

Case Report

Recurrent diffuse pigmented villonodular synovitis of the knee with posterior extension: clinical outcomes following arthroscopic synovectomy with radiosynoviorthesis and platelet rich plasma- a case report

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ABSTRACT

Pigmented villonodular synovitis (PVNS) is a rare, benign, and locally aggressive synovial disorder that most commonly affects the knee. The diffuse form carries a high recurrence risk and is challenging to treat, particularly when the posterior compartments are involved. A 29-year-old man presented with recurrent right knee stiffness and swelling without pain, five years after his second arthroscopic synovectomy for diffuse PVNS. MRI revealed extensive synovial proliferation involving the suprapatellar pouch and posterior knee compartment along the posterior cruciate ligament (PCL). He underwent arthroscopic synovectomy using a posterior trans-septal portal for complete posterior access, followed by radiosynoviorthesis with phosphorus-32, structured physiotherapy and adjuvant platelet-rich plasma (PRP) injection. At five-year follow-up, MRI showed moderate residual synovial thickening; however, the clinical outcomes improved markedly. The IKDC score increased from 41.4% to 83.9% and the Tegner-Lysholm score increased from 44% to 94%. The patient regained pain-free ambulation and knee motion from 0° to 120°, with no recurrent swelling. Recurrent diffuse PVNS with posterior compartment involvement benefits from a multimodal approach that integrates advanced arthroscopic techniques and adjuvant therapies. Significant functional recovery is achievable despite residual radiologic changes, highlighting the value of comprehensive management and long-term follow-up.

Keywords: Pigmented villonodular synovitis, Recurrent, Arthroscopic synovectomy, Posterior transseptal portal, Radiosynoviorthesis

INTRODUCTION

Pigmented villonodular synovitis (PVNS) is a rare, benign, but locally aggressive proliferative disorder of the synovium that most commonly affects young adults, with the knee being the predominant site of involvement. It presents in either a localized or diffuse form, with the latter characterized by extensive synovial involvement and

a significantly higher risk of recurrence. The clinical presentation is often insidious, with a gradual onset of swelling, stiffness and restricted range of motion, while pain may be minimal or absent, contributing to delays in diagnosis. The diffuse variant poses particular diagnostic and therapeutic challenges because of its capacity to invade multiple joint compartments, including the posterior knee and occasional extra-articular spread.

Management typically centers on synovectomy performed arthroscopically, openly, or through a combined approach, depending on the disease extent, with complete synovial excision being critical to reducing recurrence. However, achieving complete resection can be difficult in diffuse or recurrent PVNS, particularly when the posterior compartments are involved. Adjunct modalities such as radiosynoviorthesis, external beam radiotherapy and emerging biologic agents may help reduce persistent disease and recurrence risk. This case illustrates recurrent diffuse PVNS with posterior compartment involvement requiring advanced arthroscopic access and multimodal adjuvant therapy, demonstrating the importance of comprehensive planning and long-term follow-up to optimize outcomes.

CASE REPORT

A 29-year-old man presented with a six-month history of right knee stiffness and intermittent swelling, which had progressively worsened over the preceding two months and significantly impaired his daily activities, despite the absence of pain. He reported previous episodes of recurrent swelling in 2011 and 2016, which were self-resolving. In 2011, he experienced pain and swelling for five months prior to seeking treatment, at which time PVNS was diagnosed and he underwent arthroscopic synovectomy followed by radiosynoviorthesis with Phosphorus-32 (P-32) performed six months post-procedure. Symptoms resolved post-rehabilitation and remained controlled until 2016, when the swelling recurred without pain. Magnetic Resonance Imaging (MRI) confirmed synovial hypertrophy predominantly in the patellofemoral and suprapatellar compartments and a second arthroscopic synovectomy was performed without adjuvant radiation.

At the current presentation, the patient reported stiffness, difficulty in squatting, sitting cross-legged and exertional swelling. Examination revealed diffuse effusion, well-healed surgical scars, medial and lateral joint line tenderness and patellar insertional tendinitis. The knee

exhibited a fixed flexion deformity of 10° and flexion limited to 80°, with clinically stable cruciate and collateral ligaments, intact menisci and normal neurovascular status. MRI revealed a large soft-tissue mass extending into the suprapatellar bursa and posterior compartment along the PCL, representing disease progression compared to previous studies (Figure 1).

Given the recurrent and posteriorly extensive nature of the lesion, comprehensive preoperative planning was performed. Diagnostic arthroscopy was performed under combined spinal-epidural anesthesia with the patient positioned supine with the knee hanging down to 90° and surface marking performed (Figure 2). Reddish-brown frond-like synovial proliferation was observed throughout the suprapatellar pouch and medial and lateral gutters, obscuring the modified Gillquist view (Figure 3). Extensive arthroscopic synovectomy was performed using a laser coblator and shaver until the bulk of the synovial tissue was debrided (Figure 4). The PVNS deposits adjacent to the posterior horns of both menisci necessitated the creation of a posterior trans-septal portal (Figure 5), facilitating complete posterior compartment debridement and PCL clearance (Figure 6). The procedure was completed without complications and histopathological examination confirmed the diagnosis of PVNS.

Postoperatively, the patient underwent radiosynoviorthesis with intra-articular P-32, two months after surgery, structured physiotherapy and an adjuvant PRP injection at three months (Table 1). Over five years of follow-up, MRI demonstrated moderate persistent synovial thickening, predominantly in the suprapatellar and posterior recesses, consistent with residual disease (Figure 7). However, clinical outcomes improved significantly, with international knee documentation committee (IKDC) scores increasing from 41.4% to 83.9% and Tegner-Lysholm scores increasing from 44% to 94%. He is currently asymptomatic, ambulates normally and has regained a knee range of motion from 0 to 120° (Figure 8).

Table 1: Physiotherapy regimen followed for the patient.

Phases	Physiotherapy regimen
Phase 1 (Week 1-2)	Non-weight bearing walk (NWBW) with support Static and dynamic quadriceps and hamstring exercises Hip abductor and adductor strengthening Heel slides Prone hangs Patellar mobilizing exercises Hip strengthening-straight leg raises Knee ROM 0-60° Ankle pumps Continuous passive motion to 0-75°
Phase 2 (Week 3-4)	Continued phase 1 exercises + NWBW Knee ROM 0-90° Continuous passive motion to 0-100°

Continued.

Phases	Physiotherapy regimen
Phase 3 (Week 5-8)	Continued phase 1 exercises + partial weight bearing walk (PWBW) Knee ROM 0-110° Continuous passive motion to 0-120°
Phase 4-post-radiation (Week 9-12)	Continue phase 1 exercises + Full weight bearing walk with/without support (FWBW) Knee ROM 0-115° Continuous passive motion to 0-130° Wall assisted half squats Wall assisted squat hold for 20 seconds. Resistance band/ ankle weight assisted hamstring curls and quadriceps extensions
Phase 5-post PRP injection (Week 13-20)	Continue phase 4 exercises Knee ROM 0-120° Continuous passive motion to 0-135° Body weight half squats with weights and sumo squats Gait training Walking lunges with weights Jumping jacks and spot jogging
Phase 6 (Week 21-24)	Continue phase 5 exercises + FWBW Stretches

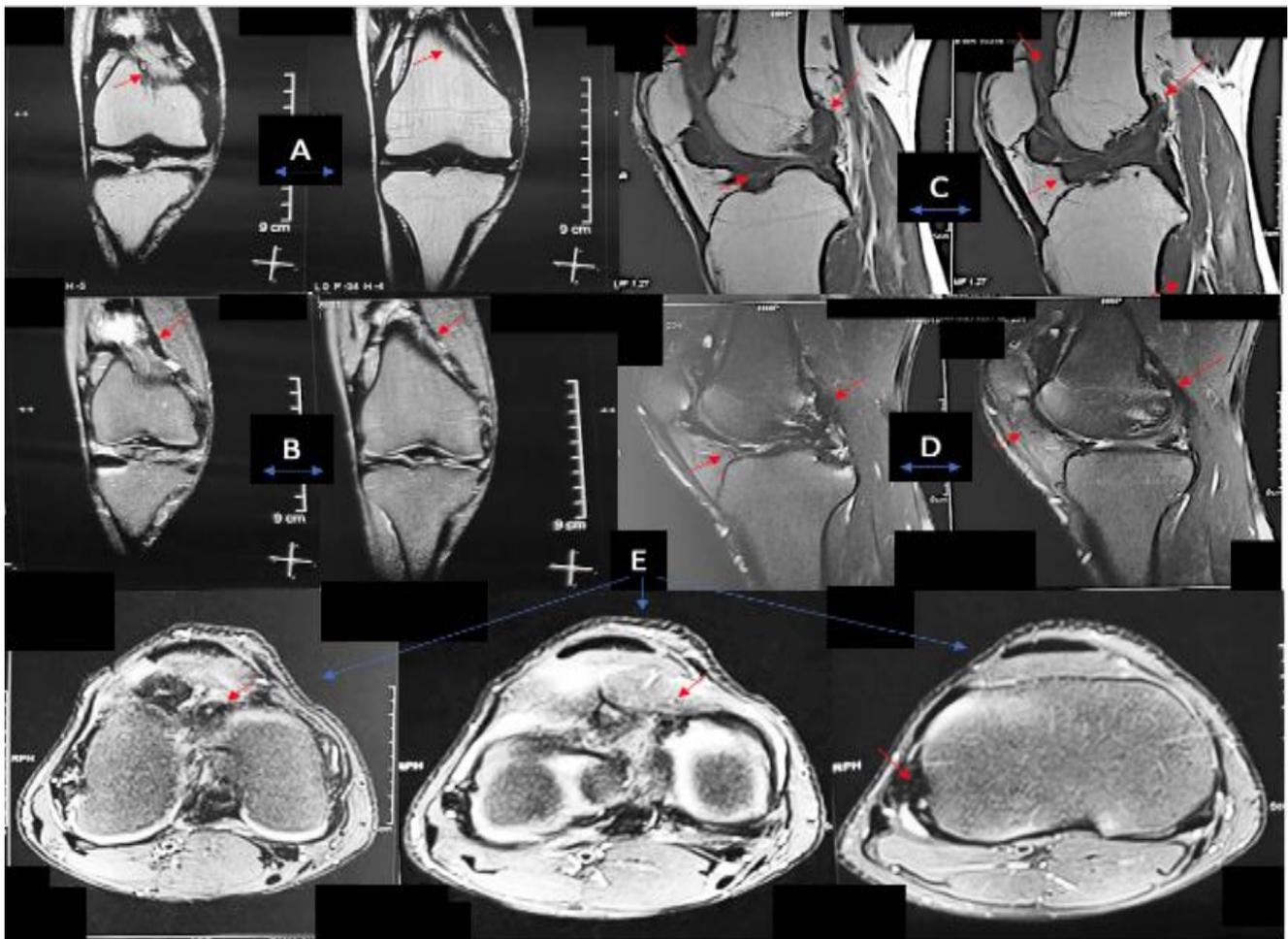


Figure 1 (A-E): MRI scans demonstrating diffuse synovial thickening characteristic of PVNS. Images (A) and (B) depict coronal views, (C) and (D) sagittal views and (E) an axial view on T1- and T2-weighted sequences, with arrows indicating areas of proliferative synovial tissue.



Figure 2 (A-C): Position of the knee and the surface marking for the portals.

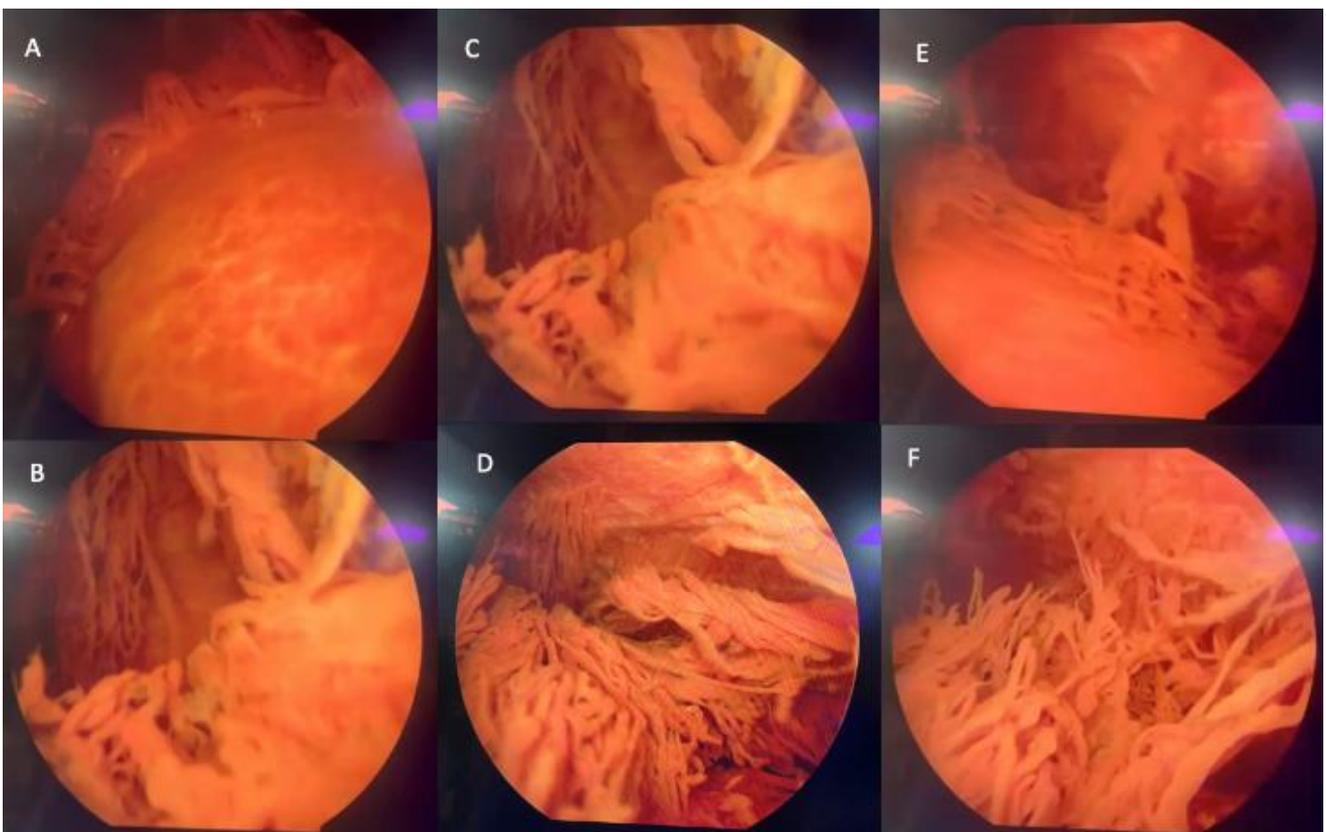


Figure 3 (A-F): Arthroscopic images demonstrating the characteristic diffuse reddish-brown frond-like synovial projections of PVNS. Images (A) and (B) show involvement of the medial gutter, (C) and (D) the suprapatellar pouch and (E) and (F) the lateral gutter.

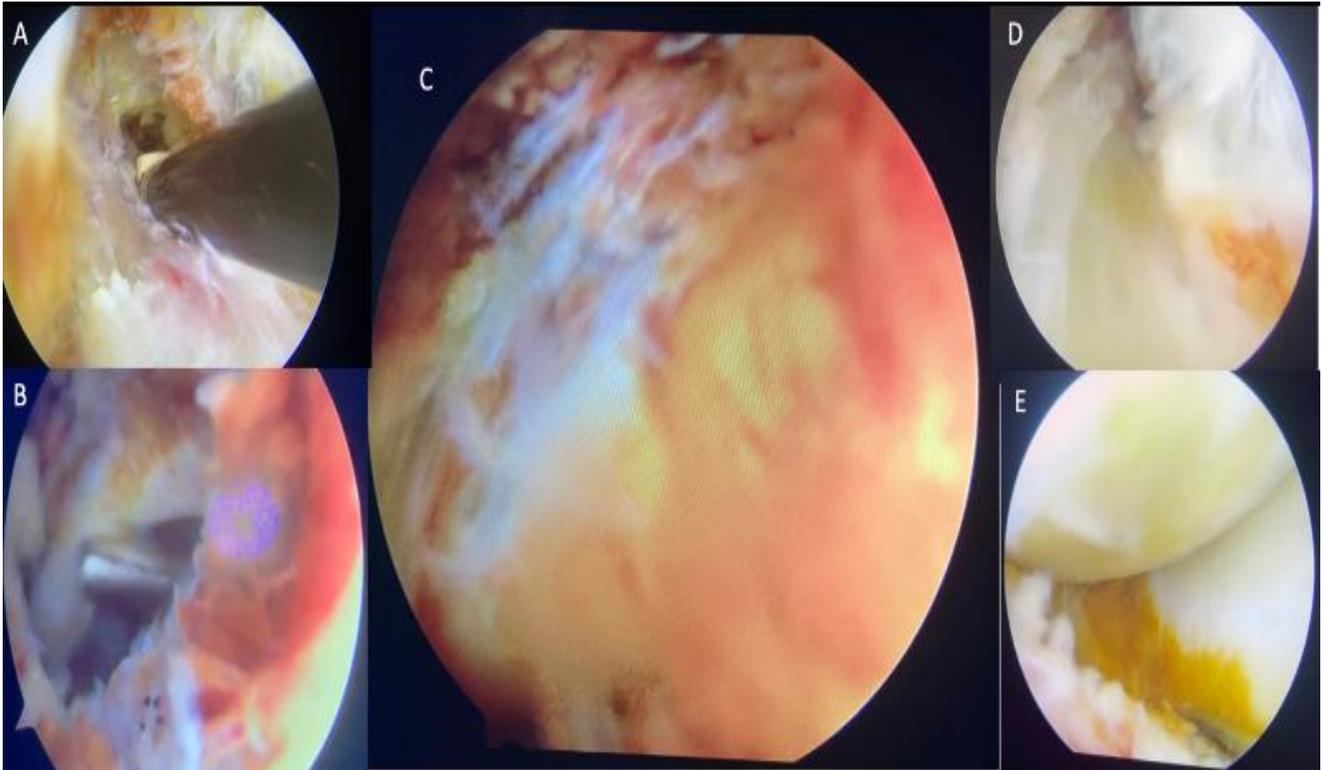


Figure 5 (A-E): Images (A) and (B) demonstrate the use of a laser coblator and shaver for synovial debridement in the anterior compartment. Image (C) shows the synovium following debridement. Images (D) and (E) highlight residual PVNS tissue located at the posterior horns of the medial and lateral menisci, respectively.

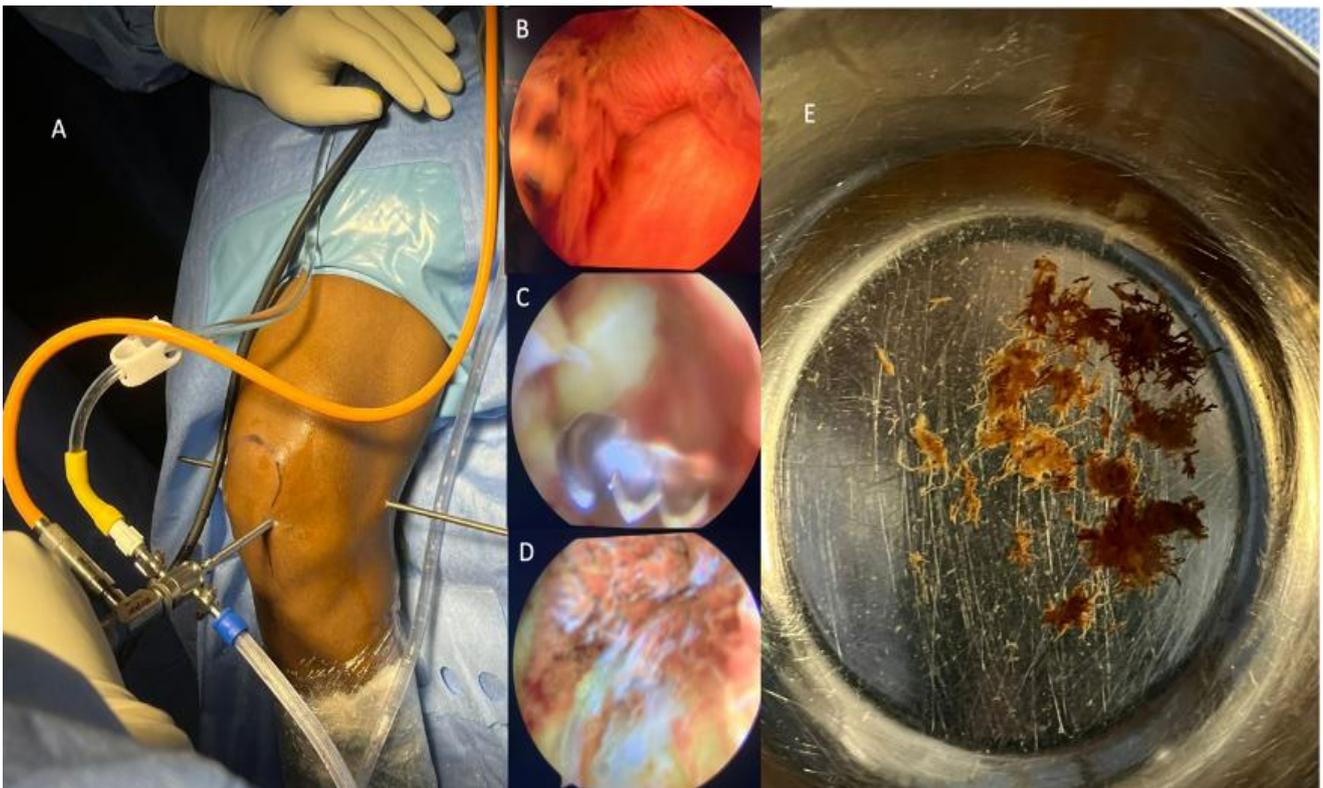


Figure 6 (A-E): Image (A) illustrates creation of the trans-septal portal. Images (B), (C) and (D) depict the sequential steps of PVNS identification, debridement and the post-debridement synovial surface. Image (E) shows the excised PVNS tissue sample collected for histopathological analysis.

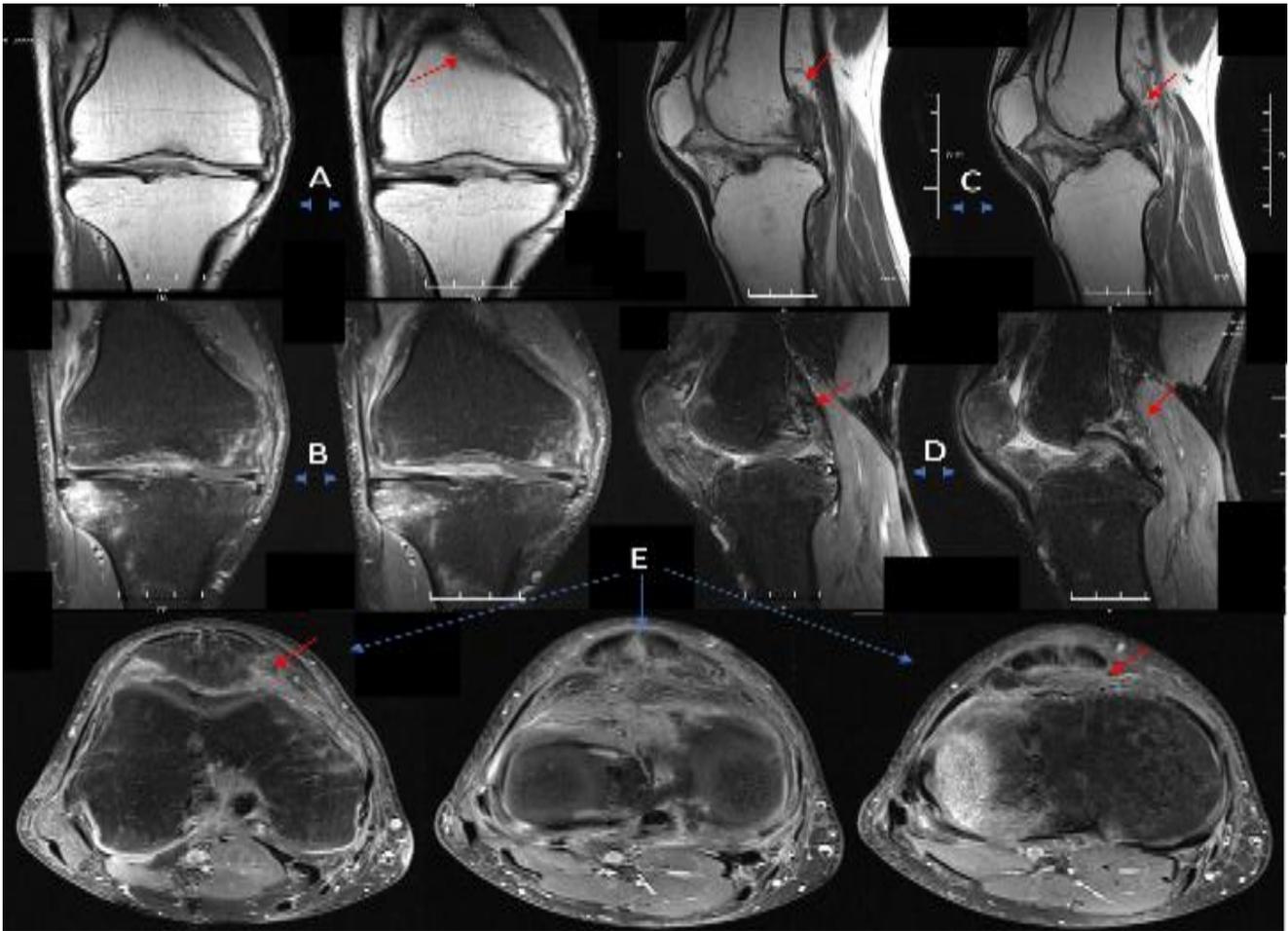


Figure 7 (A-E): MRI demonstrating postoperative reduction in synovial proliferation. Images (A) and (B) show coronal views, (C) and (D) sagittal views and (E) an axial view on T1- and T2-weighted sequences. Arrows indicate markedly reduced PVNS tissue with minimal residual thickening in the posterior compartment.



Figure 8 (A-E): Images (A) to (E) demonstrate the clinical assessment of hip and knee range of motion.

DISCUSSION

PVNS is a rare, benign proliferative synovial disorder predominantly affecting young adults, with an estimated annual incidence of approximately 1.8 per million.¹ The knee is the most frequently involved joint, followed by the hip and the ankle. PVNS exists in localized and diffuse forms, the latter of which is characterized by extensive synovial proliferation with a substantially higher risk of recurrence. The reported recurrence rates for diffuse PVNS range from 14% to over 40%, particularly when synovectomy is incomplete or when the disease extends into anatomically challenging regions, such as the posterior knee compartment.^{1,2} Diffuse lesions may infiltrate extra-articular tissues, further complicating management and increasing the risk of recurrence. The present case, demonstrating recurrent disease with posterior compartment involvement, highlights the aggressive behavior and complex treatment considerations associated with diffuse PVNS.

PVNS often presents insidiously, and its nonspecific clinical features may make early diagnosis difficult. Patients with diffuse PVNS typically experience a gradual onset of swelling, stiffness and limited range of motion, with symptoms that fluctuate over time. Hemarthrosis may occur spontaneously, leading to episodic joint discoloration. Mechanical symptoms, such as locking, catching or popping, may also be reported. Physical examination commonly reveals diffuse effusion, joint line tenderness, restricted motion and occasionally fixed deformities such as flexion contractures.²⁻⁴ Notably, pain may be mild or absent in early or recurrent disease, delaying recognition and treatment, as demonstrated in this case, where the patient's primary concerns were stiffness and recurrent swelling with minimal discomfort over several episodes.

MRI is the gold standard investigation for diagnosing PVNS because of its superior ability to delineate synovial proliferation, hemosiderin deposition and the extent of joint involvement. Characteristic MRI findings include low to intermediate signal intensity on both T1- and T2-weighted sequences caused by hemosiderin deposits, which generate distinctive blooming artifacts on gradient-echo sequences.⁵ Joint effusion and synovial thickening with frond-like projections are commonly observed. MRI precisely maps anterior and posterior compartment involvement, as well as possible extra-articular extension, which is essential for surgical planning, especially in recurrent cases. In addition to MRI, plain radiographs are often normal or show nonspecific findings such as soft tissue swelling or occasional bone erosions near the joint margins.^{5,6} Other imaging modalities, such as ultrasound and CT, have limited roles but may assist in selected cases. Histopathological examination following biopsy or synovectomy confirms the diagnosis, showing characteristic villonodular synovial hypertrophy with hemosiderin-laden macrophages and multinucleated giant cells.⁶ The MRI findings in this case closely reflect the

characteristic features of diffuse PVNS, with extensive synovial proliferation and low signal intensity on T1- and T2-weighted sequences. The disease involved both the suprapatellar compartment and the posterior recess along the PCL; a recognized pattern associated with increased surgical complexity and higher recurrence rates. Compared with earlier imaging, which showed predominantly anterior synovial involvement, the progression to posterior extension illustrates the aggressive behavior and recurrent potential of diffuse PVNS.

Management of PVNS, particularly in diffuse and recurrent forms, requires a structured, multimodal strategy to optimize outcomes and reduce the risk of recurrence.⁷ Surgical synovectomy remains the primary treatment modality and may be performed arthroscopically, via an open approach or through a combined technique depending on the extent and location of the disease.^{7,8} Arthroscopic synovectomy is preferred for anterior compartment involvement due to its minimally invasive nature, reduced morbidity and faster recovery.⁹ However, limited access to posterior or extra-articular regions can result in incomplete resection and subsequently higher recurrence rates. Open or combined approaches are therefore recommended when the disease extends into the posterior compartments or involves extensive synovial proliferation.^{7,9} Achieving complete synovectomy is critical, as residual pathological synovium is the principal contributor to recurrence. In recurrent cases such as the present one, preoperative MRI plays a key role in defining lesion extent, while advanced arthroscopic techniques, such as creation of a posterior trans-septal portal facilitate comprehensive access and more effective disease clearance.¹⁰

Adjuvant therapies in PVNS play a pivotal role in complementing surgical synovectomy, particularly in diffuse and recurrent cases, where complete excision is challenging. Radiation-based treatments, such as radiosynoviorthesis and external beam radiotherapy, aim to eradicate residual microscopic synovial disease that cannot be surgically removed.¹¹ Radiosynoviorthesis involves intra-articular injection of radioactive isotopes, such as Phosphorus-32 or Yttrium-90, which deliver localized radiation to ablate hyperplastic synovium.^{11,12} This method has demonstrated efficacy in reducing recurrence rates, especially when administered within weeks to months postoperatively, by targeting residual cells and diminishing the proliferative potential of the synovium. External beam radiotherapy, although less commonly used, is another option in refractory or extensive cases.¹² Biologic adjuvants, such as PRP injections, are emerging options that may accelerate tissue regeneration, modulate inflammation, and improve healing of the synovium and surrounding structures after surgical intervention.¹³ While current evidence for PRP's role in PVNS is limited, it is gaining interest due to its safety profile and potential benefits in functional recovery. Structured physiotherapy is equally essential, focusing on

restoring the knee range of motion, strengthening periarticular muscles and facilitating the return to normal activities to prevent stiffness and disability.¹⁴ In our patient, the multimodal approach incorporated radiosynoviorthesis post-synovectomy based on evidence supporting its effectiveness in recurrent diffuse PVNS, along with adjuvant PRP to enhance joint healing. This comprehensive adjuvant strategy likely contributed to significant clinical improvement despite residual imaging findings, underscoring the importance of combining modalities to optimize long-term outcomes

The limitations of this case report should be acknowledged. As a single observational case, the findings may not be generalizable to the broader PVNS population, given the rarity and heterogeneity of this condition. Although the patient demonstrated significant functional improvement over three years of follow-up, persistent synovial thickening on MRI introduces uncertainty regarding long-term disease control and the risk of further recurrence. The multimodal treatment strategy employed, that is, combining arthroscopic synovectomy, radiosynoviorthesis and PRP, precludes the determination of the individual therapeutic contribution of each modality, particularly in the absence of comparative or controlled data.

Additionally, while standardized, imaging interpretation and clinical scoring may be subject to inter-observer variability. The use of PRP, in particular, remains experimental because of limited evidence specific to PVNS. These limitations underscore the need for larger cohort studies and long-term follow-ups to better define optimal multimodal management strategies for recurrent diffuse PVNS.

CONCLUSION

This case highlights the complex and recurrent nature of diffuse PVNS of the knee, particularly when posterior compartment involvement complicates surgical access and increases the risk of recurrence. Comprehensive diagnosis using MRI is essential for accurately defining disease extent and guiding surgical and adjuvant treatment decisions. Advanced arthroscopic techniques, including the anterior transseptal portal, enable thorough synovectomy and enhanced lesion clearance. The addition of radiosynoviorthesis and structured physiotherapy, complemented by adjuvant PRP, contributed to meaningful long-term functional improvement despite persistent radiologic evidence of residual synovitis in the knee. The patient achieved substantial recovery in pain-free function, activity level and range of motion, demonstrating that a carefully planned multimodal approach can provide excellent clinical outcomes in recurrent diffuse PVNS. Continued surveillance is necessary because of the risk of late recurrence and further research involving larger cohorts is required to optimize treatment algorithms, clarify the role of adjuvant therapies and improve long-term disease control.

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REFERENCES

1. Myers BW, Masi AT. Pigmented villonodular synovitis and tenosynovitis: a clinical epidemiologic study of 166 cases and literature review. *Medicine (Baltimore)*. 1980;59(3):223-38.
2. Fang Y, Zhang Q. Recurrence of pigmented villonodular synovitis of the knee: A case report with review of literature on the risk factors causing recurrence. *Medicine (Baltimore)*. 2020;99(16):e19856.
3. Ma X, Shi G, Xia C, Liu H, He J, Jin W. Pigmented villonodular synovitis: a retrospective study of seventy five cases (eighty one joints). *Int Orthop*. 2013;37(6):1165-70.
4. Li Y, Mei L, Li T, Pang L, Tang X, Li J. Clinical outcomes of patients with pigmented villonodular synovitis of the shoulder after arthroscopic synovectomy. *BMC Musculoskelet Disord*. 2022;23(1):1023.
5. Cheng XG, You YH, Liu W, Zhao T, Qu H. MRI features of pigmented villonodular synovitis (PVNS). *Clin Rheumatol*. 2004;23(1):31-4.
6. Murphey MD, Rhee JH, Lewis RB, Fanburg-Smith JC, Flemming DJ, Walker EA. Pigmented villonodular synovitis: radiologic-pathologic correlation. *Radiographics*. 2008;28(5):1493-518.
7. Temponi EF, Barros AAG, Paganini VO, Barbosa VAK, Badet R, Carvalho Júnior LH de. Diffuse pigmented villonodular synovitis in knee joint: diagnosis and treatment. *Rev Bras Ortop*. 2017;52(4):450-7.
8. Rodriguez-Merchan EC. Review article: Open versus arthroscopic synovectomy for pigmented villonodular synovitis of the knee. *J Orthop Surg (Hong Kong)*. 2014;22(3):406-8.
9. Yang B, Liu D, Lin J, Jin J, Weng X-S, Qian W-W, et al. Surgical treatment of diffuse pigmented villonodular synovitis of the knee. *Zhongguo Yi Xue Ke Xue Yuan Xue Bao*. 2015;37(2):234-9.
10. Papamerkouriou Y-M, Posantzis MI, Kouremenos D, Manousakis C, Plessas SI. Arthroscopic technique for the treatment of localized pigmented villonodular synovitis of the knee. *Cureus*. 2020;12(4):e7832.
11. Duan Y, Qian J, Chen K, Zhang Z. Necessity of adjuvant postoperative radiotherapy for diffuse pigmented villonodular synovitis of the knee: A case report and literature review. *Medicine (Baltimore)*. 2018;97(3):e9637.
12. Kodyan J, Department of Radiation Oncology, University of Florida College of Medicine, Gainesville, FL, USA, Zlotecki RA, Scarborough M, Reith J, Mendenhall WM. The role of radiotherapy in the treatment of pigmented villonodular synovitis. *Hong Kong J Radiol*. 2017;47-52.

13. Kapoor C, Jhaveri M, Soni R, Shah M, Rathi P, Golwala P. Pigmented villonodular synovitis of the knee joint: A case report. *Cureus*. 2016;8(10):e816.
14. Alharbi JM. Post-operative physical therapy management of recurrence diffuse pigmented villonodular synovitis. *Int J Clin Studies Med Case Rep*. 2023;30:2.

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