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Clinical Paper

Management of symptomatic Baker's cysts with ultrasound and fluoroscopic-guided aspiration followed by therapeutic injection with Depomedrone and Bupivacaine leads to a durable reduction in pain symptoms in a majority of patients; A case series and literature review.

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Abstract

Purpose

To evaluate the efficacy of ultrasound and fluoroscopic-guided aspiration and therapeutic injection of Baker's cysts in the relief of pain and pressure symptoms.

Methods

A retrospective, observational, single-arm study of consecutive patients referred from the Orthopaedic service for image-guided aspiration followed by therapeutic injection of symptomatic Baker's cysts was performed with institutional approval in the context of a Quality Improvement project. Patients' pain was graded using a 10-point Likert scale. Under standard sterile conditions, a 10 cm 5 Fr Yueh centesis needle was advanced into the cyst under direct ultrasound guidance, septae disrupted as necessary, the contents of the cyst aspirated, and a sample sent for microbiological analysis. Bursography was performed in an attempt to identify the expected communication with the knee joint, the contrast was aspirated and 40 mg of DepoMedrone and 5 ml of Bupivacaine were injected.

Results

Thirteen patients were referred, nine of whom satisfied the inclusion criteria (all female, average age 63.8 years). Over a 35-month period, 11 procedures were performed (bilateral in 1, repeated in another) yielding an average volume of 20.1 ml (range 10 – 50 mls). In 2/11 procedures the communication with the knee joint was outlined. The average follow up post-procedure was 8.3 months. The average patient's pain score reduced to zero from 5.7 for an average period of 5.96 months. After this period patients reported a gradual return of an ache, but none returned to the pre-procedure severity which, in some cases, had prevented them from sleeping.

Conclusion

Aspiration of symptomatic Baker's cysts under Ultrasound and fluoroscopic guidance followed by therapeutic injection of DepoMedrone and Bupivacaine leads to a durable reduction in pain symptoms in a majority of patients.

Introduction

Conventional treatment options for Baker's cysts include conservative management, oral anti-inflammatory and analgesic medications, and surgery directed at treating underlying joint pathology. Several studies have shown satisfactory outcomes in the treatment of popliteal cysts with ultrasound-guided percutaneous aspiration followed by intra-articular or intra-cyst corticosteroid injection alone [1] or in combination with local anaesthetic agents [2,3].

Data specifically evaluating the efficacy and durability of the combination of ultrasound and fluoroscopy-guided aspiration of Bakers cysts followed by therapeutic injection in the relief of pain and pressure symptoms is lacking. Thus, our aim was to document our results and assess the medium-term durability of symptomatic relief. We situate our pilot study in the context of quality improvement and an up-to-date literature review.

Methods

Study Design

The study was conducted as a retrospective, observational, single-arm study approved by the relevant institutional review board. Consecutive patients referred from the Orthopaedic Service with symptomatic Baker's cysts for ultrasound and fluoroscopic-guided aspiration and therapeutic corticosteroid injection over a 21-month period were included from a prospectively maintained database, all of whom had the presence of a Baker's cyst confirmed on MRI or Ultrasonography prior to referral for aspiration. The patients' pain and symptoms were assessed preceding and following the intervention using reported subjective symptoms and a 10-point Likert scale. Written informed consent was obtained from all patients at the time of the procedure and all patients agreed to clinical follow-up.

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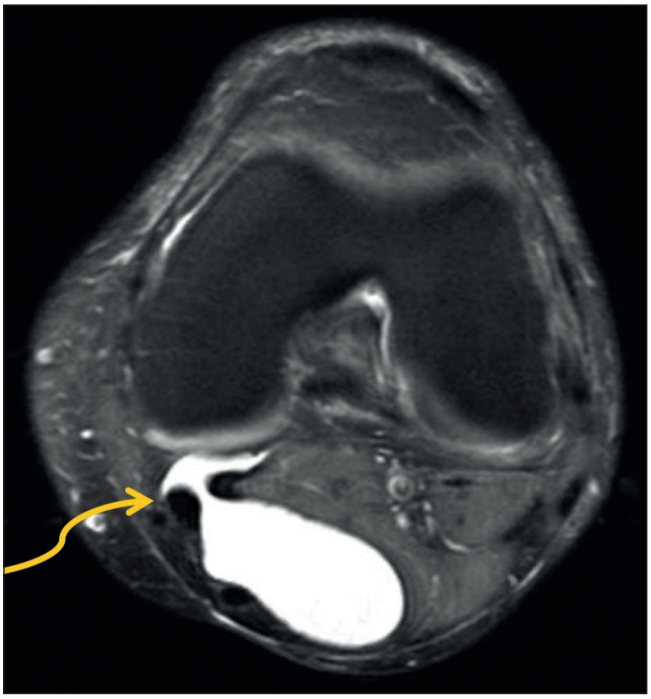

Figure 1.
Distended bursa protruding between the medial head of gastrocnemius and the tendon of semi-membranosus (curved arrows).

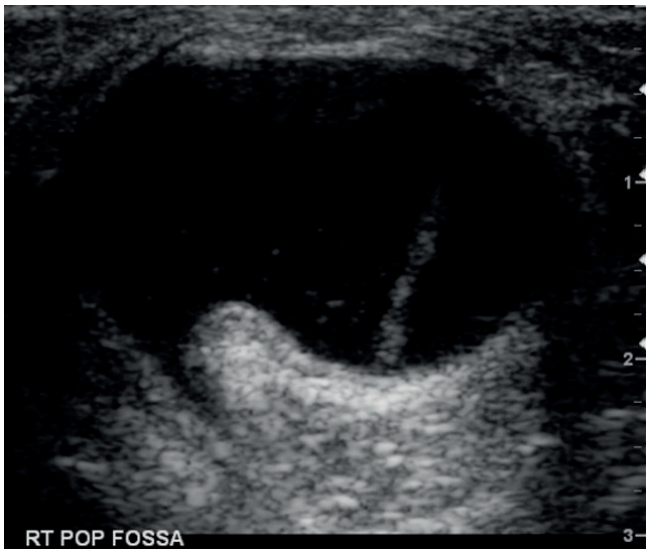

Figure 2.
Popliteal fossa ultrasound demonstrating the typical "talk bubble" configuration of the cyst in transverse orientation, the arrow formed by the tail communicating with the joint.

Exclusion Criteria

Patients were excluded on the basis of the following criteria: a) if no cyst was identifiable at the time of the proposed procedure, b) if the patient reported symptoms in keeping with recent cyst rupture, c) if the protocol under evaluation was not adhered to e.g. where aspiration was performed in the absence of Depomedrone injection and d) if the patient was lost to follow up

Therapeutic Procedure

The patients were positioned prone. All patients initially underwent sonographic evaluation of the popliteal fossa using a high-frequency linear array transducer to confirm the diagnosis, the ongoing presence of the cyst and lack of interval rupture. The expected location of the popliteal neurovascular bundle deep to the cyst was also confirmed, to minimise the risk of potential haemorrhagic complications.

Under standard sterile conditions, a 10 cm long 5 French Yueh centesis catheter needle (COOK MEDICAL LLC, P.O. Box 4195, Bloomington, IN 47402-4195, U.S.A.) was advanced into the popliteal cyst under direct ultrasound guidance. Internal septae were disrupted as necessary, the contents of the cyst aspirated, and a sample was sent for microbiological analysis. Microscopy was also performed in all cases to evaluate for the presence of crystals. The total aspirated volume was recorded in each instance. Fluoroscopy-guided bursography using 50% Omnipaque 300 diluted with saline was performed to evaluate for communication with the knee joint. The contrast was then aspirated and therapeutic injection with 40mg Depomedrone and 5ml of 0.5% Bupivacaine was performed.

Follow Up

Telephone follow-up was performed in all cases at multiple intervals, varying from 2 to 14.5 months, with respect to symptom resolution/persistence and, if the pain had persisted or recurred, the score on the Likert scale was recorded. A follow-up ultrasound was performed in the event of recurrent symptoms.

Results

Thirteen patients were referred for treatment, four of whom were excluded; two as their cysts were aspirated but no therapeutic injection was performed, one on the basis of recent cyst rupture, one had no identifiable cyst on the day of proposed drainage and one patient was lost to follow up secondary to emigration.

All patients included in the final analysis had a confirmed Baker's cyst that was symptomatic at the time of referral and intervention. Some, but not all, patients complained of a 'fullness' behind their knee. A popliteal fossa swelling was palpable in the majority on clinical examination.

Preprocedural knee radiographs demonstrated evidence of osteoarthritis in 8/9 patients. No radiographs were available for the remaining patient.

In total, 9 patients (9 female, average age 63.8 years) all complaining of knee pain and swelling underwent 11 procedures (bilateral in 1 patient, repeated in another) over a 35-month time period. Puncture and aspiration were carried out as described above, yielding an average volume of 20.1 ml (range 10 – 50 mls).

Communication with the knee joint was demonstrated in only 2/11 procedures, despite the characteristic 'tail' being visible

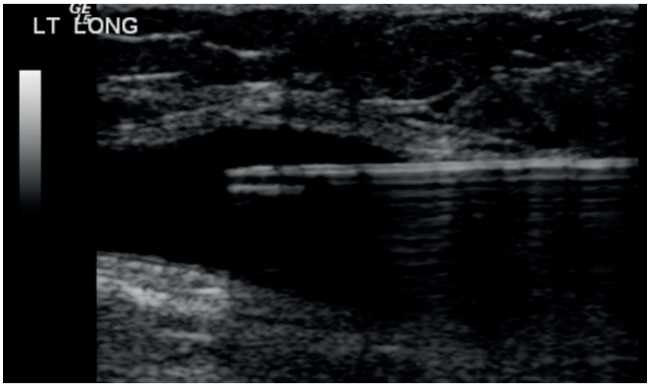

Figure 3.
5 French Yueh centesis cannula in situ, central stylet removed.

on ultrasound in a number. In 5/11 procedures, complex cysts were demonstrated at sonography, with internal septations or evidence of prior intra-cyst haemorrhage.

The average follow-up of patients was 8.3 months, ranging from 2 to 12 months. Patients reported a significant improvement in symptoms for an average duration of 5.96 months (range 0.5 – 12 months), with an average reduction of pain score on a 10-point Likert scale by 5.7 points to 0. After this period, patients reported a gradual return of an ache; however, none reported a return to pre-procedural severity, which in some cases had been enough to prevent them from sleeping. Two patients received no further intervention (including pain relief) for 12 months. The swelling returned in 3 patients; however, this was not painful. A single patient found minimal relief in symptoms and proceeded to Total Knee Arthroplasty, this outcome presumed to reflect moderately severe underlying knee joint osteoarthrosis.

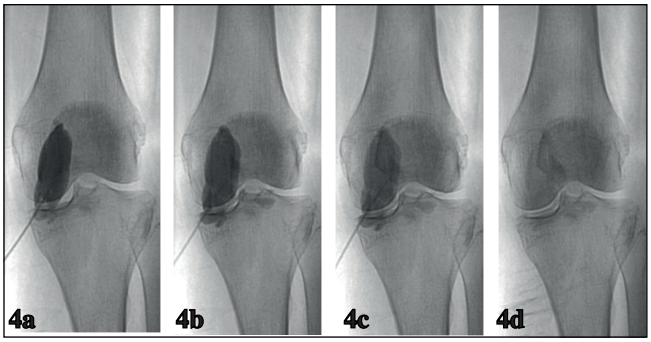

Figure 4.
Baker's cyst fluoroscopy-guided bursography and arthrography using contrast demonstrate communication with the knee joint

Figure 4
(a) Early filling of cyst
(b) Early joint space filling
(c) Later joint space filling with subtle opacification of the suprapatellar pouch
(d) After contrast aspiration, a trace of contrast remains in the medial joint space

Two of the five patients with complex cysts had durable, complete relief of the pain at the cyst site, with some ongoing knee joint pain in one patient and return of swelling in another patient. One of the patients with a complex cyst experienced 1 month of relief followed by a return of less severe pain in comparison to the pre-procedure severity. This patient had ongoing issues with patellar maltracking and was subsequently referred for physiotherapy.

No immediate or delayed complications following intervention were observed or reported.

Discussion

Robert Adams first described the popliteal cyst in 1840, as a fluid-filled synovium-lined sac arising in the popliteal fossa between the semimembranosus tendon and the medial head of gastrocnemius [4]. William Morantt Baker, the British surgeon after whom the condition was subsequently named, described eight further cases and their management [5]. In stark contrast to current management, popliteal cysts were at that time treated with bandaging of the knee, seton insertion and occasionally, limb amputation.

Baker's cysts are found in association with osteoarthritis of the knee, meniscal tears, rheumatoid arthritis, and Charcot joints, and are also seen in the post-traumatic setting in athletes. Furthermore, synovial disorders of the knee including synovitis, synovial osteochondromatosis and pigmented villonodular synovitis can also promote the formation of a Baker's cyst [6]. The fluid may communicate

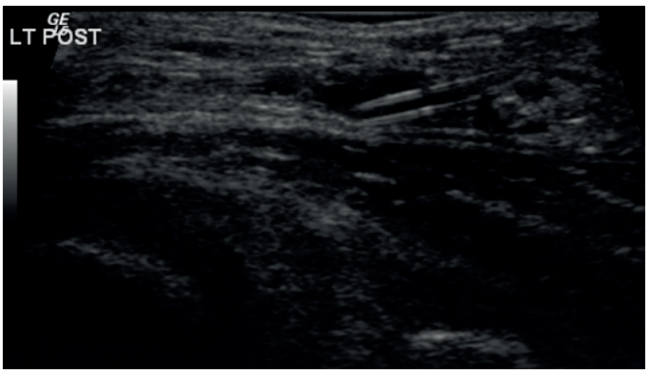

Figure 5.
Post aspiration ultrasound demonstrates minimal residual contrast within the collapsed cyst prior to steroid / Bupivacaine injection.

freely, or via a one-way valve mechanism allowing unidirectional flow from the knee joint into the bursa, between the tendons of the semimembranosus and the medial head of the gastrocnemius muscles. While the majority of Baker's cysts are asymptomatic, patients most commonly present with knee joint pain and stiffness, and/or a palpable mass in the medial popliteal fossa. In cases of cyst rupture or dissection, patients may also present with a clinical picture resembling either deep venous thrombosis or thrombophlebitis, the latter manifesting with pain, ecchymosis and itching, known as 'pseudothombophlebitis

syndrome'. On clinical examination, the differential diagnosis includes parameniscal cysts, liquefied hematoma in the post-traumatic setting, popliteal artery aneurysm and soft tissue masses [7].

Initial imaging of Baker's cysts should include knee radiographs to assess for pathology associated with the condition, such as osteoarthritis or rheumatoid arthritis. Radiography may also identify calcified/ossified loose bodies within the cysts. On ultrasonography, Baker's cysts typically have a well-defined anechoic or hypoechoic appearance with posterior acoustic enhancement. If present, loose bodies are echogenic with posterior acoustic shadowing. Magnetic Resonance Imaging is the preferred modality in the imaging of popliteal cysts, as it can identify a number of the potential underlying causes and differentiate them from parameniscal cysts [7]. The patients in this cohort who had MRIs but not x-rays reflect a growing trend among family practitioners to go directly to MRI, given increasing ease of access to the latter in recent years.

Corticosteroids are widely used in the management of musculoskeletal disorders and are commonly injected into joints, bursae, tendon sheaths, the epidural space, cysts, ganglions and around interdigital neuromas, among others [1, 2, 7]. Absolute contraindications to corticosteroid injection in the musculoskeletal system include local or intraarticular sepsis, bacteraemia, intraarticular fracture, coagulopathy, hypersensitivity or a joint prosthesis. Relative contraindications include severe juxta-articular osteoporosis, joint instability, poorly controlled diabetes and adjacent skin abrasions [8].

Di Sante et al [N = 60] have previously concluded that cyst aspiration with corticosteroid injection affords good pain relief and cyst volume reduction in patients with Baker's cysts and concomitant knee osteoarthritis; however, they suggested that the technique does not achieve results superior to those obtained with intraarticular corticosteroid injection alone [9]. Bandinelli et al [N = 40] demonstrated that in the setting of knee osteoarthritis, a greater reduction in cyst volume and wall thickness was obtained when the Baker's cyst was directly aspirated and infiltrated with corticosteroids compared to intraarticular steroid injection. The study hypothesized that the findings are due to the higher steroid concentrations achieved more rapidly within the cyst [10].

Köroğlu et al [N = 32] concluded that cyst aspiration with ultrasound-guided corticosteroid injection yields clinical improvement and cyst volume reduction in all subgroups of patients with Baker's cysts (simple or complex) secondary to knee osteoarthritis [11]. Acebes et al [N = 30] demonstrated a reduction in Baker's cyst volume and wall thickness four weeks after a single intraarticular corticosteroid injection, hypothesizing that corticosteroids can migrate from the joint into the Baker's cyst by the same valvular mechanism allowing cyst growth [12].

Paladini et al [N = 80] compared the management of Baker's cysts by injecting either steroid or tetracycline antibiotic, each of which resulted in a reduction in cyst volume following direct cyst instillation and a reduction in the patients' VAS pain scores. While tetracycline treatment resulted in a lower cyst persistence/recurrence rate, the authors observed that no Gold Standard treatment of Baker's cysts could be recommended on the basis of the existing literature [13]. All studies demonstrate clinical improvement and cyst volume reduction with Baker's cyst aspiration with ultrasound-guided corticosteroid injection. Corticosteroid injection was used alone in three studies [10, 11, 12], and in combination with anaesthetic in two studies [9, 14], all showing a beneficial effect [14].

Our pilot study replicated the results of others who have benefited from this technique, with a significant reduction in the severity of symptoms and some patients requiring no further medical treatment. Failure to document Baker's cyst communication with the joint on fluoroscopy in 9/12 cases, despite the latter being demonstrated on MRI, or suggested by ultrasound, is presumed to reflect a ball-valve-like effect between the joint and the cyst with unidirectional flow, either in the context of chronic inflammation or due to the action of the semimembranosus and gastrocnemius muscles in knee extension. This is an interesting finding and supports the use of intra-cystic, rather than intra-articular injection to treat symptomatic baker's cysts.

Prior to undertaking our study, we believed more complex, multilocular cysts would respond less well than simple, uncomplicated cysts; however, on analysis, the complicated cysts respond just as well from a symptomatic perspective. This is an important finding as clinicians may be reluctant to perform or refer patients with complex cysts for intra-cystic therapy due to perceived limited benefit in comparison to patients with simple cysts, thus negatively impacting patients with complex Bakers cysts.

Limitations and Future Perspective

This study is limited by the small cohort, with only 11 procedures included in total. The patients' symptoms were subjectively assessed and documented objectively using a Likert scale. An interactive Visual Analog Scale will be used in future studies. The follow-up period was limited and varied between patients [shortest 2 months, longest 1 year]. This has informed current practice, and currently, we employ a standard, 3, 6, 9 and 12-month follow-up questionnaire. The study has served the department well as a baseline for future quality improvement.

There was no comparison group e.g., no placebo control or comparison against an alternative treatment. The absence of a placebo or 'sham' comparison group was at least in part based on the results in a limited number of patients treated prior to the current protocol in whom aspiration alone was performed, without injection of steroid, in whom their symptoms recurred quickly. For this reason, it appeared

unethical to perform this comparison, although it would undoubtedly have scientific merit. The performance of a 'sham' would be near impossible in the patients who could feel the swelling in their popliteal fossa, as clearly, there would be no change post-procedure if aspiration was not performed.

Potential avenues of future research include comparison with other active therapies used elsewhere in the musculoskeletal system e.g., hyaluronic acid, Hypertonic Dextrose, platelet-rich plasma (PRP), and botulinum toxin A (BTA) (all used in treating knee OA), with placebo and each other, with a view to establishing an equivalence with steroids, particularly given concerns raised in recent years regarding the intraarticular injection of the latter [15, 16].

There was no significant difference in results in patients demonstrating free communication with the knee joint at bursography (1 patient demonstrated complete symptom resolution, in the second patient the symptoms returned). While the patient number in our study is small, future studies will further evaluate the practice of bursography at the time of Baker's cyst injection given the apparent absence of significant additional benefit.

Given the concerns regarding the effects of steroids on knee joint cartilage [15, 16], one potential avenue of research would be to compare the knee cartilage (cartilage mapping with MRI) in those with, versus those without a demonstrable communication with the knee joint.

Some authors advocate additional assessment of the knee joint with ultrasound at the time of the procedure, and if an effusion is demonstrable, recommend that it be aspirated at the same appointment, given the potential communication between the Baker's cyst and the knee joint. [17]. This is not part of our protocol given the benefit experienced by the majority of our patients following cyst aspiration and injection alone.

Despite the limitations, the study confirms the safety and efficacy of this technique in the management of patient symptoms and demonstrates a durable medium-term effect on patient's symptoms, the combination of decompression via aspiration and the anti-inflammatory effect of steroids working synergistically.

Conclusion

First-line treatment of symptomatic Baker's cysts with aspiration under ultrasound and fluoroscopic guidance followed by therapeutic injection of corticosteroids and local anaesthetic is a safe procedure, leading to a durable reduction in pain symptoms in the majority of patients.

Main Points

- Treatment of symptomatic Baker's cysts with aspiration under ultrasound and fluoroscopic guidance followed by therapeutic injection of Depomedrone and Bupivacaine leads to a durable reduction in symptoms.
- There was no significant difference in patient-reported outcomes between patients with simple vs complex multilocular Baker's Cysts.
- Similar patient-reported outcomes were obtained in patients where communication between the Baker's cyst and knee joint compartment was documented at fluoroscopy vs. those where a communication was not identified.

REFERENCES

1. Reidy M, Cousins G, Finlayson D. Corticosteroid injection of the arthritic hip: what is the indication? *Scott Med J*. 2015; **60(1)**:29-31.
2. MacMahon PJ, Eustace SJ, Kavanagh EC. Injectable corticosteroid and local anaesthetic preparations: a review for radiologists. *Radiology*. 2009; **252(3)**:647-61.
3. Louis LJ. Musculoskeletal ultrasound intervention: principles and advances. *Radiol Clin North Am*. 2008;**46(3)**:515-33.
4. Adams R. Chronic rheumatoid arthritis of the knee joint. *Dublin J Med Sci*. 1840; 17: 520.
5. Baker WM. On the formation of synovial cysts in the leg in connection with disease of the knee-joint. *Clin Orthop Relat Res*. 1999;**299**:2-10
6. Toussaint SP, McCabe S. Baker's cyst imaging. *Int J Emerg Med*. 2010;**3 (4):** 469-70.
7. Frush TJ, Noyes FR. Baker's Cyst: diagnostic and surgical considerations. *Sports Health*. 2015;**7(4):**359-65.
8. Kruse DW. Intraarticular cortisone injection for osteoarthritis of the hip. Is it effective? Is it safe? *Curr Rev Musculoskelet Med*. 2008; **1(3-4):** 227–33.
9. 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. *Am J Med Rehabil* 2010; **89(12):**970-5.
10. Bandinelli F, Fedi R, Generini S, Porta F, Candelieri A, Mannoni A, *et al*. Longitudinal ultrasound and clinical follow-up of Baker's cysts injection with steroids in knee osteoarthritis. *Clin Rheumatol*. 2012;**31(4):**727-31.
11. Köroğlu M, Callıoğlu M, Eriş HN, Kayan M, Cetin M, Yener M, *et al*. Ultrasound-guided percutaneous treatment and follow-up of Baker's cyst in knee osteoarthritis. *Eur J Radiol*. 2012; **81(11):**3466-71.
12. Acebes JC, Sánchez-Pernaute O, Díaz-Oca A, Herrero-Beaumont G. Ultrasonographic assessment of Baker's cysts after intra-articular corticosteroid injection in knee osteoarthritis. *J Clin Ultrasound*. 2006;**34**:113-17.
13. Percivale I, Borzelli A, Pane F, Paladini A. Use of sclerosant acting antibiotic versus corticosteroids to treat symptomatic Baker cysts: a prospective study. *Semin Musculoskeletal Radiol*. 2020;24(S 02): S9-S30. .
14. Smith MK, Lesniak B, Baraga MG, Kaplan L, Jose J. Sports Health: A Multidisciplinary Approach May 5, 2015. Treatment of Popliteal (Baker) Cysts With Ultrasound-Guided Aspiration, Fenestration and Injection: Long-term Follow-up. *Sports Health*. 2015;**7(5):**409-414.
15. Kompel AJ, Roemer FW, Murakami AM, Diaz LE, Crema MD, Guermazi A. Intra-articular corticosteroid injections in the hip and knee: perhaps not as safe as we thought? *Radiology*. 2019; **293**(3): 656-63.
16. Hauser RA. The deterioration of articular cartilage in osteoarthritis by corticosteroid injections. *J Prolotherapy*. 2009;**1(2):**107-23
17. Lesniak BP, Loveland D, Jose J, Selley R, Jacobson JA, Bedi A. Use of ultrasonography as a diagnostic and therapeutic tool in sports medicine. *Arthroscopy*. 2013; **30(2):** 260–70.