Baker's cyst in pediatric patients: Ultrasonographic characteristics

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KEYWORDS

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Abstract *Objective:* Evaluate incidence, etiology, and sonographic features of Baker's cyst in children.

Materials and methods: We examined 16 pediatric patients, with the clinical diagnosis of Baker's cyst. The possibility to confirm or to exclude the presence of the lesion, assess the structure, presence of bilateralism and joint effusion were considered. Three subjects had known juvenile arthritis, 2 hemophilia, 11 a popliteal swelling in the absence of concomitant diseases.

Results: In all patients it was possible to confirm (11) or to exclude (5) the presence of Baker's cyst. The idiopathic forms (6) exhibited anechoic structure; in patients with arthritis (3) there was hypertrophic synovium; in hemophilic patients at the presentation (2) anechoic structure with layering (serum and red blood cells); in chronic hemophilia synovial hypertrophy was seen. Joint effusion was constantly present in children with hemophilia and arthritis and in 1 case of idiopathic cyst.

Conclusion: Baker's cysts in children are rare. Ultrasound is able to confirm or to exclude the presence of the lesion and it is able to evaluate characteristics, bilateralism and association with joint effusion.

Sommario *Obiettivi:* Scopo del lavoro è valutare incidenza, eziologia e caratteristiche ecografiche delle cisti di Baker nei bambini.

Materiali e metodi: Sono stati esaminati 16 pazienti di età pediatrica, con diagnosi clinica di cisti di Baker. È stata valutata la possibilità di confermare o di escludere la presenza di tale formazione, di documentarne la struttura, la presenza di bilateralità e di versamento articolare.

Tra i pazienti esaminati 3 soggetti presentavano artrite reumatoide giovanile, 2 erano affetti da emofilia, 11 si presentavano con una tumefazione nel cavo popliteo, in assenza di patologie concomitanti.

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Risultati: In tutti i giovani pazienti è stato possibile confermare (11) o escludere (5) la presenza di cisti di Baker. Le forme idiopatiche (6) presentavano struttura oncogena, nei pazienti con artrite (3) mostravano ipertrofia della sinovia, in quelli emofilici (2), in fase iniziale, si osservava struttura anecogena con stratificazione (siero e globuli rossi), nelle forme croniche era presente ipertrofia sinoviale. Nei bambini con emofilia, artrite e in 1 caso di cisti idiopatica era presente versamento articolare.

Conclusioni: Le cisti di Baker nei bambini sono rare. L'ecografia permette di confermare o di escludere la presenza di tali formazioni e di valutarne le caratteristiche, la bilateralità e la concomitante presenza di versamento articolare.

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Introduction

Popliteal synovial cysts (Baker's cysts) represent common occurrences in adults. A popliteal cyst is a mass containing synovial fluid folded by synovial wall and it is located in popliteal fossa [1,2].

The eponym honors the work of Dr William Marrant Baker [1], a British surgeon who lived in 18th century.

According to the best reliable theory, a Baker's cyst is the serous bursa of the tendons of the medial head of the gastrocnemius and semimembranosus muscles (Fig. 1A). It usually communicates with the joint by way of a slitlike opening of the postero-medial side of the knee capsule just above to the joint line. According to a different theory it is a simple extension of the synovial joint; in all cases the term "cyst" is inappropriate, as it is a synovial structure.

A Baker cyst may serve as a protective mechanism for the knee, infact intrinsic intra-articular disorders may cause joint effusion. The knee effusion is displaced into the Baker's cyst, thus reducing potentially dangerous pressure in the joint space. Jayson and Dixon postulated that joint effusion and fibrin are pumped from the knee joint into the Baker's cyst but not in the reverse direction, thanks to a valvelike communication, such as a ball valve or a Bunsen valve.

In the ball valve mechanism, effusion is pumped from the knee joint into the Baker's cyst, but fibrin acts as a 1-way valve that blocks the effusion in its way back to the knee joint. In the Bunsen valve mechanism, the enlarging Baker's cyst produce a mass effect on the slitlike opening between the joint and the cyst, trapping effusion. The trapped effusion is reabsorbed through the semipermeable

membrane, leaving behind concentrations of fibrin. This explains the difficulty of aspirating the thick, glutinous contents of these cysts [3].

Several conditions are associated with Baker's cysts, such as intra-articular lesions (meniscal tears, anterior cruciate ligament tears), arthritides (rheumatoid arthritis, osteoarthritis, juvenile idiopathic arthritis, psoriasis) [4], systemic lupus erythematosus, infection, hemophilia, pigmented villonodular synovitis [5,6].

In adults Baker's cyst is associated with an intra-articular condition while in children the formation is isolated and primitive in 95% of the cases [7]. The idiopathic form affects children between 2 and 14 years old, twice as common as in males. Usually it is asymptomatic, but may cause discomfort and movement limitation [5,8,9]. In this study a painless popliteal mass or swelling was the most common presenting complaint.

Diagnosis is based on clinical examination but imaging evaluation is important and ultrasonography is a very helpful technique in the detection of a popliteal mass [9,10]. In current practice Baker's cysts are also, often, detected incidentally on MRI evaluations of the knee [11–13].

Baker's cysts do not require treatment, 70% resolves spontaneously over months or years with conservative treatment [13]. Radioactive synoviorthesis can be used to treat inflammatory arthritides and hemophilia. Cyst excision can be adopted when a Baker's cyst is unresponsive to all other therapies.

The recurrence rate is approximately 40%.

The aim of our study was to evaluate incidence, etiology, and sonographic features of Baker's cyst in children.

Figure 1 "Idiopathic" Baker's cyst: axial ultrasound shows anechoic, fluid, mass located between the medial head of gastrocnemius and the semimembranosus tendon (A), intra-articular effusion is also present (B).

Table 1 Clinical and ultrasound characteristics of Baker's cysts examined.

Baker cyst	Structure	Synovium proliferation	Uni/bilateralism	Joint effusion
Idiopathic (6)	Anechoic-homogeneous – regular margins	No	5 bilateral 1 unilateral	5 no 1 yes
Arthritis (3)	Heterogeneous-hypoechoic with echogenic septa	Yes	3 bilateral	3 yes
Hemophilia (2)	Anechoic with two layers (serum and red blood cells)	Yes	2 unilateral	2 yes

Materials and methods

Ultrasound of the popliteal fossa was performed with 12–18 MHz linear probe in B-mode in axial and longitudinal, followed by a color Doppler evaluation.

From September 2007 to August 2008, 16 patients (10 male, 6 female) were examined, aged between 4 and 16 years, with clinical diagnosis of Baker's cyst (Table 1).

In all patients the study was performed comparatively.

Patients presentation was asymptomatic or with local pain, discomfort or stiffness, either associated or not with popliteal swelling.

The following parameters were recorded:

- Structure of the cyst (cell wall, presence of septa, synovium proliferation);
- Joint effusion;
- Bilaterality;
- Differential diagnosis with aneurysms of the popliteal artery, synovial sarcoma, ganglia of the popliteus tendon.

Among the subjects 3 patients presented with concomitant juvenile idiopathic arthritis, 2 with hemophilia, and 11 with popliteal swelling in absence of concomitant diseases.

In one case presenting with idiopathic Baker's cyst, MR was performed after US.

Results

In all patients it was possible to confirm (11) or to exclude (5) the presence of Baker's cyst. The idiopathic forms (6) had anechoic structure, sometimes not homogeneous (Fig. 2), in patients with arthritis (3) the lesions presented hypertrophic synovium (Figs. 3 and 4), in hemophilic patients (2) we found an anechoic structure and the

presence of two layers (serum and red blood cells) when the patient was kept prone for a few minutes (Fig. 5) followed by a synovial hypertrophy, linked to irritating action of the blood (Fig. 6). The lesion was bilateral in 5 idiopathic lesions and in the arthritis, and it was unilateral in the others. Joint effusion was constantly present in children with hemophilia and arthritis and in 1 case of idiopathic cyst (Fig. 1B).

We performed an extended field of view to evaluate size and relationships with surrounding structures in patients with significantly large cyst.

Discussion

Pediatric Baker's cyst is often idiopathic, less frequently related to juvenile arthritis or other diseases such as hemophilia [5,9].

The diagnosis is clinical and its presence confirmed by ultrasound and/or MR.

In this study ultrasound was the initial imaging method used. Baker's cyst appears as a well demarcated hypo-anechoic mass (Fig. 1). The presence of echoes (Fig. 2) depends on debris and clots that may make difficult a US detection of the small cysts. Cysts often contain calcifications with fibrous connective branches and several internal septations.

When Baker's cysts are arthritis related, US reveals increase in wall thickness, presence of septa, corpusculated material, synovial proliferation (Fig. 4).

Synovial cysts, are often undetectable because of the communication with the knee joint, that allow synovial fluid preventing any distension. A manual compression of the anterior joint fluid is important to revalue popliteal fossa and demonstrate the presence of the lesion.

Size monitoring of Baker's cysts is useful to evaluate clinical outcome of the arthritis (8) and effectiveness of the therapy; US can also be useful as a guide to drain Baker's

Figure 2 Baker's cysts in child with juvenile arthritis: ultrasonography shows corpuscular fluid lesion (A) associated with corpuscular intra-articular effusion (B).

Figure 3 Baker's cysts in child with juvenile arthritis: the lesion appears set with corpuscular fluid.

cyst using a needle or syringe with possible injection of corticosteroids.

In the suspicion of a popliteal swelling, an ultrasound examination is fundamental to differentiate a Baker's cyst from other vascular diseases (aneurysms of popliteal artery, venous thrombosis), or muscular affections, or ganglia.

Giant Baker's cysts often may appear with a complication, as a ruptured [10] creating inflammation of the surrounding soft tissues and the muscular structures, so simulating a thrombophlebitis. Therefore deep venous thrombosis should be excluded in patients with Baker cyst and leg swelling [14].

A recent rupture of a giant cyst may appear in ultrasound imaging as an area with indistinct margins, associated with a fluid collection, around the cyst itself. In doubtful cases, US with color or power-Doppler are diriment. Six cases of ruptured synovial cysts in children aged less than 14 years are reported in the literature.

Ultrasonography can confirm or exclude the presence of a Baker's cyst and usually differentiate various forms [10]. It can also evaluate the relationships and the complications.

Color Doppler imaging can confirm the absence of vascular flow within the mass in order to exclude a popliteal artery aneurysm; and it is useful to confirm or exclude

Figure 4 Baker's cysts in child with juvenile arthritis: ultrasonography shows fluid mass with extensive synovial proliferations.

vessels involvement. In our study we did not found vascular complications.

Magnetic Resonance may be considered a second line investigation, infact it is helpful to demonstrate atypical locations or extension (tibio-fibular joint-gastrocnemius and biceps bursa), other comorbidities (meniscal tears, LCA tears, intra-articular loose bodies, intra-articular hemorrhage) and to provide differential diagnosis with aneurysms of popliteal artery and venous malformations. The advantages of MRI derive from the high soft-tissue contrast resolution that results from the technique's multiplanar capability, and that helps to determine the extent and nature of the Baker's cyst [10–12].

Figure 5 Baker's cysts in child with hemophilia: keeping the patient supine for several minutes is possible to distinguish two layers, serum and red blood cell, both in axial (A) that in sagittal (B) plane.

Figure 6 Same case as in Figure 5 after one month: ultrasonography shows synovial hypertrophy linked irritating action of blood on the synovium.

In children with juvenile rheumatoid arthritis, MR can demonstrate joint effusion, synovial changes and erosions with sensibility and accuracy [9].

One of the most important benefits of adopting MR is the ability to use the axial plane to establish positive identification of the high-signal intensity, fluid-filled neck of the cyst that connects the cyst to the joint space.

Conclusions

Baker's cysts in children are rare compared to the adult population and, in the idiopathic forms, rarely associated with joint effusion or intra-articular lesions. The possibility of rupture is unusual.

Ultrasound is the initial and follow-up imaging method of choice; it is able to confirm or to exclude the presence of the lesion and it is able to evaluate characteristics, bilateralism and association with joint effusion.

US can be supplemented by MRI in unusual cases [8].

Conflict of interest statement

The authors have no conflict of interest to declare.

Appendix Supplementary material

Supplementary data related to this article can be found online at [doi:10.1016/j.jus.2011.06.007](https://doi.org/10.1016/j.jus.2011.06.007).

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