

Non-calcified Synovial Chondromatosis Masquerading as a Posterior Knee Cyst: A Diagnostic Challenge

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Learning Point of the Article:

Synovial chondromatosis, when presenting without characteristic calcifications, may closely resemble cystic or neoplastic lesions of the posterior knee, underscoring the need for a high index of suspicion, advanced imaging, and histopathological confirmation for accurate diagnosis and appropriate management.

Abstract

Introduction: Synovial chondromatosis (SC) is a rare, benign metaplastic disorder of the synovial membrane that typically presents with joint pain, swelling, and mechanical symptoms. Although the knee is the most frequently involved joint, diagnosis can be challenging in early or atypical cases, particularly when classical calcifications are absent on imaging.

Case Report: We present the case of a young adult male with a 1-year history of insidious onset posterior knee pain, without any antecedent trauma. Clinical examination revealed a full range of motion with no joint instability. Radiographs were inconclusive, showing only a faint opacity, while magnetic resonance imaging (MRI) demonstrated a well-defined, encapsulated lesion in the posterior compartment adjacent to the posterior cruciate ligament. A provisional diagnosis of a cystic or neoplastic lesion was considered. The patient underwent open surgical excision via a posterior approach. Intraoperatively, multiple cartilaginous loose bodies were found within the lesion. Histopathological evaluation confirmed the diagnosis of SC. The patient recovered uneventfully with complete resolution of symptoms and full functional restoration at final follow-up.

Conclusion: This case highlights an uncommon presentation of non-calcified SC mimicking a posterior cystic or soft-tissue tumor, emphasizing the importance of MRI and histopathological evaluation in cases with atypical imaging features to avoid misdiagnosis and ensure appropriate treatment.

Keywords: Synovial chondromatosis, knee joint, posterior cyst, magnetic resonance imaging, loose bodies.

Introduction

Synovial chondromatosis (SC) is a rare, benign disorder affecting the synovial lining of joints, tendon sheaths, and bursae, potentially leading to significant joint dysfunction and disability. The condition was initially documented in the knee by Ambroise Paré in 1558. Later, in 1813, René Laennec provided a description of intra-articular loose bodies arising from the subsynovial layer [1]. Although any joint can be involved, such as

metacarpophalangeal joints, temporomandibular joints (TMJs), distal radio-ulnar joints, and the hips, the knee is the most common with an occurrence rate 50–65% [2, 3, 4].

SC presents as the gradual, insidious onset of mono-articular joint discomfort and stiffness [5]. If the complaints are left untreated, they could lead to a reduction in movement range, effusions, crepitation, and eventually locking of the joint.

Author's Photo Gallery



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Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2025.v15.i10.6180>

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Submitted: 13/07/2025; Review: 08/08/2025; Accepted: September 2025; Published: October 2025

DOI: <https://doi.org/10.13107/jocr.2025.v15.i10.6180>

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Figure 1: Plain radiograph of the knee showing a subtle radio-opaque circular shadow located just posterior to the tibial slope, suggestive of an intra-articular or para-articular lesion.

The differential diagnosis associated with SC should include synovial hemangioma, pigmented villonodular synovitis (PVNS), synovial cyst, lipoma arborescence, and malignancies, such as synovial chondrosarcoma or synovial sarcoma [2]. The diagnosis suspected clinically is confirmed based on imaging modalities such as plain radiographs, ultrasound, computed tomography scans, and magnetic resonance imaging (MRI). The gold standard diagnostic method is MRI due to its superiority in enhancing soft-tissue contrast [6].

This case report describes the first known instance of SC in the knee, manifesting as a well-defined encapsulated lesion, with the patient presenting with pain in the popliteal fossa.

Case Report

A young adult male in his late 20s presented with a 1-year history of popliteal fossa pain, which began insidiously and gradually worsened in severity. Despite receiving treatment from general practitioners, his symptoms persisted. The patient reported no history of trauma. On clinical examination, the knee exhibited full range of motion, with flexion and extension from 0° to 130°. The collateral and cruciate ligaments were stable, and no varus or valgus deformities were noted. Palpation revealed no localized increase in temperature or tenderness, and the distal neurovascular status was intact.

Investigations

Radiographs demonstrated a subtle radio-opaque circular shadow located just posterior to the tibial slope (Fig. 1). T2-weighted MRI imaging revealed a well-defined lesion with heterogeneous signal intensity, measuring 1.4 × 2.5 × 3 cm. The lesion was situated in the midline posterior compartment, anterior to the knee capsule, and in close proximity to the posterior cruciate ligament (PCL) (Fig. 2). The differential diagnoses included ganglion cyst, Baker's cyst, parameniscal cyst, PVNS, lipoma arborescens, synovial hemangioma, early-stage SC, and soft-tissue neoplasms such as synovial sarcoma or chondrosarcoma. The patient underwent a computed tomography torso and chest radiograph, which revealed no evidence of primary malignancy or metastasis.

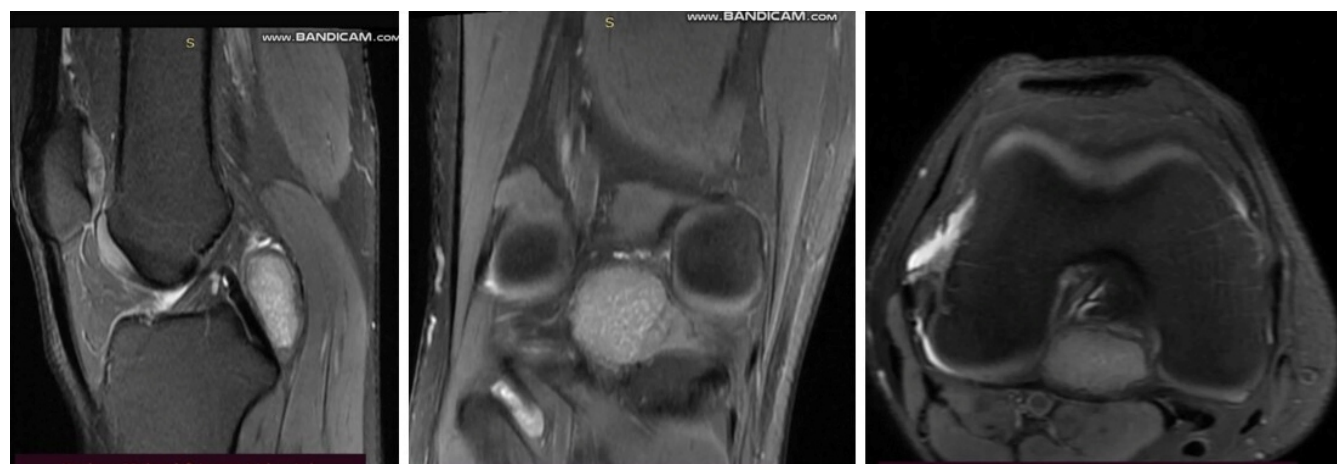


Figure 2: T2-weighted magnetic resonance image of the knee demonstrating a well-defined lesion with heterogeneous signal intensity. The lesion is located in the midline posterior compartment, anterior to the knee capsule, and closely abutting the posterior cruciate ligament.



Figure 3: Intraoperative photograph showing a 2.5 cm × 2.5 cm encapsulated mass (green arrow) located behind the posterior cruciate ligament. The excised mass contains multiple white loose bodies (blue arrow).

Treatment

After detailed counseling regarding the nature of the lesion and treatment options, the patient consented to surgical intervention. A surgical approach was planned, and an open excisional biopsy was performed using a posterior reverse L-shaped incision (Burks-Schaffer approach) [7]. On posterior capsule opening, a 2.5 cm × 2.5 cm encapsulated mass was identified behind the PCL and was excised en bloc. The mass contained multiple white loose bodies, each approximately 5 mm in diameter (Fig. 3). Both the excised loose bodies and synovial tissue were sent for histopathological analysis. Histopathological examination identified nodules of hyaline cartilage with clustered chondrocytes, encased by synovial tissue of varying thickness, thereby confirming the diagnosis of SC (Fig. 4).

Outcome and follow-up

Post-operative rehabilitation included weight bearing as tolerated, along with knee range-of-motion exercises and isometric quadriceps and hamstrings strengthening. The patient was followed up at 1, 3, and 6 months postoperatively. At the final 1½ year follow-up, the patient demonstrated an active knee flexion-extension range of 0°–130° without discomfort with full weight-bearing gait without support.

The patient achieved a Lysholm knee score of 95/100, an IKDC subjective knee evaluation score of 92/100, and a WOMAC score of 6/96, indicating excellent post-operative recovery with minimal

residual symptoms and full functional restoration.

Discussion

SC is the metaplastic process of synovium, which converts it into the cartilage and gets detached to become a loose body [8]. SC is typically classified according to its usual progression through three stages as described by Milgram in 1977. In phase I, metaplasia of the synovial intima occurs. Active synovitis and nodule formation are present, but no calcifications can be identified. In Phase II, these nodules detach from the synovium to become loose bodies within the joint. The loose bodies are primarily still cartilaginous. In the first two stages, plain radiographs will show no gross abnormalities of the affected

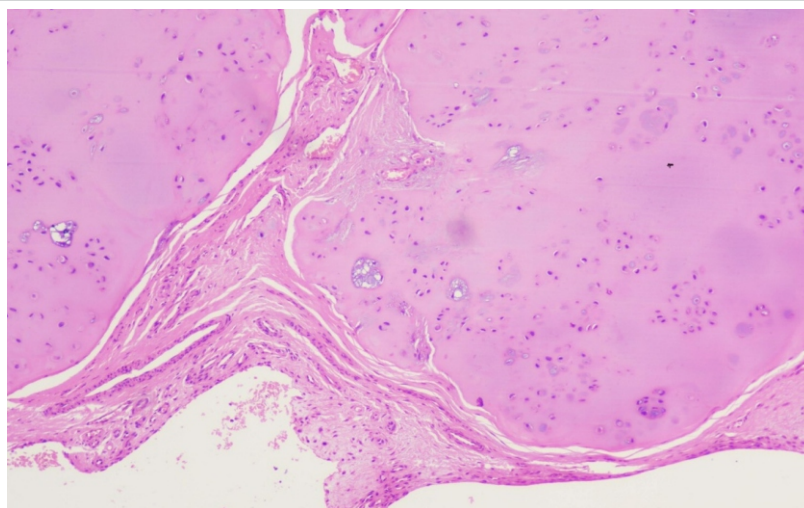


Figure 4: Histological section demonstrating nodules of hyaline cartilage with clustered chondrocytes, surrounded by synovial tissue of variable thickness, consistent with synovial chondromatosis (H&E stain, ×10).

Table 1: Reported cases of synovial chondromatosis mimicking cystic or neoplastic lesions.

Article	Age	Imaging details	Operative approach and findings	Histopathology	Outcome
Shah et al. (2016) [17]	43/male	Radiographs: intracystic opacity; MRI: intracystic bodies (variable signal). Not a classic fully ossified appearance.	Open synovectomy with cyst excision – cartilaginous loose bodies removed from Baker's cyst.	Hyaline cartilage nodules consistent with SC.	Symptom resolution after excision.
Yang et al. (2018) [18]	47/male	MRI showed non-typical signal; calcification absent or limited on radiographs	Arthroscopic synovectomy and loose-body removal.	Hyaline cartilage nodules confirming SC.	Good recovery, no recurrence reported.
Lee DH et al (2016) [19]	76/male	Radiograph: no calcification; MRI: posterior compartment nodular lesion.	Open excision – cartilaginous nodules removed.	SC confirmed on histology (hyaline cartilage nodules).	Good functional outcome.
Zanna L et al (2022) [20]	35/male	MRI localized posterior loose bodies; calcification variable.	Arthroscopic removal using posteromedial portal – multiple loose bodies removed arthroscopically.	SC (hyaline cartilage nodules).	Good outcome; arthroscopic posteromedial approach feasible in selected cases.
Khadka et al. (2023) [21]	47/male	MRI: intra-articular disease with extension into Baker's cyst; mixed signal intensity, some calcification on CT/radiograph in parts.	Open/arthroscopic combined approach reported – intra- and extra-articular loose bodies retrieved.	SC confirmed.	Good recovery reported.
Zelege et al. (2025) [22]	50/male	MRI: extensive loose bodies, synovial hypertrophy; calcification present in some nodules.	Staged open radical synovectomies (anterior then posterior) – multiple large loose bodies removed.	SC with synovial papillary hyperplasia.	Improved ROM and symptoms at 6 months; no recurrence at 1 year.

MRI: Magnetic resonance imaging, CT: Computed tomography, SC: Synovial chondromatosis, ROM: Range of motion

joint. Phase III is characterized by multiple loose bodies within the joint space, with none remaining within the synovial tissue lining. Synovitis has typically resolved at this phase of the disease. It is at this stage that multiple intra- or extra-articular opaque loose bodies of various sizes are typically demonstrated as the loose bodies have calcified [9].

Earlier Jang et al., in their case series on SC of the TMJ, noted that over 80% of the patients' exhibited calcifications [10]. Imaging plays a crucial role in the diagnosis of SC, with calcifications being present in standard radiographic examination in 70–95% of cases. Thus, in cases where plain radiography cannot demonstrate calcification or ossification, MRI is particularly useful [11]. Our case also did not present with any noticeable calcifications in radiographs; hence, the exclusion of differential diagnoses rested on MRI.

Posterior knee lesions encompass a wide spectrum of benign and malignant entities – including Baker's cysts, ganglion or parameniscal cysts, PVNS, lipoma arborescens, and synovial sarcoma – that can mimic non-calcified SC. These lesions often share overlapping clinical and radiological presentations, typically presenting as well-defined cystic or lobulated masses in the popliteal fossa. However, MRI may offer diagnostic clues: lipoma arborescens characteristically follows fat signal on all sequences and suppresses on fat-saturated imaging [12]; PVNS displays hemosiderin-related blooming artifacts on gradient echo or susceptibility-weighted sequences due to hemoglobin breakdown products [13]; and synovial sarcoma

often presents with aggressive margins and solid enhancement – features that aid differentiation [14]. Nevertheless, histopathology remains the definitive diagnostic modality, confirming SC and excluding malignancy.

This case report describes SC of the knee presenting as a non-calcified, well-defined encapsulated mass on MRI. The lesion exhibited features that closely resemble those of a sarcoma or a complex cyst, thus highlighting the diagnostic challenge posed by this rare presentation. The imaging characteristics of the mass make this case an important contribution to the understanding of SC in the knee.

To contextualize our findings, we reviewed previously published case reports of non-calcified or atypically presenting SC around the knee. A comparative analysis of these reports (Table 1) highlights that such cases often mimic cystic or neoplastic lesions, reinforcing the diagnostic challenge and the pivotal role of MRI and histopathology in establishing a definitive diagnosis.

The goal for the treatment of SC is to remove the loose bodies, improve pain symptoms, regain movement in the joint, and limit the development of early osteoarthritis [15]. The treatment of choice is either open or arthroscopic surgical excision. Close long-term follow-up is recommended, because although rare, there is a chance of malignant change [3]. Recurrence after surgical excision of SC has been reported in 3–23% of cases, with the rate largely dependent on the completeness of synovectomy and removal of loose bodies

[16].

Our patient successfully underwent an open excision of the lesion, and at the final follow-up, there was no recurrence of symptoms, demonstrating a favorable outcome following complete surgical excision.

Conclusion

SC is an uncommon etiology of knee pain and may present with atypical cystic formation. Awareness of this condition is essential for accurate diagnosis and effective management, as

its presentation can be easily confused with other more common, aggressive pathologies.

Clinical Message

Unusual presentations of SC – such as non-calcified, encapsulated posterior knee lesions – can be easily mistaken for benign or malignant masses. Recognizing these rare imaging variants and selecting an appropriate surgical approach are key to achieving accurate diagnosis and optimal patient outcomes.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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Conflict of Interest: Nil

Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Singh M, Gahlot N, Bains A. Non-calcified Synovial Chondromatosis Masquerading as a Posterior Knee Cyst: A Diagnostic Challenge. Journal of Orthopaedic Case Reports 2025 October;15(10): 120-125.