A Peculiar Case of Gas in Popliteal Cyst: Is there a Potential Association with Rheumatoid Arthritis?

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Not applicable

ABSTRACT

We report a rare case of atraumatic gas within a popliteal cyst in an elderly woman with seropositive rheumatoid arthritis. The patient presented with posterior knee swelling but no signs of infection or trauma. Imaging revealed soft tissue gas within the cyst, confirmed on radiographs and MRI. Aspiration yielded sterile, straw-coloured fluid without crystals or malignant cells. The patient remained well with conservative management. While only two similar cases have been reported, both also involved rheumatoid arthritis, suggesting a possible – but unproven – association. We discuss potential mechanisms, including altered synovial fluid gas dynamics in rheumatoid arthritis, and emphasize the importance of clinioradiological correlation to avoid unnecessary intervention.

CASE REPORT

BACKGROUND

Gas within soft tissues is commonly associated with penetrating trauma or gas-forming infection, and typically warrants urgent clinical attention. We report a rare case of gas in popliteal cyst occurring in a non-traumatic and non-infective setting. Review of limited literature suggests a possible, but unproven, association with rheumatoid arthritis (RA). This case report contributes to the growing body of observations suggesting a potential benign mechanism of soft tissue gas. It underscores the importance of correlating imaging findings with clinical context to avoid misdiagnosis and guide appropriate management.

CASE REPORT

An elderly woman with a long-standing history of seropositive RA presented with a two-week history of progressive swelling in the back of the right knee and calf. She denied trauma, fever or any recent procedure. Examination showed a fluctuant mass in the popliteal fossa extending to the proximal calf. The overlying skin was intact without erythema and warmth. The joint range of motion was maintained, and neurovascular status was normal. Laboratory results showed no leucocytosis and normal inflammatory markers.

Imaging findings

Duplex ultrasound excluded deep vein thrombosis but demonstrated a multilobulated popliteal cyst. Radiographs showed multiple lucent foci within the soft tissue in the posterior aspect of right knee. Magnetic Resonance Imaging (MRI) of the right knee revealed a multilobulated popliteal cysts measuring 4.2 x 2.1 x 1.9 cm with multiple round hypointense foci on both T1- and T2-weighted images, consistent with intra-cystic gas.

There was no evidence of fascial enhancement or soft tissue inflammation to suggest infection.

Management and follow-up

Although the patient exhibited no clinical signs or symptoms of infection, the presence of soft tissue gas – typically associated with gas-forming infection – prompted ultrasound-guided aspiration to definitively exclude infection. Aspiration of the popliteal cyst yielded 10 ml of thick straw-coloured fluid. Cytology revealed foamy macrophages and granular debris with no malignant cells or crystals. Cultures and stains for bacteria, fungi and mycobacteria were negative. The patient was managed conservatively without antibiotics. At three-month follow-up, the patient remained well. Follow-up radiographs showed resolution of soft tissue gas.

DISCUSSION

Etiology & demographics

Popliteal (Baker's) cysts are synovial-lined fluid collections that often communicates with the knee joint, typically arising in the context of intra-articular pathology such as osteoarthritis or inflammatory arthritis. They are commonly seen in patients over 50 years old and have a higher prevalence among individuals with chronic knee joint conditions [1, 2].

Soft tissue gas is a radiologic finding most associated with severe pathologies such as gas-forming infections, penetrating trauma, or post-operative/intervention changes. When detected in musculoskeletal tissues, it often prompts urgent investigations due to the risk of necrotising fasciitis or septic arthritis. However, when encountered in the absence of causative factors, this finding challenges the conventional diagnostic paradigm.

Gas within a popliteal cyst is exceedingly rare. Our literature review produced only two other case reports of atraumatic gas in popliteal cyst [3,4]. Interestingly, we observed that both cases involved patients with RA, as in our case. While this pattern is intriguing, the limited number of reports precludes any definitive association. Nevertheless, the consistency across cases invites further consideration for shared mechanism.

One hypothesis involves the anatomical communication between the knee joint and the popliteal cyst through a valvular opening in the posterior capsule [2]. Vacuum phenomenon associated with degenerative joint disease [5] could have passed through this one-way valve to enter the popliteal cyst but preventing its return to the joint. Specific to our case, there is no significant degeneration in the right knee to attribute the soft tissue gas to vacuum phenomenon related to osteoarthrosis.

Another possible explanation lies in the altered synovial environment observed in RA. In a seminal study by Falchuk et al., investigators evaluated the gas composition of synovial fluid in patients with RA and found significantly reduced oxygen and elevated carbon dioxide partial pressures compared to healthy controls [6]. These findings point to a circulatory-metabolic imbalance in inflamed synovial tissues. It is conceivable that such physiologic changes could lower gas solubility thresholds, leading to formation of gas bubbles in fluid. Coupled with synovial hypertrophy and increased synovial fluid production, the resultant elevated intra-articular pressure could promote flow of synovial fluid – and potentially gas bubbles – into the popliteal cyst through the existing anatomical communication.

Although speculative, this mechanism may offer a plausible explanation for atraumatic and non-infective gas accumulation in synovial-derived cysts. While further study is needed to clarify these observations, this case highlights the important of correlating radiologic findings with the clinical picture and avoiding premature conclusions based on imaging alone.

Clinical & imaging findings

Patients with popliteal cysts typically present with posterior knee swelling or discomfort. In this case, imaging revealed the unusual presence of gas in the popliteal cyst – an uncommon finding that typically raises concern for gas-forming infection or penetrating trauma. However, no accompanying imaging features of infection is present on MRI. Clinically, the patient remained afebrile with unremarkable inflammatory markers, supporting a non-infective etiology.

Treatment & prognosis

In the absence of trauma and infection, conservative management is appropriate. Our patient, like those in prior reports, improved without antimicrobial therapy or surgical excision.

Differential Diagnoses

The differential diagnosis for gas in the popliteal region includes gas-forming infection, post-operative/intervention changes, penetrating trauma, or vacuum phenomenon from degenerative joint disease. Clinical and laboratory correlation, combined with careful imaging interpretation, is essential [1].

TEACHING POINT

Gas in the popliteal cyst is rare and may be encountered in patients with RA without trauma or infection. Radiologists should consider benign etiologies when intra-cystic gas is seen on imaging, especially when there is no supporting clinical evidence of infection.

QUESTIONS

Question 1: Which of the following is the most likely clinical presentation of a patient with a popliteal (Baker's) cyst?

A. Anterior thigh pain
B. Fever and chills
C. Posterior knee swelling (applies)
D. Hip joint stiffness
E. Neurological deficit

Explanation: Patients with popliteal cysts typically present

with posterior knee swelling or discomfort due to distension of the cyst in the popliteal fossa.

Question 2: Which of the following imaging findings most strongly supports a non-infective etiology in the presence of intra-cystic gas?

A. Gas locules adjacent to bone cortex
B. Absence of fascial enhancement on MRI (applies)
C. Rim-enhancing abscess
D. Soft tissue oedema with skin thickening
E. Subcutaneous emphysema

Explanation: The absence of fascial enhancement, soft tissue oedema, or marrow signal abnormality on MRI supports a non-infective cause of gas within the gas

Question 3: Which of the following are plausible mechanisms contributing to gas accumulation in a popliteal cyst in rheumatoid arthritis?

A. Valvular opening allowing gas movement into the cyst (applies)
B. Vacuum phenomenon associated with degenerative joint disease (applies)
C. Decompression illness
D. Septic arthritis
E. Altered synovial gas dynamics in RA (applies)

Explanation: Gas may enter and cyst via a ball-valve mechanism from the joint, possibly influenced by vacuum phenomenon and altered gas dynamics in rheumatoid arthritis.

Question 4: What is the most appropriate management for an afebrile patient with atraumatic intra-cystic gas and no signs of infection?

A. Intravenous antibiotics
B. Emergent surgical debridement
C. Arthroscopic washout
D. Conservative monitoring (applies)
E. High-dose corticosteroids

Explanation: In the absence of trauma or infection, conservative management is appropriate. This approach led to symptom resolution in this case.

Question 5: Which of the following is included in the differential diagnosis of gas in the popliteal region?

A. Post-surgical changes (applies)
B. Myositis ossificans
C. Gas-forming infection (applies)
D. Penetrating trauma (applies)
E. Synovial sarcoma

Explanation: The differential diagnosis includes gas-forming infection, post-operative/intervention changes, and trauma, among others.

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FIGURES

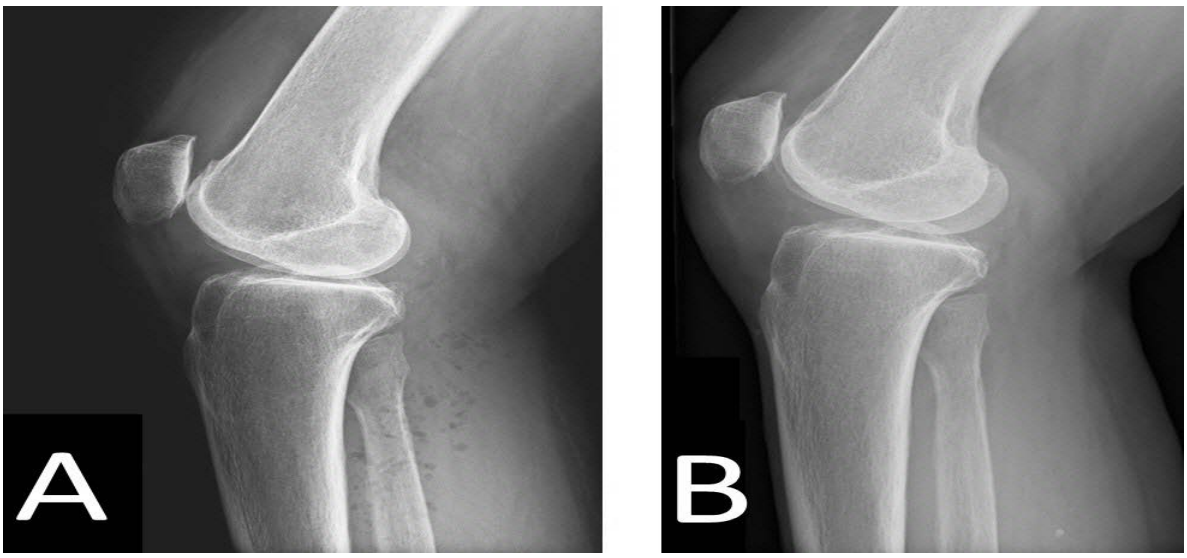

Figure 1: (A) Lateral radiographic view of the right knee showed multiple soft tissue gas projected over the posterior aspect of the proximal tibia-fibula. **(B)** Follow-up radiograph performed 9 months later showed complete resolution of soft tissue gas.

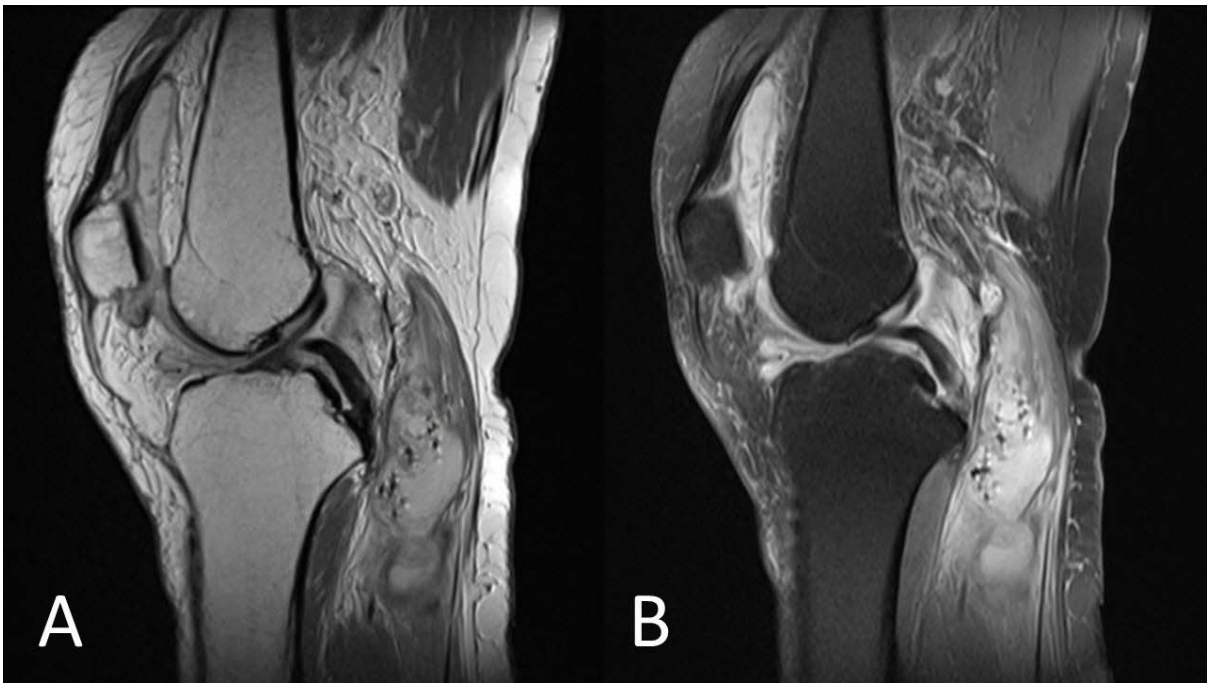

Figure 2: Sagittal PD (A) and PD FS (B) of the right knee showed a popliteal cyst with multiple round hypointense foci - correlating to recent radiographic appearance of gas locules.

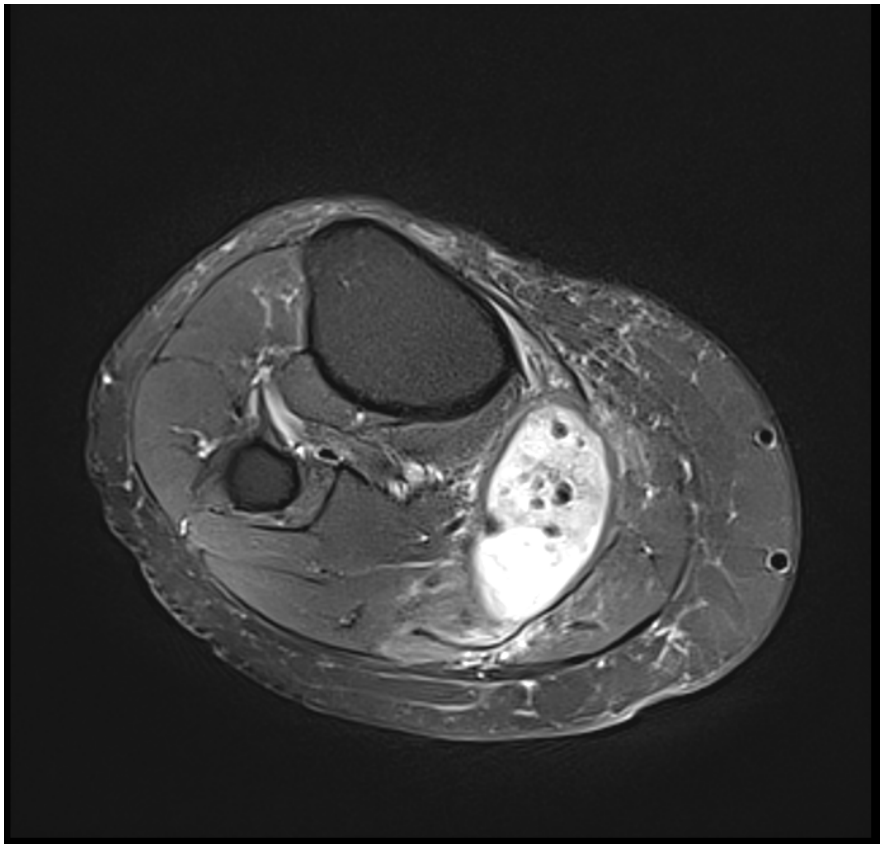

Figure 3: Axial T2 FS of the right knee showed a popliteal cyst containing multiple round hypointense foci - correlating to recent radiographic appearance of gas locules. There was no evidence of soft tissue inflammation to suggest infection.

KEYWORDS

Popliteal cyst; Baker's cyst; rheumatoid arthritis; soft tissue gas; vacuum phenomenon

ABBREVIATIONS

RA = RHEUMATOID ARTHRITIS
MRI = MAGNETIC RESONANCE IMAGING

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