Baker's cysts are fluid-filled cystic lesions but not true cysts lined with synovium [9, 10]. Although the prevalence of popliteal cyst is dependent on the patient population of each research and on the research technique used to detect Baker's cyst, the reported prevalence rate of Baker 's cyst ranged from 5% to 19% in a large MR imaging series [9, 11, 12]. Typical Baker's cyst can easily be diagnosed by imaging studies such as ultrasonogram or MRI. Baker's cyst usually appears on MR images as well-defined fluid collections with few septa between the tendons of the medial head of the gastrocnemius and the tendons of the semimembranosus [1, 2]. Complicated Baker's cyst with hemorrhage, loose bodies or debris within the cyst, is not uncommon on MR images [6]. Recently, Molla et al. reported a 6.9% (10/145) incidence of complicated Baker's cyst on MRI [13]. Comparing to occurence of complicated Baker's cysts, popliteal cystic lesions mimicking Baker's cysts occur so rarely and they tend to be misinterpreted as complicated Baker's cyst. Several cases of popliteal cystic mass mimicking Baker 's cyst, such as cystic neurogenic tumor, liposarcoma, and pigmented villonodular synovitis, has been misdiagnosed as complicated Baker's cysts because this possibility was not considered in the usual differential diagnosis of the popliteal mass due to its rare occurrence [3-5, 14, 15]. Similar morphological characteristics of these lesions may cause confusion on MR, especially for the inexperienced examiner.

As we encountered patients with other popliteal cystic lesions similar to complicated Baker's cyst on MR images, this led us to try to find different MR findings to distinguish them.

Ward et al. studied 21 cases of Baker's cysts and two cases of other popliteal cystic lesions (meniscal cyst and myxoid liposarcoma) using ultrasound and MRI. The presence of fluid between the medial head of the gastrocnemius and the semimembranosus tendon on MRI, was found in all cases of Baker's cysts but in none of the cases of other popliteal cystic lesions mimic them [16]. Similarly, the most important clue for diagnosing complicated Baker 's cysts in our study was also detection of a beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus tendon as it was also invariably present in all complicated Baker's cysts but in none of the other popliteal cystic lesions. This result may be supported on the pathophysiological background of Baker's cyst. Most existing theories of the etiology of Baker 's cysts support a weakness of the posterior capsule. This weak area is located between the two expansions of the semimembranosus muscle from the medial head of the gastrocnemius. Recent investigation of cadaveric knee joint dissection for the development of Baker's cyst revealed lack of synovial capsule in this area [17]. Therefore, the presence of fluid between the medial head of the gastrocnemius and the semimembranosus tendon, is essential in order to differentiate complicated Baker's cyst from other popliteal cystic lesions mimicking Baker's cyst. Other morphologic characteristics, including signals of the intracystic fluid, morphology of the cyst wall, the presence of internal septations, and the presence of a intracystic nodule or debris, did not differ in complicated Baker's cyst and other popliteal cystic lesions and were therefore not helpful for arriving at a differential diagnosis.

Pathophysiologically, Baker's cysts have been attributed to trauma, arthritis, and infections. Sansone et al. reported that 94% of cases are associated with one or more disorders including meniscal (83%) or chondral (43%) injuries [18] Also, a significant association between Baker's cysts and several factors such as joint effusion, meniscal lesions, and degenerative arthritis, has been reported [6, 19-21]. In our data, despite several previous studies regarding the strong association of Baker's cysts and MR findings including joint effusion and internal derangements, combined joint effusion and associated internal derangements are more frequently found in patients with complicated Baker's cysts but there is no statistically significant difference. However, we assume that the tendency toward a higher percentage of joint effusion and associated internal derangements may be helpful in making the diagnosis of complicated Baker's cyst and in distinguishing from other popliteal cystic lesions mimicking complicated Baker's cysts. The possible limitation of our study is the relatively small number of study cases because of the rare occurrence of other popliteal cystic lesions mimicking complicated Baker's cyst. The other is that other popliteal cystic lesions that mimic complicated Baker's cysts consisted of various pathologic entities and may have diverse MR findings. Therefore, further larger scale studies with replication of our study may be needed.

In conclusion, the presence of beak like cyst extension between the medial head of the gastrocnemius and the semimembranosus tendon is the most important MR finding for the differential diagnosis of complicated Baker's cysts from its mimics. Also, the presence of joint effusion and combined internal derangements are helpful MR findings of complicated Baker's cysts. Therefore, despite its rare occurrence, radiologists should be aware of the MR characteristics of complicated Baker's cyst in order to prevent misinterpretation of other popliteal cystic lesions as complicated Baker's cysts.

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