Musculoskeletal Ultrasonography of Baker's Cyst in Primary Osteoarthritis of Knee: An Observational study

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ABSTRACT

Background

Knee pain and limitation of joint movement are common compliant in pain clinic due to knee osteoarthritis and often associated with Baker's cyst. These are usually asymptomatic during the initial phase and might be missed during clinical examination and later may present in complicated form. Musculoskeletal ultrasonography might be helpful in detecting asymptomatic Baker's cyst during the early course of the disease.

Objective

To observe the incidence of Baker's cyst in patient with primary osteoarthritis of knee with the help of routine musculoskeletal ultrasonography of knee during clinical evaluation of patient.

Method

A total of 114 patients with unilateral or bilateral knee pain diagnosed as primary osteoarthritis of knee were included in this study. Musculoskeletal ultrasonography was performed on all patients to look for the presence of Baker's cyst. The incidence of Baker's cyst was the primary outcome of this study. Depending upon the presence/absence of Baker's cyst, two groups were formed, and variables were compared between these groups to find the factors associated with Baker's cyst. Statistical analysis was done using student t-test, ANOVA test and Chi-square test.

Result

The incidence of Baker's cyst in this study was 21.1% of the patients and 89.28% were asymptomatic. Baker's cysts were strongly associated with joint effusion and synovial hypertrophy.

Conclusion

Baker's cyst was a common finding in the patient with knee osteoarthritis. Musculoskeletal ultrasound would be a valuable tool to detect such asymptomatic cysts early.

KEY WORDS

Baker's cyst, Knee osteoarthritis, Synovitis, Ultrasonography

INTRODUCTION

Knee pain is common complaint in pain outpatient department (OPD) affecting one fourth of world population which increased up to 65% in adult population during last 2 decades.[1] Knee osteoarthritis (KOA) is characterized by pain and limitation of joint range of motion with subsequent disability especially in elderly subjects and challenge their management.[2,3] Baker's cyst (BC) is basically a distention of a preexisting bursa in popliteal fossa, that communicates with knee joint and other periarticular bursae, via an opening in joint capsule posterior to medial femoral condyle.[4,5] BC are rarely found alone and most often associated with other intra-articular pathology.[6,7] These are mostly symptom less during initial phases and may miss during clinical evaluation. And later present either as mass mimicking popliteal artery aneurysm or pseudo thrombophlebitis, cellulitis due to leakage or rupture or deep venous thrombosis and ischemia.[6,8-12] That's why looking for presence of BC and its frequency in KOA could be of clinical and prognostic value. Previous studies had wide range of frequency, with different methodology for imaging detection like: MRI (magnetic resonance imaging), USG (ultrasonography), or scintigraphy, and in different population. BC detection with musculoskeletal ultrasonography (MSKUSG) considered sensitive, simple, reliable, and cost-effective technique.[4,13-15] However, MRI is considered gold standard, but not always feasible due to cost and availability. USG is helpful in cases where the cyst is clinically undetectable but may be the reason for knee pain and management can be decided based on clinical picture.[16-19] There are limited studies in our part of the world regarding the incidence of Baker's cyst in osteoarthritis of knee. The main aim of this study was to observe the incidence of Baker's cyst in patients with primary osteoarthritis of the knee.

METHODS

The current cross-sectional observational study was conducted in Pain OPD, Dhulikhel Hospital, Kathmandu University Hospital during the period of 15th May 2024 to 15th July 2024 after obtaining written informed consent from all included patients. Ethical approval for this study was obtained from Kathmandu University School of Medical Science Institutional Review Committee on 12th May 2024 (IRC-KUSMS approval No. 158/24). Eligible Nepalese participants of both gender, age more than 18 years, patient with unilateral or bilateral knee pain diagnosed as primary OA knee according to ACR [American college of Rheumatology radiology] on regular treatment by analgesia either systemic or tropical were included in this study. Exclusion criteria were recent knee trauma or mechanical knee derangement, previous knee joint surgery, inflammatory joint disease or rheumatoid arthritis, crystal arthritis and spondyloarthropathy, patients with chronic systemic disease that could affect functional ability eg: renal, liver, cardiac impairment, or neurological disorder, or who received arthrocentesis and/or intra-articular steroid injection during the last 3 months.

History taking and Examination – The demographic data of all the patients were recorded and specific symptoms (swelling or pain) from knee and popliteal fossa were asked to the patients. Clinical examination of both the knees was done in laying supine and flat on his/her back with knee in full extension and in up to 90° flexion with examiner's thumb around the anterior part of the knee while the fingers palpated posteriorly deeply and firmly into the posterior fossa. Any round, fluctuant, transilluminating swelling that exhibit increase tension on extension and softened or disappear on flexion to 45° [Foucher's sign] were noted. Radiological evaluation: Knee x-ray of weight-bearing anteroposterior (AP) and lateral view with reporting from radiologist were sent to all the patients. Radiologists were blinded to the clinical and MSKUSG finding. The severity of OA was done using the Kellgren and Lawren [K-L] radiologist scale with score of (0-4).[20] Ultrasonography assessment: All patients underwent a MSKUSG examination of the knees using a commercially available ultrasound real-time scanner with a multi-frequency linear transducer (8-20 MHz) and color Doppler ability. The MSKUSG examination was performed according to a standardized scanning method.[21] The following techniques was used: transverse and longitudinal scans through the suprapatellar recess, longitudinal scans laterally and medially to the patella and along the joint space (patients with supine and knees extension position), and longitudinal and transverse scans of the popliteal fossa (patients with prone and knees extension position). The following parameters like presence or absence of Baker's cyst, joint effusion, synovial hypertrophy, hyaline cartilage degeneration and osteophytes were noted. A dichotomous score was assigned to each item (1 present, 0 absent). Baker's cyst was defined as a hypoechogenic cystic formation between the tendons of the medial head of gastrocnemius and semimembranosus muscles.[22] Symptomatic Baker's cyst was defined as the patients with posterior knee pain along with clinical examination and MSKUSG evaluation suggestive of Baker's cyst. Whereas Asymptomatic Baker's cyst was defined as the patients without posterior knee pain but clinical examination and MSKUSG evaluation suggestive of baker's cyst. Joint effusion was defined as a hypoechogenic or anechoic distension of the joint space, displaceable and compressible, as for OMERACT definition, and measured in the suprapatellar recess.[23] Synovitis was defined as hypoechoic synovial hypertrophy with a thickness of > 2 mm whereas osteophytes was defined as irregularities in the bone contour. Femoral hyaline cartilage was assessed from anterior suprapatellar with maximum flexion of the knee, and normally appears as anechoic structure. Losses of cartilage thickness was defined as

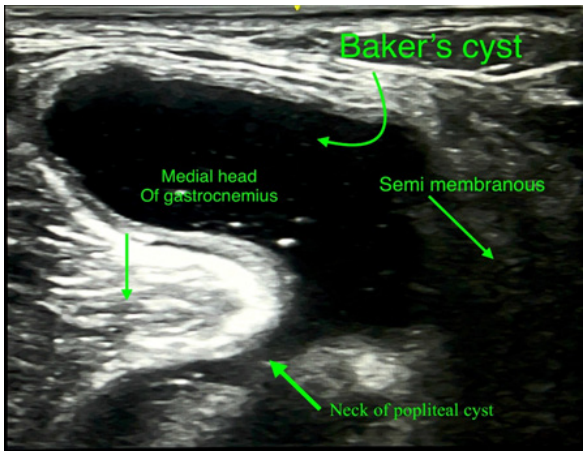
hyaline cartilage degeneration. The primary aim of the study was to evaluate the incidence of BC in primary OA knee. Depending upon the presence or absence of BC, two groups were formed. Group A was defined as the absence of BC whereas Group B was defined as the presence of BC. Demographic variables (Age, Gender, Weight, Height, BMI), duration of symptoms, NRS score, side of the knee involved, K-L grade was compared between two groups and co-relation of BC with joint effusion, synovial hypertrophy, hyaline cartilage degeneration and osteophytes were studied.

Abogamal et al. "Prevalence of Baker's Cyst among Female Patients with Knee Osteoarthritis, an Ultrasonographic Study, in Egypt". EC Orthopedics 5.4 (2017): 117-126.[14] where the prevalence of Baker's cyst was 12.9%. Considering doubling in incidence of Baker's cyst as clinically significant and assuming alpha error of 5% and power of 95%, the sample size was determined to be 114 patients for one study versus population design and binominal/dichotomous primary end point. Continuous numerical data were expressed as mean and standard deviation (for normally distributed data) or median and inter-quartile range (for data not normally distributed). Categorical data were expressed as frequencies, ratio, percentages, and numbers. Normally distributed numerical data were analyzed using a two-tailed student t-test. Skewed numerical data were analyzed using the Mann-Whitney U-test. Categorical variables were analyzed using Pearson's Chi-square test. P value less than 0.05 were considered statistically significant.

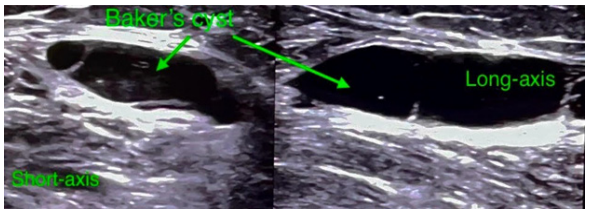
RESULTS

Baker's cysts were demonstrated by MSKUSG in 24 (21.1%) of 114 patients or 28 (12.16%) of 222 knees (Fig. 1). Only 3 (10.71%) of 28 BC were symptomatic and the clinical diagnosis matched with MSKUG findings whereas in 25 (89.28%) BC, they were asymptomatic and not found on history taking and physical examination but detected on MSKUG (Table 1, Fig. 2). These findings were statistically highly significant (p-value < 0.01). Similarly, 4 (16.66%) patients had bilateral BC and remaining 20 (83.33%) patients had unilateral BC which was also statistically significant (p-value < 0.01, Table 1).

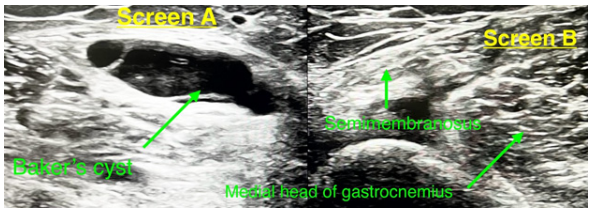
A total of 114 patients with 222 knees were scanned for MSK ultrasonography. Most of the patients (106; 92.98%) were presented with bilateral knee pain with an average duration of knee pain of 76 months (Table 1). On MSK ultrasonography, 74.56% patients had joint effusion, 42.10% patients had synovial hypertrophy, 57.01% patients had hyaline cartilage degeneration, and 98.24% patients had osteophytes (Table 1). Demographic variables like Age, Gender, Weight, Height, BMI were compared between these groups and there were no statistically significant



Picture 1. MSK USG of posterior knee showing Baker's cyst (Anechoic cystic structure between medial head of gastrocnemius and semimembranosus along with neck of the cyst communicating with the knee joint.)



Picture 2. MSK USG showing Baker's cyst in both short and long axis view with few septations.



Picture 3. MSK USG knee of the patients with unilateral BC showing BC of one knee in screen A and normal finding of another knee in screen B.

differences (Table 1, p-value > 0.05). Similarly, duration of symptoms (knee pain), NRS score, side of knee pain and K-L grade (Table 1) were also comparable between two groups (Table 1, p-value > 0.05). Most of the patients had bilateral knee pain with K-L grade II or III at the time of presentation (Table 1). Statistically significant co-relation was noted with the occurrence of BC and presence of joint effusion and synovial hypertrophy (Table 1, Fig. 3). Effusion was present in 23 out of 24 (95.83%) patients with BC, compared to 62 out of 90 (68.88%) patients without BC (p-value < 0.01). Similarly, synovial hypertrophy was present in 16 out of 24 (66.66%) patients with BC, compared to 32 out of 90 (35.55%) patients without BC (p-value < 0.01). Whereas co-relation between occurrence of BC and with presence of hyaline cartilage degeneration and osteophytes were statistically not significant (p-value > 0.05, table 1, Fig. 3).

Table 1. Comparison of study variables between two groups

Particulars	Absence of BC	Presence of BC	P-value
Age (years)	62.63±9.22	60.96±8.95	0.428
Weight(kilograms)	68.92±9.23	69.42±12.74	0.831
Height(centimeters)	150.19±6.83	151.96±6.71	0.260
BMI (kg/m^2)	30.40±3.27	29.90±4.26	0.535
Duration of symptoms (months)	72.06±59.34	80.96±60.79	0.517
NRS (Minimum)	3.03±0.18	3.08±0.28	0.292
NRS (Maximum)	6.76±0.67	6.79±0.65	0.815
Gender (Female: Male)	82:8	24:0	0.130
Side of knee pain (Bilateral: Unilateral)	82:8	24:0	0.663
K L grade of OA knee (I: II: III: IV)	14:35:36:4	0:14:9:1	0.223
Symptoms of BC (Asymptomatic: Sympto-matic)	-	21:3	0.001*
Side of BC (Bilateral: Unilateral)		4:20	0.008*
Joint Effusion (No : Yes)	28:62	1:23	0.007*
Synovial Hypertrophy (No : Yes)	58:32	8:16	0.006*
Hyaline Cartilage Degeneration (No : Yes)	41:49	8:16	0.283
Osteophytes (No : Yes)	2:88	0:24	0.461

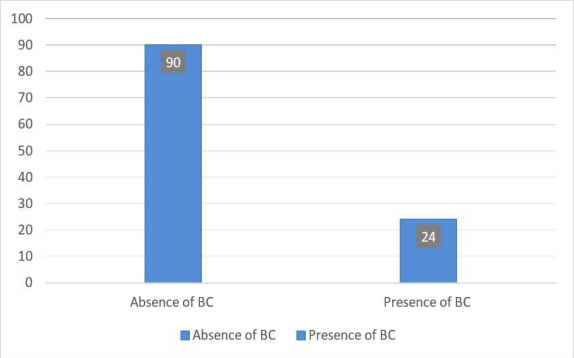


Figure 1. Incidence of Baker's cyst in Primary KOA

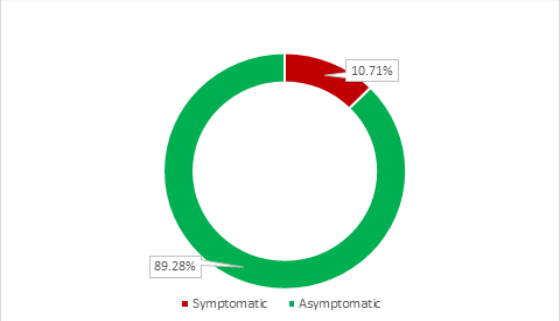


Figure 2. Symptoms of BC in KOA

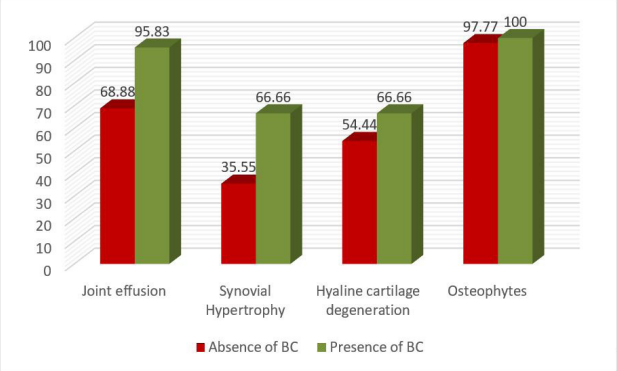


Figure 3. Co-relation of variables with BC

DISCUSSION

Primary KOA are commonly associated with Baker's cyst.[2-4] There are varies studies showing different prevalence of BC in adults which ranges from (6-45%).[2-4] In our study, the prevalence of BC was 21.1% of the patients and 12.16% of the knees and these findings were like the findings by various studies. Chi-Sheng et al., where prevalence of BC was 26.7% of the patients.[4] Similarly, Picerno et al. BC was found in 25.8% of the patients.[17] Salman et al. in which the prevalence of BC was 24.8% of the patients.[19] And in Naredo et al. BC was found in 22.2% of the patients.[24] However, Abogamal et al. found BC only in 12.9% of the primary KOA patients.[14] Fam et al. where BC was found in 42% and Chatzopoulos et al. where BC was found in 37% of the patients.[25,26] We believed that high prevalence in this study may be due to the inclusion of cases of chronic knee pain of different severity and pathology. Whereas, in our study, we only included primary KOA and excluded secondary cause of OA knee which directly or indirectly alter or attenuate the disease progression like knee trauma, mechanical knee derangement, previous knee joint surgery, inflammatory joint disease or rheumatoid arthritis, crystal arthritis, spondyloarthropathy, patients who received arthrocentesis or intraarticular steroid injections. The patient population also influences the prevalence of Baker's cysts. Studies in patient populations with rheumatoid or other inflammatory arthritis showed a much-higher prevalence; a sonographic study of 44 children with juvenile rheumatoid arthritis and other arthritic conditions revealed a 61% prevalence.[27] Similar rates were found in cohorts of cases with rheumatoid arthritis by Carpenter et al. and Meire et al.[8,28]

Various studies have shown a strong association of BC with synovitis presented clinical as synovial hypertrophy and joint effusion in MSK ultrasonography. The probable cause of occurrence of BC in inflammatory and degenerative arthropathies are thought to be due to joint effusion and synovitis.[29] There is increase in intra-articular pressure due to joint effusion which forces joint fluid through a weakened posteromedial joint capsule into the potential

space of gastrocnemius semimembranosus bursa.[5] In this study also, there was statistically significant co-relation between BC and synovitis as joint effusion and synovial hypertrophy. (p-value < 0.01). Although osteophytes and hyaline cartilage degeneration were found in 98.24% and 57.01% respectively, there was no significant statistical difference between the two groups.

In our study, 89.28% of the BC were asymptomatic and only 3 patients with BC (10.71%) were symptomatic with the complaint of posterior knee pain and posterior knee swelling on clinical evaluation. BC are usually symptomless in the initial period and present later as complicated form like phlebitis or cellulitis due to leakage or rupture. However, there was no case of complicated BC in this study. The higher rate of asymptomatic BC in our study was supported by the results of other studies as well.[4,17,30] The findings of our study signify the importance of MSKUSG as a routine tool during examination of patients with knee pain for early detection of asymptomatic BC and prevention of complicated BC with early initiation of the treatment.

Large volume and multicenter studies would be more beneficial. Sonographic data and images were operator dependent. Lack of comparison of ultrasonographic result to standard MRI for the diagnostic accuracy of USG but however MRI was expensive option.

CONCLUSION

In our study, the prevalence of Baker's cyst in primary osteoarthritis of knee was significantly in number with majority of cyst being asymptomatic. BC might be missed during general history taking and clinical examination. Addition of MSKUSG to the routine clinical examination of knee would be a valuable tool to detect asymptomatic BC in its early course of the disease so that definite management plan can prevent the occurrence of complicated BC which might mimic other disease entity.

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REFERENCES

1. Bunt CW, Jonas CE, Chang JG. Knee pain in adults and adolescents: The initial evaluation. *Am Fam Physician*. 2018;98(9):576-85.
2. Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. *Casp J Intern Med.* 2011;2(2):205-12.
3. Pisters MF, Veenhof C, van Dijk GM, Heymans MW, Twisk JWR, Dekker J. The course of limitations in activities over 5 years in patients with knee and hip osteoarthritis with moderate functional limitations: Risk factors for future functional decline. *Osteoarthr Cartil.* 2012;20(6):503–10.
4. Chiou C sheng, Liao S tsung, Liu H yi, Chang C ching, Hou T yun, Liu F cheng, et al. Prevalence of Baker ' s cysts in painful primary osteoarthritis of the knee: a musculoskeletal ultrasound study. *Formos J Rheumatol.* 2008;(22):43–9.
5. Lindgren PG, Willén R. Gastrocnemio-semimembranosus bursa and its relation to the knee joint: I. Anatomy and histology. *Acta radiol*. 1977;18(5):497-512.
6. Burlesson R, Bickel W, Dahlin D. Popliteal cyst; a clinicopathological survey. *J bone Jt Surg.* 1956;38(6):1265-74.
7. Gristina A, Philip W. Popliteal cysts in Adult and Children. *Arch Surg*. 1964;88:357-63.
8. Carpenter J, Hattery R, Hunder G, Bryan R, Mcleod R. Ultrasound evaluation of the popliteal space: comparision with arthrography and physical examination. *Mayo Clin Proc.* 1976;51(8):498–503.
9. Lieberman J, Yulish B, Bryan P, Newman A. Magnetic resonance imaging of ruptured baker's cyst. *Can Assoc Radiol J*. 1988;39(4):295-7.
10. Brady H, Quigley C, Stafford F, Bresnihan B, Hourihane B, FitzGerald M. Popliteal cyst rupture and the pseudothrombophlebitis syndrome. *Ann Emerg Med*. 1987;16(10):1151-4.
11. Petros DP, Hanley JF, Gilbreath P, Toon RD. Posterior compartment syndrome following ruptured Baker's cyst. *Ann Rheum Dis*. 1990;49(11):944-5.
12. Lazarus M, Charles E, Cesar M. MRI finding of concurent acute DVT and dissecting popliteal cyst. *Manetic Reson Imaging.* 1994;12:155-8.
13. Handy JR. Popliteal Cysts in adults: A review. *Semin Arthritis Rheum*. 2001;31(2):108-18.
14. Abogamal A, Kasem A, Naseer H, Abdulhakim S, Dewedar A. Subclinical Baker's cyst and functional limitation in patient with knee osteoarhritis: ultrasonographic and power of doppler study. *Ann Rheum Dis*. 2014;73(2):248.
15. Bevers K, Zweers MC, Van Den Ende CHM, Martens HA, Mahler E, Bijlsma JWJ, et al. Ultrasonographic analysis in knee osteoarthritis: Evaluation of inter-observer reliability. *Clin Exp Rheumatol.* 2012;30(5):673-8.
16. Blome A, Harrigan R, Goett H, Costantino T, Gibbons R. Ultrasonographic Characteristics of Baker's Cysts: The Sonographic Foucher's Sign. *J Emerg Med*. 2017;53(5):753-5.
17. Picerno V, Fillippou G, Bertoldi I, Adinolfi A, Sabatino V. Prevalence of Baker's cyst in patients with knee pain: an ultrasonographic study. *Reumatismo.* 2013;65(6):264-70.
18. Kandemirli GC, Basaran M, Kandemirli S, Inceoglu LA. Assessment of knee osteoarthritis by ultrasonography and its association with knee pain. *J Back Musculoskelet Rehabil.* 2020;33(4):711-7.
19. Abbasi SH, Farooq M, Basit A, Shah FH. Prevalence of Baker cyst in patients presenting with knee pain. *Rawal Med J*. 2023;48(1):119-22.
20. Canoso JJ, Goldsmith MR, Gerzof SG, Wohlgethan JR. Foucher's sign of the Baker's cyst. *Ann Rheum Dis*. 1987;46:228-32.
21. Backhaus M, Burmester GR, Gerber T, Grassi W, Machold KP, Swen WA, et al. Guidelines for musculoskeletal ultrasound in rheumatology. *Ann Rheum Dis.* 2001;60(7):641-9.
22. Meenagh G, Filippucci E, Iagnocco A, Delle Sedie A, Riente L, Bombardieri S, et al. Ultrasound imaging for the rheumatologist VIII. Ultrasound imaging in osteoarthritis. *Clin Exp Rheumatol*. 2007;25(2):172-5.
23. Wakefield RJ, Balint PV, Szkudlarek M, Filippucci E, Backhaus M, D'Agostino MA, et al. Musculoskeletal ultrasound including definitions for ultrasonographic pathology. *J Rheumatol.* 2005;32(12):2485-7.

24. Naredo E, Cabero F, Palop MJ, Collado P, Cruz A, Crespo M. Ultrasonographic findings in knee osteoarthritis: A comparative study with clinical and radiographic assessment. *Osteoarthr Cartil.* 2005;13(7):568-74.

25. Fam AG, Wilson SR, Holmberg S. Ultrasound evaluation of popliteal cysts on osteoarthritis of the knee. *J Rheumatol*. 1982;9(3):428–34.

26. 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;29(2):141-6.

27. Szer IS, Klein-Gitelman M, DeNardo BA, McCauley RG. Ultrasonography in the study of prevalence and clinical evolution of popliteal cysts in children with knee effusions. *J Rheumatol.* 1992 Mar;19(3):458-62.

28. Meire H, Lindsay DJ, Swinson DR, Hamilton EB. Comparison of ultrasound and positive contrast arthrography in the diagnosis of popliteal and calf swellings. *Ann Rheum Dis.* 1974;33(4):221-4.

29. Wolfe R, Colloff B. Popliteal cyst: A clinicopathological survey. *J Bone Jt Surg*. 1972;54:1057-63.

30. Suryakamal, Anjana P, Hemant S, Neha A, Sanjeev K. Musculoskeletal ultrasound study of Baker cyst prevalence in primary osteoarthritis knee. *IOSR J Dent Med Sci*. 2023;22(2):32-7.