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Baker's Cyst with Knee Osteoarthritis: Clinical and Therapeutic Implications

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Highlights of the Study

- Baker's cysts associated with knee osteoarthritis contribute to the burden of knee symptoms.
- Conservative treatment (hyaluronic acid, corticosteroids, fluid withdrawal) of Baker's cysts associated with knee osteoarthritis yields significant improvements.
- At 6 months, better outcomes were observed in patients with knee osteoarthritis without Baker's cyst.

Keywords
Baker's cyst · Knee osteoarthritis · Conservative treatments

Abstract
Objective: Several symptoms are common to knee osteoarthritis and Baker's cyst. To what extent each condition contributes to the patient's discomfort is still a matter of debate. The aim of the present study was twofold: first, to compare the burden of symptoms in patients with isolated knee osteoarthritis and patients with knee osteoarthritis associated with Baker's cyst; second, to assess the outcomes after conservative treatments. ***Subject and Methods:*** Patients suffering from monolateral idiopathic knee osteoarthritis were enrolled. Demographic, anthropometric and clinical data (KOOS scale) were collected. Ultrasound evaluation was performed according to standard protocols. On the basis of the clinical presentation different therapeutic options were used (fluid withdrawal, hyaluronic acid and/or steroids injections). ***Results:*** One-hundred and thirty patients were included in the study (97 with isolated knee osteoarthritis, 33 with knee osteoarthritis and Baker's cyst). In basal conditions, lower scores in KOOS sub-scales were observed in patients with knee osteoarthritis associated with Baker's cyst and in patients with effusion compared with patients without effusion. At 3 months after therapy significant higher scores were observed in both groups. At 6 months the scores were unchanged in the patients without Baker's cyst, but worsened in those with Baker's cyst. ***Conclusions:*** The study shows that Baker's cysts associated with knee osteoarthritis contribute to the burden of symptoms. The conservative treatment of both conditions allows significant improvements, but in the medium term (6 months) the efficacy of the therapy declines in patients with knee osteoarthritis associated with Baker's cyst.

Introduction

Baker's cyst (BC) results from fluid enlargement of the gastrocnemio-semimembranosus bursa located in the medial aspect of the popliteal fossa. It may be detected incidentally in the general population but is more fre-

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quently found in patients suffering from knee osteoarthritis (KOA) [1–6]. In these patients the prevalence ranges from 20% to 40%, and increases with age, severity of OA, and duration of disease [7–13]. This figure is not surprising given that in almost 30–50% of cases a connection is present between the knee articular space and the gastrocnemio-semimembranosus bursa. The communication channel is a 15–20 mm transverse slit-like capsular opening adjacent to the proximal postero-lateral margin of the medial femoral condyle [14–16]. There is a "valve" effect between the bursa and the joint, due to the action of the semitendinosus and gastrocnemius muscles. During flexion the "valve" opens and the synovial fluid under pressure moves into the bursa; during extension the "valve" closes due to the tension of these muscles and the fluid remains trapped inside the bursa. In normal conditions the amount of fluid is small and can be easily reabsorbed; on the contrary, in OA (mainly in activated knee osteoarthritis) the amount of fluid is increased and this causes the filling and the formation of popliteal cysts [15, 16]. However, roughly 50% of BCs do not communicate with the knee joint; therefore, other mechanisms may be involved. Bursal enlargement and inflammation could be the result of the same factors involved in the pathogenesis of KOA (e.g., multiple micro-traumas due to an excessive loading on the joint, sporting activity, impaired joint stability, meniscal tears, chondromalacia, valgus deformity and others) [2, 11, 12]. Several symptoms (e.g., pain, swelling, stiffness, loss of flexibility) are common both to KOA and BC. The location of pain and swelling may be diagnostic, but sometimes it may be difficult to evaluate the exact cause of symptoms. So, it is debated whether and to what extent each condition contributes to the patient's discomfort. Besides authors who claim that the presence of the enlarged bursa may increase the symptoms of KOA [10, 12, 13, 17–19], others have not observed any relationship with pain and other discomfort [8, 9, 11, 20]. In order to disentangle this complex issue, the aims of the present study were to evaluate the burden of symptoms in patients with different Kellgren-Lawrence (K-L) degree of KOA, comparing those with and without BC, and to assess the outcomes after conservative treatments in both groups.

Subjects and Methods

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments; informed written consent for participation was obtained from each patient. Institutional ethics committee approval was not required for the retrospective nature of the study [21]. We screened subjects referred to the Orthopaedic and Traumatological Clinic of Chieti University Hospital from January 2012 to February 2020, suffering from idiopathic KOA, diagnosed according to the American College of Rheumatology [22]. These patients were studied with a standard methodology.

At baseline, history, demographic and anthropometric data were collected. In each participant, height and weight were measured and body mass index (BMI) was calculated. Physical activity was classified as light (home and office work) or heavy (farm, factory and building industry work). Symptoms were assessed by means of the Knee Injury and Osteoarthritis Outcome Score (KOOS) [23]. This index, patient-administered, is composed by 5 sub-scales: (1) pain; (2) other symptoms; (3) ADL (activities of daily living); (4) sport and recreational function; (5) QOL (knee related quality of life). The score ranges from 0 (extreme symptoms) to 100 (no symptoms). Weight-bearing antero-posterior and lateral radiographs of both knee were performed, and OA severity was assessed using the K-L scale (I–IV). Therefore, all patients underwent a US examination of the knees using a high-resolution, multi-frequency (6–15 MHz) linear array transducer (*ProSound ALPHA10, Aloka, Japan*). The evaluation was performed following the indications provided by the EULAR guidelines for musculo-skeletal US in rheumatology [24]. In particular, the evaluation of the posterior aspect of the knee, performed with the patient prone and the knee in full extension, included longitudinal and transverse scans of the gastrocnemius-semimembranous bursa. Bursal enlargement, if present, was identified, longitudinal and transversal diameters were measured (in millimetre) and echogenicity (homogenous or heterogenous content) was evaluated. Joint effusion was identified as a hypo-echoic or anechoic distension of the articular space, displaceable and compressible, according to the OMERACT criteria [25, 26]. Exclusion criteria were bilateral KOA, previous knee surgery, therapeutic injections (corticosteroids, hyaluronic acid [HA], platelet rich plasma) in the previous 6 months, recent knee trauma, lower limb length discrepancy, rheumatic pathologies (rheumatoid, psoriatic and reactive arthritis, arthritis associated with inflammatory bowel diseases, and spondiloarthritis), ligament tears, meniscal lesions, patellar tendinopathy and other peri-articular bursal distension. Patients with high degree KOA (K-L IV) were also excluded. After the screening, patients suffering from monolateral low-moderate KOA (K-L grade I–III), isolated or associated to a BC, were included in the study. Different therapeutic schedules were used [27, 28]. The procedures were performed in sterile conditions and under US guidance by the same well-trained operator with 15 years' experience in the field of musculo-skeletal disorders. In OA knees without effusion (dry knees) and without BC, HA was injected according to standard protocols. At this purpose, a non-pyrogenic, sodium chloride (phosphate buffered) solution of highly purified, chemically non-modified HA of bio-fermentative origin was used (1.6% [32 mg/2 mL, 1,100–1,400 kDa]). One injection every 2 weeks for 3 times was performed. In OA knees without effusion and with BC, HA was injected into the articular space as previously described (one injection every 2 weeks for 3 times). Moreover, intra-bursal fluid was withdrawn, followed by a corticosteroid injection (40 mg/mL triamcynolone acetonide [1 mL]). In OA knees with effusion and without BC, fluid withdrawal (arthrocentesis), followed by a single intra-articular corticosteroid injection, was performed. In OA knees with effusion and BC, fluid was with-

drawn from both the knee and the bursa, followed by a single corticosteroid injection only in the articular space. After each injection, the patients were kept under observation for 30 min (monitoring early side effects) and then discharged from the unit. At home, patients were asked to restrict the use of the leg for at least 24 h; rest, ice packs and acetaminophen were recommended. Patients were asked to register possible adverse events (pain, swelling, heat, functional limitations) and acetaminophen consumption during the following days after the injection. During the treatment period, mild activities (pool or bike exercise), and, subsequently a gradual return to sport or recreational activities were allowed. Ongoing and/or initiation of new concomitant systemic treatment was allowed if essential for patient health, and not specified in the exclusion criteria. Non-pharmacological recommendations (patient education, weight loss and functional rehabilitation) were provided in all cases. After 3 and 6 months KOOS scores were collected, and US evaluation was performed in all patients. Data are reported as mean ± standard deviation for continuous variables, whereas categorical and dichotomous variables are reported as frequencies and percentage. The 2-sample Student's *t* test was used to compare continuous variables, when the distribution of data was normal; the Wilcoxon's rank sum test was used otherwise. The χ^2 test was used to evaluate associations between categorical data. The significance level was determined at $p < 0.05$.

Table 1. Demographic and clinical characteristics of patients

	KOA	KOA + BC	*p* value
Number	97	33	
Age	59.6±10.4	62.9±8.5	0.5
Sex			
M	44	12	0.3
F	53	21	
BMI	25.7±2.4	26.8±2.6	0.01
Symptoms duration, months	27.6±15.3	31.9±12.2	0.7
Heavy work, *n* (%)	31 (31.9)	17 (51.5)	0.04
Sport activities, *n* (%)	19 (19.5)	9 (27.2)	
K-L score, *n* (%)			
I	30 (30.9)	4 (12.1)	0.03
II	39 (40.2)	10 (30.3)	0.3
III	28 (28.8)	19 (57.5)	0.00
Intra-articular effusion,* *n* (%)	50/97 (51.5)	21/33 (63.6)	0.2
Mild	7 (14)	4 (19)	0.5
Moderate	16 (32)	5 (24)	0.4
Severe	27 (54)	12 (57)	0.8

* Mild = 2–5 mm thick; moderate = 5–10 mm; severe >10 mm.

Results

215 of the 345 participants screened were excluded after clinical and instrumental evaluation according to the criteria previously established. So, only 130 patients (97 with isolated KOA and 33 with KOA associated to BC) were included in the study. The demographic and clinical characteristics of the patients belonging to the study groups are shown in Table 1. No significant differences were observed for age, sex distribution and symptoms duration; however, the patients with KOA associated to BC showed higher BMI values and performed heavy work more frequently. An increased prevalence of K-L III scores (57.5% vs. 28.8%; $p = 0.002$) was found in KOA + BC group, whereas no statistical difference for intra-articular effusions was observed between groups (51.5% vs. 63.6%; $p = 0.22$). Four cysts were associated with K-L I knees, 10 with K-L II and 19 to KL III. Diameters increased accordingly with K-L score (longitudinal diameter from 32 ± 9.8 mm [KL I] to 42.7 ± 13.2 [KL III]; transverse diameter from 9.7 ± 3.7 [KL I] to 19.1 ± 8 [KL III]) (Fig. 1). The US picture was heterogenous (US signs of chronicity and inflammation) in 9/33 of cases (27.2%). In basal conditions lower scores in all KOOS sub-scales were observed in the patients of the KOA + BC group, expression of more severe symptoms (Table 2), with the exception of sport activities which however were practiced only by few subjects (19.5% and 27.2%, respectively). Subjects with KOA + intra-articular effusion showed lower scores when compared to subjects without effusion (Tables 3, 4). Out of 97 osteoarthritic knees without BC, intra-articular HA was injected in 47 cases with no effusion; in 50 cases with effusion the fluid was evacuated and therefore a corticosteroid injection was performed. In 12 dry KOA with BC, HA was injected in the articular space and therefore the fluid was withdrawn from the bursa, followed by a corticosteroid injection. The fluid was withdrawn both from the joint and the cyst in 21 KOA with effusion and BC; then, corticosteroid was injected only in the articular space. None of the patients complained adverse events after the treatments. Evaluating the patients altogether with and without BC, at 3 months a significant improvement was observed in both groups. The KOOS scores in the different items did not show any difference between groups; however, because the subjects with KOA + BC in basal conditions had lower scores, the increase in percentage was higher in this group (Table 2). At 6 months, the clinical situation was unchanged in the KOA group, whereas a worsening of KOOS score for pain ($p = 0.04$), ADL ($p = 0.002$), and quality of life ($p = 0.004$) was observed in KOA + BC group (Table 2). Sub-analyses were performed subsequently. In the first sub-analysis, dry knees only (treated with HA) were compared with dry knees + BC (treated with HA and fluid withdrawal from the bursa and corticosteroids). In basal conditions the patients with dry knees + BC showed significantly lower

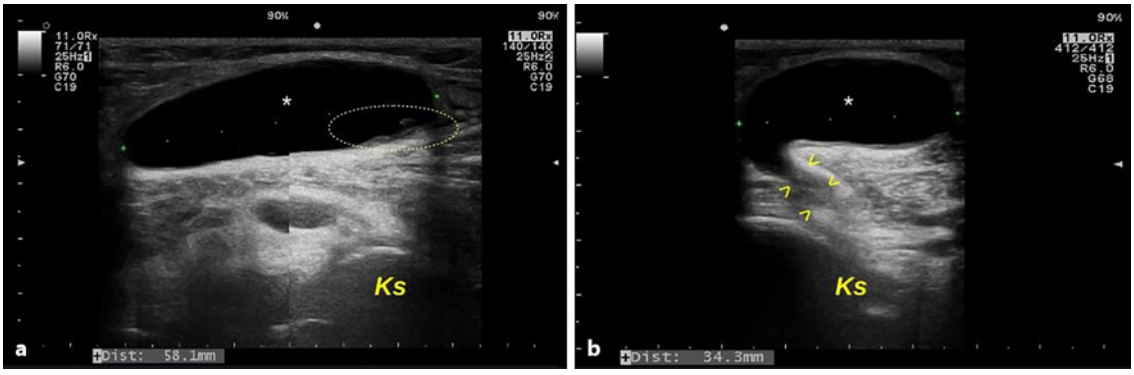

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Fig. 1. Longitudinal (**a**) and transverse (**b**) ultrasonographic scans of the posterior aspect of the knee. **a** A fair amount of synovial fluid (*) is present in the BC. Hypo-echoic material (circle) is observed near the cystic wall. **b** In the connection with the knee articular space (Ks) can be appreciated (arrowheads). Green lines = longitudinal and transverse dimensions.

Table 2. KOOS scale at baseline, 3 and 6 months

	Baseline	3 months	Increase,° %	*p*^ value	6 months	Increase,° %	*p*^ value
Pain							
KOA	50.6±9.6	69.1±14.3	36.5	0.00001	72.3±12.8	42.8	0.00001
KOA + BC	45.8±9.4	70.2±12.3	53.2	0.00001	67.9±11.1	48.2	0.00001
*p** value	0.0068	0.3493			0.0405		
Other symptoms							
KOA	59.9±11.2	74.7±11.9	24.7	0.00001	75.3±12.1	25.7	0.00001
KOA + BC	48.8±8.5	78±14.6	59.8	0.00001	72.7±13.2	48.9	0.00001
*p** value	0.00001	0.1001			0.1508		
ADL							
KOA	57.7±10.2	75.7±11.8	31.1	0.0001	77.2±12.3	33.7	0.00001
KOA + BC	48.1±8.8	77.9±12.7	61.9	0.0001	70.3±13.5	46.1	0.00001
*p** value	0.00001	0.1804			0.0026		
Sport/recreational activities							
KOA	29±4.7	35.2±7.5	21.3	0.0036	33.8±8.1	16.5	0.0265
KOA + BC	29.7±5.6	37.5±3.9	26.2	0.0019	32±5.4	7.7	0.2051
*p** value	0.3395	0.1929			0.3261		
Quality of life							
KOA	57.2±10.7	77.2±12.2	34.9	0.00001	78.6±12.3	37.4	0.00001
KOA + BC	48.9±9.2	79.5±13.4	62.5	0.00001	71.9±13.5	47	0.00001
*p** value	0.00001	0.1818			0.0047		

* Infra-groups comparison (all patients): at baseline lower scores of KOOS scales were observed in KOA + BC group; no difference was observed at 3 months after treatment, due to the greater improvement in KOA + BC group (e.g., 53.2% vs. 36.5% for pain); however, at 6 months, the patients belonging to this group showed worse performances for pain, ADL and quality of life scores (0.04, 0.02 and 0.04, respectively). ^ Intra-groups comparison: a significant improvement after therapy was observed in both group, when comparing 3 and 6 months versus baseline KOOS values. ° Percentage of increase at 3 and 6 months versus baseline.

scores in the sub-scales other symptoms and ADL (Table 3). At 3 months no statistical differences were found between groups, whereas at 6 months the scores in subscales pain, ADL and quality of life were significantly higher in KOA group. In the second sub-analysis, patients with KOA + effusion with and without BC were compared. The values are shown in Table 4. In basal conditions, the subject with effusion + BC showed significantly lower scores in all sub-scales. Neither at 3 months nor at 6 months differences between the groups with and without BC were observed. In subjects with effusion the increase of the scores after treatment was lower in com-

Table 3. Patients with dry knees only compared with patients with dry knees + Baker's cyst

	Baseline			3 months			6 months		
	KOA	KOA + BC	*p* value	KOA	KOA + BC	*p* value	KOA	KOA + BC	*p* value
Pain	54.2±9.8	51±10.1	0.163	73.9±12.8	72±13.7	0.325	80.2±9.5	71.7±10.3	0.003
Other symptoms	61.1±9.9	51.4±6.7	0.001	75.9±11.5	76.6±14	0.424	80.9±10.7	76.5±10.1	0.100
ADL	61±10.5	54±9.3	0.020	76.1±11.6	80.1±12	0.148	82±10.3	74.6±9.9	0.015
Quality of life	59.4±10.8	54±10.8	0.061	77.8±12.8	80.6±8.9	0.238	84.7±10.8	77.2±8.2	0.014

Table 4. Patients with effusion only compared to patients with effusion + Baker's cyst

	Baseline			3 months			6 months		
	KOA	KOA + BC	*p* value	KOA	KOA + BC	*p* value	KOA	KOA + BC	*p* value
Pain	46.8±7.9	42.8±7.7	0.027	64.1±14.1	69.2±11.1	0.073	63.8±10.4	65.7±11.2	0.256
Other symptoms	56.5±10.1	47.4±9.2	0.0004	73.4±12.3	78.7±15.2	0.065	69.4±10.6	70.6±14.5	0.325
ADL	54.2±11.6	44.7±6.5	0.00001	75.3±12.1	74.7±13.3	0.334	72.7±12.3	67.3±14.8	0.060
Quality of life	54.7±10.1	46±6.9	0.00034	76.7±11.7	78.9±15	0.256	72.9±10.9	68.9±15.1	0.105

parison with the patients with dry knees (as is evident from the comparison of data reported in Tables 3, 4). The differences were statistically significant for pain at 3 months (73.9 ± 12.8 vs. 64.1 ± 14.1; $p = 0.000$) and for all sub-scales at 6 months.

Discussion

BC, a fluid collection in gastrocnemius-semimembranous bursa, is frequently found in patients with KOA, the prevalence ranging from 5% to 38% of cases [1–6]. This finding is not surprising because the bursa is connected to the articular space in many subjects [14]. Such a connection was found in 30–50% of cadaveric dissections, in 55% of surgically proven cysts, in 37% of arthroscopically examined knees and in 50% of arthrograms of normal knees [14]. However, in the remaining 50% of cases of KOA + BC, no communication exists between the anatomical structures. In such cases the bursal enlargement could be the result of the same factors responsible of KOA (e.g., multiple micro-traumas related to excessive loading on the joint, sporting activity, impaired joint stability, meniscal tears, patellar chondromalacia, valgus deformity and others) [2, 11, 12]. BCs, when of small dimensions and not inflamed, frequently are asymptomatic, but when inflamed are responsible of a variety of symptoms (sensation of tightness, discomfort, or pain behind the knee). The compression of nerve endings in the cystic wall, as well as the presence of pro-inflammatory cytokines in synovial fluid, explains the onset of pain [7]. Pain often worsens with increased activity, and may inhibit full flexion or extension at the knee. Swelling may be more evident when the patient is standing with full extension at the knee, but is reduced or disappears as the knee is flexed to 45° (Foucher's sign), due to the relief of tension on the cyst. In more advanced stages, BCs may compress surrounding vessels, resulting in lower extremity edema. It is evident that several symptoms due to BC are similar to those of KOA and therefore, in the case of association, it may be difficult to understand whether and at what extent each condition contributes to the patient's discomfort. Literature data are conflicting. Some authors found that the presence of the bursa may play a role in exacerbating pain due to KOA [10, 12, 13, 17–19], whereas others have not observed any relationship with pain and other symptoms [8, 9, 11, 20]. These discrepancies can be explained by several factors: patients selection (community dwelling or subjects seen in rheumatologic services), demographic differences, different degree KOA, methods of investigation, and others. In order to disentangle this complex issue, aims of the present study were to assess the burden of symptoms in patients with different KOA K-L degree, comparing those with and without BCs, and to evaluate in both groups the outcomes after conservative treatments. According to literature, we observed that BCs were frequently associated to KOA and their

prevalence increased with K-L score. Moreover, KOA + BCs were associated to higher BMI values, and more frequent practice of heavy works. Bearing in mind the pathogenetic mechanisms, these findings are not surprising and are supported by obvious physio-pathologic plausibility. Beside that, we observed that BCs showed different clinical and US features. Some cysts were of small dimensions, with an homogenous anechoic content, and painless whereas others were of medium or large size with US signs of chronic inflammation. Given that the patients enrolled in the study were all attending a service specialized in echo-guided therapies (second referral), it can be easily explained why, in comparison to other studies [2, 4, 6], they showed higher K-L scores and larger BCs size, and complained more severe symptoms. Symptoms and function (evaluated by means of KOOS scale) were significantly worse in KOA + BCs patients, compared to isolated KOA, suggesting a contribution of these lesions to the clinical picture. This finding was observed both in patients with dry knees and in patients with effusion. Moreover, it is not surprising that the patients with intra-articular effusion (activated KOA) had more symptoms than those with dry knees. After treatment, performed according accepted therapeutic protocols [27, 28], in all patients a significant reduction of pain and of the related physical impairment was observed. In the short term (3 months) the improvement was of greater magnitude in the patients with BC, as shown by the percent increase of the scores of all KOOS sub-scales. Hypothesizing that the efficacy of the treatment for KOA was similar in both groups, it may be inferred that the therapeutic intervention on the bursae contributed to the better clinical results. These findings suggest that BCs, when large or inflamed, contribute to the worsening of symptoms, and can explain the conflicting data reported in literature. Indeed, in previous studies, little or no attention has been paid to the characteristics of BCs, limiting the description to the mere observation of presence/absence. Thus, it is probable that the discrepancy can be reported to the characteristics of BCs included in different studies, some of which performed on patients recruited in the general population, presumably with minor severity of knee pain and radiologic features of OA [8–13, 17–20, 29]. In the medium term (6 months) in patients with dry knees without KOA the therapeutic benefit was preserved, whereas a decline was observed in those with BC. In patients with effusion, the scores of all KOOS sub-scales showed a further trend to reduction, although statistically not significant in both groups. The subjects with dry knees (treated with HA + fluid withdrawal from the cyst and corticosteroids when BC was associated) both at 3 and 6 months showed better results (higher KOOS scores) when compared with patients with effusion. This finding may be due to the minor degree of KOA and to the lack of inflammation in patients with dry knees, and/or to the superior efficacy of HA in comparison to steroids. The strengths of our study are the strict selection criteria and the similar composition of the groups in terms of demography and severity of KOA. However, some limitations must be acknowledged. The main weakness stems from the retrospective design of the study. Moreover, a Magnetic Resonance Imaging (MRI), which could add more information on the articular picture, was performed only in selected patients. Indeed, it is well known that US is unable in detecting intra-articular structures which can be better investigated by MRI. Therefore, some pathologies included in the list of exclusion criteria, could be present in the patients belonging to the study groups. Third, it is impossible to estimate the contribution of the therapy of both conditions to the positive outcomes. In other words, we cannot establish how much the symptoms were reduced by the improvement of KOA and how much by the treatment of bursae. Moreover, it is conceivable that, at least in some cases, the connection between the articular space and the bursa allowed the diffusion of the injected drugs. Similarly, it is possible that the reduced production of intra-articular synovial fluid had positive effects on the bursa limiting the amount of fluid passing inside. Finally, the US evaluation was performed by a single researcher and this can be a limiting factor because the component of subjectivity inherent to the US methodology. However, it has been demonstrated that the inter-observers (and even more intra-observer) reliability in detecting knee pathologic findings (including effusion, bone surface abnormalities, tendon lesions, bursitis and BC) is excellent [24, 26]. Actually, all the US examinations in this study were performed by the same physician with 15 years experience in musculo-skeletal sonographic methodology.

Conclusion

The present study shows that BCs are frequently associated to KOA, mainly in overweight patients practicing heavy works; their prevalence, as well their size, increase in relationship to the severity of KOA. Moreover, and more importantly, BCs contribute to the burden of symptoms of KOA. The conservative treatment of both conditions allows significant improvements, but in the medium term (6 months) the efficacy of the therapy declines in the subjects with BC associated to knee OA.

Statement of Ethics

The present research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. Subjects have given their written informed consent.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

M.A.: Design of the work, acquisition, analysis, and interpretation of data; drafting and critical revision of the work; final approval of the version to be published. L.D.C.: Analysis, and interpretation of data; final approval of the version to be published. A.D.I.: Analysis and interpretation of data, revision of the manuscript. V.S.: Design of the work; critical revision of the paper; final approval of the version to be published.

References

1 Liao ST, Chiou CS, Chang CC. Pathology associated to the Baker's cysts: a musculoskeletal ultrasound study. Clin Rheumatol. 2010 Sep;29(9):1043–7.
2 Demange MK. Baker's cyst. Rev Bras Ortop. 2015 Nov;46(6):630–3.
3 Visser AW, Mertens B, Reijnierse M, Bloem JL, de Mutsert R, le Cessie S, et al. Bakers' cyst and tibiofemoral abnormalities are more distinctive MRI features of symptomatic osteoarthritis than patellofemoral abnormalities. RMD Open. 2016;2(1):e000234.
4 Delannoy G, Vallet CE. [Popliteal cyst]. Rev Prat. 2017 Feb 3;67(2):166.
5 Balik MS, Turan A, Celik FB. Is there a relationship between three-dimensionally measured Baker's cyst volume and knee pathologies? Eurasian J Med. 2019 Feb;51(1):64–9.
6 Park GY, Kwon DR, Kwon DG. Clinical, radiographic, and ultrasound findings between simple and complicated Baker's cysts. Am J Phys Med Rehabil. 2020 Jan;99(1):7–12.
7 Chatzopoulos D, Moralidis E, Markou P, Makris V, Arsos G. Baker's cysts in knees with chronic osteoarthritic pain: a clinical, ultrasonographic, radiographic and scintigraphic evaluation. Rheumatol Int. 2008 Dec;29(2):141–6.
8 Guermazi A, Hayashi D, Roemer FW, Niu J, Yang M, Lynch JA, et al. Cyst-like lesions of the knee joint and their relation to incident knee pain and development of radiographic osteoarthritis: the MOST study. Osteoarthritis Cartilage. 2010 Nov;18(11):1386–92.
9 Hayashi D, Roemer FW, Dhina Z, Kwoh CK, Hannon MJ, Moore C, et al. Longitudinal assessment of cyst-like lesions of the knee and their relation to radiographic osteoarthritis and MRI-detected effusion and synovitis in patients with knee pain. Arthritis Res Ther. 2010;12(5):R172.
10 Abogamal AF, Kasem A, Nasser HS, Abdulhakim S, Abd Elghaffar TM, Zayed FH, et al. Subclinical Baker's cysts and functional limitation in patients with knee osteoarthritis: ultrasonographic and power Doppler study. Al-Azhar. 2013 Jul;42(3).
11 Bevers K, Bijlsma JW, Vriezekolk JE, van den Ende CH, den Broeder AA. Ultrasonographic features in symptomatic osteoarthritis of the knee and relation with pain. Rheumatology. 2014 Sep;53(9):1625–9.
12 Cao Y, Jones G, Han W, Antony B, Wang X, Cicuttini F, et al. Popliteal cysts and subgastrocnemius bursitis are associated with knee symptoms and structural abnormalities in older adults: a cross-sectional study. Arthritis Res Ther. 2014;16:R59.
13 Picerno V, Filippou G, Bertoldi I, Adinolfi A, Di Sabatino V, Galeazzi M, et al. Prevalence of Baker's cyst in patients with knee pain: an ultrasonographic study. Reumatismo. 2014;65(6):264–70.
14 Rauschning W. Anatomy and function of the communication between knee joint and popliteal bursae. Ann Rheum Dis. 1980 Aug;39(4):354–8.
15 Lindgren G, Rauschning W. Clinical and arthrographic studies on the valve mechanism in communicating popliteal cysts. Arch Orthop Trauma Surg. 1979;95(4):245–50.
16 Johnson LL, van Dyk GE, Johnson CA, Bays BM, Gully SM. The popliteal bursa (Baker's cyst): an arthroscopic perspective and the epidemiology. Arthroscopy. 1997 Feb;13(1):66–72.
17 Kim IJ, Kim DH, Song YW, Guermazi A, Crema MD, Hunter DJ, et al. The prevalence of periarticular lesions detected on magnetic resonance imaging in middle-aged and elderly persons: a cross-sectional study. BMC Musculoskelet Disord. 2016 Apr 26;17:186.
18 Resorlu M, Doner D, Karatag O, Toprak CA. The relationship between chondromalacia patella, medial meniscal tear and medial periarticular bursitis in patients with osteoarthritis. Radiol Oncol. 2017 Nov 29;51(4):401–6.
19 Hill CL, Gale DG, Chaisson CE, Skinner K, Kazis L, Gale ME, et al. Knee effusions, popliteal cysts, and synovial thickening: association with knee pain in osteoarthritis. J Rheumatol. 2001 Jun;28(6):1330–7.
20 Kornaat PR, Bloem JL, Ceulemans RY, Riyazi N, Rosendaal FR, Nelissen RG, et al. Osteoarthritis of the knee: association between clinical features and MR imaging findings. Radiology. 2006 Jun;239(3):811–7.
21 Kıraç FS. Is ethics approval necessary for all trials? A clear but not certain process. Mol Imaging Radionucl Ther. 2013 Dec;22(3):73–5.
22 Altman RD. Criteria for the classification of osteoarthritis of the knee and hip. Scand J Rheumatol Suppl. 1987;65:31–9.
23 Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnon BD. Knee injury and osteoarthritis outcome score (KOOS) development of a self-administered outcome measure. J Orthop Sports Phys Ther. 1998 Aug;28(2):88–96.
24 Backhaus M, Burmester GR, Gerber T, Grassi W, Machold KP, Swen WA, et al.; Working Group for Musculoskeletal Ultrasound in the EULAR Standing Committee on International Clinical Studies Including Therapeutic Trials. Guidelines for musculoskeletal ultrasound in rheumatology. Ann Rheum Dis. 2001 Jul;60(7):641–9.
25 Pham T, van der Heijde D, Altman RD, Anderson JJ, Bellamy N, Hochberg M, et al. OMERACT-OARSI initiative: osteoarthritis research society international set of responder criteria for osteoarthritis clinical trials revisited. Osteoarthritis Cartilage. 2004 May;12(5):389–99.
26 Bruyn GA, Naredo E, Damjanov N, Bachta A, Baudoin P, Hammer HB, et al.; Ultrasound Task Force. An OMERACT reliability exercise of inflammatory and structural abnormalities in patients with knee osteoarthritis using ultrasound assessment. Ann Rheum Dis. 2016 May;75(5):842–6.
27 Abate M, Salini V. Safety and tolerability of intra-articular hyaluronic acid (Sinovial®/GELSYN-3tm) injections in the treatment of knee osteoarthritis. J Biol Regul Homeost Agents. 2017 Oct–Dec;31(4):1139–45.
28 Di Sante L, Paoloni M, Ioppolo F, Dimaggio M, Di Renzo S, Santilli V. Ultrasound-guided aspiration and corticosteroid injection of Baker's cysts in knee osteoarthritis: a prospective observational study. Am J Phys Med Rehabil. 2010 Dec;89(12):970–5.
29 Abate M, Pelotti P, De Amicis D, Di Iorio A, Galletti S, Salini V. Viscosupplementation with hyaluronic acid in hip osteoarthritis (a review). Ups J Med Sci. 2008;113(3):261–77.