Case Report

Pigmented Villonodular Synovitis: A Disease in Evolution

HENDA BOUALI, ERIC J. DEPPERT, LAWRENCE J. LEVENTHAL, BRIAN REEVES, and THOMAS POPE

ABSTRACT. Pigmented villonodular synovitis (PVNS) is a rare, benign, proliferative disease of the synovial membrane of joints, tendon sheaths, and bursas. Joint aspiration typically yields hemorrhagic or xanthochromic/serosanguinous (brown, murky) fluid. We describe a case of PVNS that presented as an acute, painless, nontraumatic right knee effusion with clear synovial fluid on arthrocentesis. Initial magnetic resonance imaging of the knee revealed no evidence for hemosiderin. A diagnostic arthroscopy and surgical arthrotomy revealed a unique case of PVNS evolving from local to diffuse involvement of the synovium. (J Rheumatol 2004;31:1659–62)

Key Indexing Terms:
PIGMENTED VILLONODULAR SYNOVITIS
MAGNETIC RESONANCE IMAGING
KNEE JOINT
SYNOVIAL BIOPSY

Pigmented villonodular synovitis (PVNS) is a synovial proliferation disorder that remains a diagnostic difficulty because of its nonspecific presentation and subtle radiographic findings. Clues gathered through the history, physical examination, and radiographic studies could aid in reaching the diagnosis. Despite magnetic resonance imaging (MRI) sensitivity in revealing findings consistent with PVNS, these findings are neither constant nor specific for PVNS.

PVNS usually presents in 2 unique forms, diffuse and localized. In the diffuse variety, the entire synovium of an affected joint or structure is involved. Grossly, the synovium is prolific with coarse villi, finer fronds, and diffuse nodularity. The synovium is often heavily pigmented, ranging from dark yellow to chocolate brown. The localized form involves only a portion of a synovial surface, tends not to be as darkly pigmented, and has less villous proliferation than is seen in the diffuse form. In cases of localized PVNS where the hemosiderin deposition is minimal, the MRI could be normal.

We describe an elusive case of PVNS in which the clinical presentation was acute, rather than insidious, the synovial fluid was clear rather than hemorrhagic or xanthochromic, and the initial MRI was negative for hemosiderin. The diagnosis was reached by diagnostic arthroscopy and a synovial biopsy, which revealed both diffuse and focal involvement. We propose that this represents a case of PVNS in evolution from local to diffuse form. The diagnosis of PVNS must be made with a high index of clinical suspicion and synovial biopsy, until a more sensitive noninvasive test can be developed.

From the Department of Rheumatology, The Graduate Hospital, Philadelphia, Pennsylvania; and the Department of Radiology, Medical University of South Carolina, Charleston, South Carolina, USA.

H. Bouali, MD, Research Fellow, Department of Rheumatology; E.J. Deppert, MD, Co-Director, Internal Medicine Residency Program; L.J. Leventhal, MD, FACP, FACR, Chair, Department of Medicine, Chief, Division of Rheumatology, Program Director, Internal Medicine Residency Program; B. Reeves, DO, Radiology Fellow; T. Pope, MD, FACR, Professor of Radiology, Medical University of South Carolina.

Address reprint requests to Dr. H. Bouali, 1314 Ashley Hall Road, Charleston, SC 29407. E-mail: boualih@musc.edu

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CASE REPORT

A 26-year-old white man complained of painless swelling and tightness of his right knee of 2 days' duration. There was no history of antecedent injury, locking, or instability. He denied fever, chills, weight loss, malaise, other joint pains or swelling, myalgias, venereal disease, gastrointestinal, genital, or urinary complaints, rashes, or tick bites, but did admit a vague distant history of trauma secondary to contact sports. Concern over the possible diagnosis of septic arthritis led to the need for hospitalization.

Abnormalities on examination were confined to the right knee. A nontender palpable effusion was noted. There was no mass, instability, or joint-line tenderness. All diagnostic meniscal tear maneuvers were negative. Arthrocentesis revealed 125 ml of yellow, minimally cloudy synovial fluid with 50,000 leukocytes. There was no evidence of crystals on polarizing microscopy. Synovial fluid culture for bacteria, fungus, and acid-fast bacilli were negative. Lyme titer, antinuclear antibodies, and rheumatoid factor were negative. Roentgenograms of the right knee and the sacroiliac joints were normal.

A 7-day course of vancomycin and gentamycin was administered. Daily arthrocentesis of the right knee was performed without corticosteroid injection. Hospital course was uncomplicated. A minimally persistent painless effusion of the right knee was noted at the time of discharge.

During 2 year followup the right knee was aspirated 12 times, with a rapid reaccumulation of clear fluid. A trial of corticosteroid injection was attempted with no symptomatic relief. MRI studies of the right knee were done without gadolinium, including T1 and T2 weighted images revealing a large effusion with a popliteal cyst and chronic synovial swelling, negative for hemosiderin. There was no evidence of PVNS or joint trauma (Figure 1).

A diagnostic arthroscopy revealed several nodules on vascular pedicles along with several fibrotic loose bodies in the joint. Interestingly, there were areas of synovium that were diffusely involved and others that had focal involvement. The lesions ranged from white to brown fronds, sessile

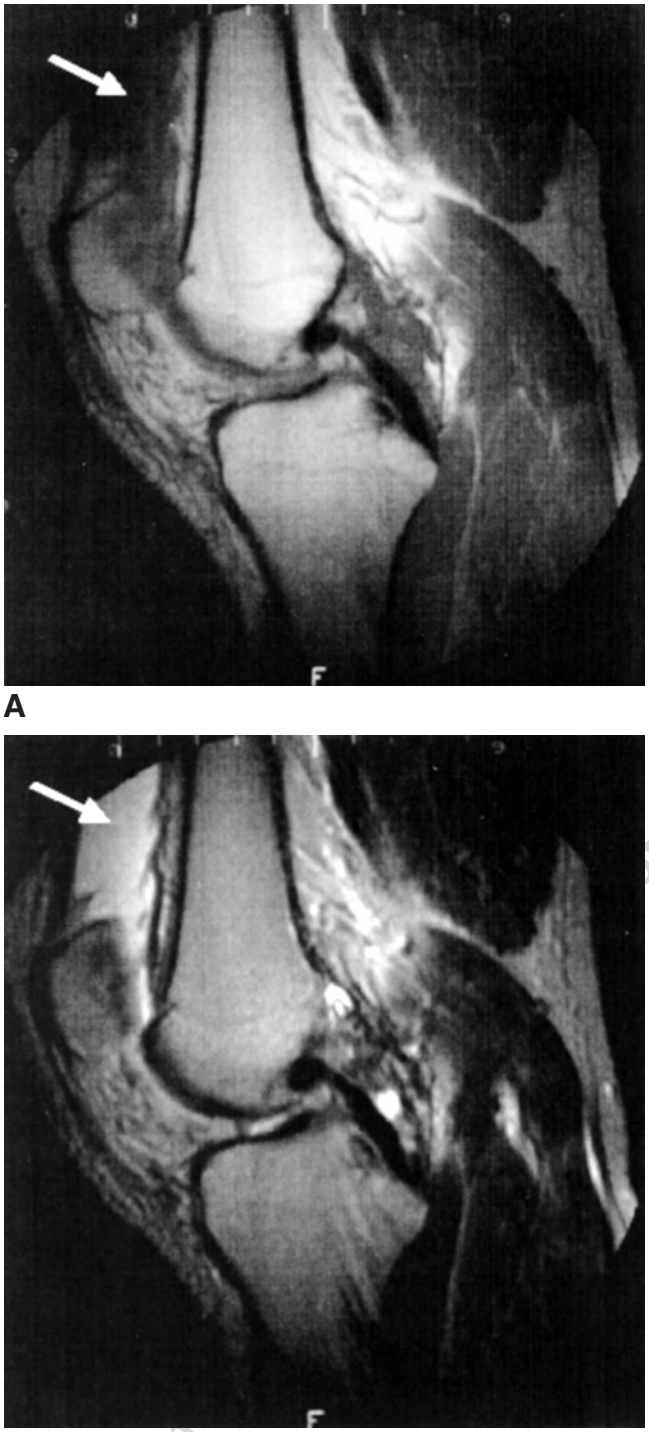


Figure 1. A. Sagittal T1 weighted MR image (TR 783, TE 20) midline at the level of the posterior cruciate ligament, showing a large suprapatellar effusion without evidence of synovial hypertrophy. B. Sagittal T2 weighted image (TR 2000, TE 80) shows large suprapatellar effusion without evidence of hemosiderin deposition within the synovium.

polypoid to vascular pedunculated. There were occasional gray-white bodies felt to represent torsed and infarcted tumor. There was no evidence of articular damage or internal derangement.

Histologic examination of the synovial biopsy showed a proliferation of multinucleated giant cells, fibroblasts, focal areas of hemosiderin-laden histiocytes, foam cells containing lipid, full of vascular congestion, and hemorrhage consistent with PVNS (Figure 2).

Surgical synovectomy was performed. One year after surgical resection, a recurrence of the same symptoms was noted that was treated by a repeat arthroscopic synovectomy. Interestingly, the arthroscopy revealed some areas of "local" PVNS with juxtaposed normal synovium, with the remaining synovium being involved much more diffusely compared to the initial arthroscopic view one year previously.

A yearly followup MRI of the right knee was performed. These eventually depicted decreased signal intensity in T1 and T2 weighted images more typical of the classic MRI findings seen with DPVNS (Figure 3).

Since then the patient has resumed full functional capacity and has been symptom-free for the last 11 years.

DISCUSSION

PVNS is a rare, benign, proliferative disease of the synovial membrane of joints, tendon sheaths, and bursas[1-3]. The first description of PVNS is attributed to the 1852 writings of Chassaignac[4]. Simon described a focal form of PVNS in 1865, and Moser in 1909 described a diffuse PVNS[5,6]. A variety of names had been used to describe this lesion, such as synovial xanthoma, synovial endothelioma, benign fibrous histiocytoma, myeloplaxoma, and fibrohemosiderinic sarcoma[7]. In 1941, Jaffa, *et al* recognized that the differing morphologies represent variants of the same proliferative disorders of joints and tendons[8].

The etiology of PVNS is still uncertain[9,10]. Chronic inflammation, trauma, hemarthrosis, neoplastic origin, and chromosomal disorder have been considered to be the

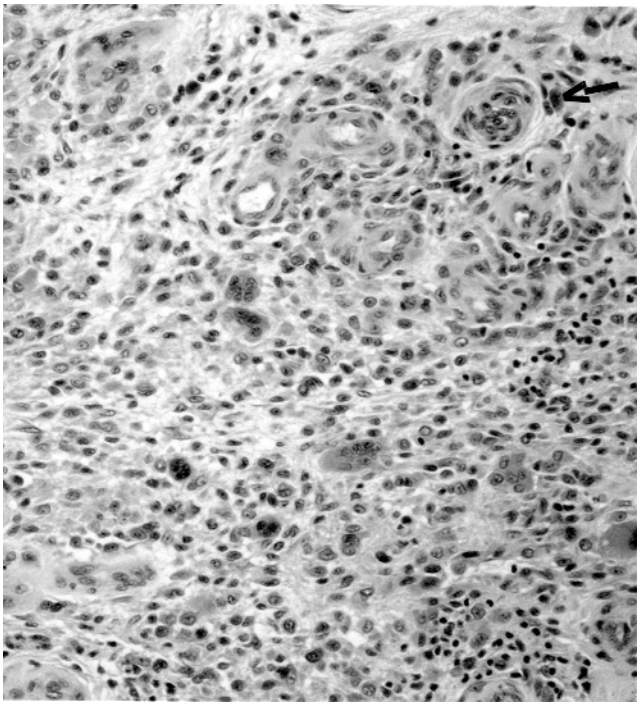
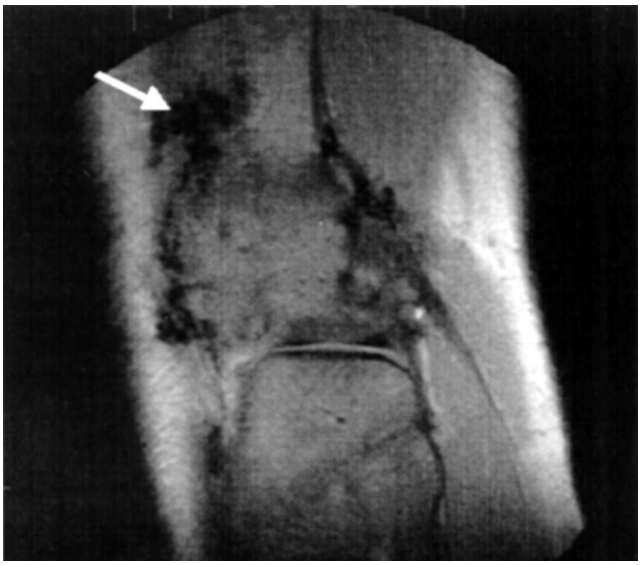


Figure 2. Photomicrograph reveals synovial proliferation with multinucleated giant cells, foamy macrophages, and hemosiderin-laden histiocytes (arrow) (high power ×200, H&E stain).



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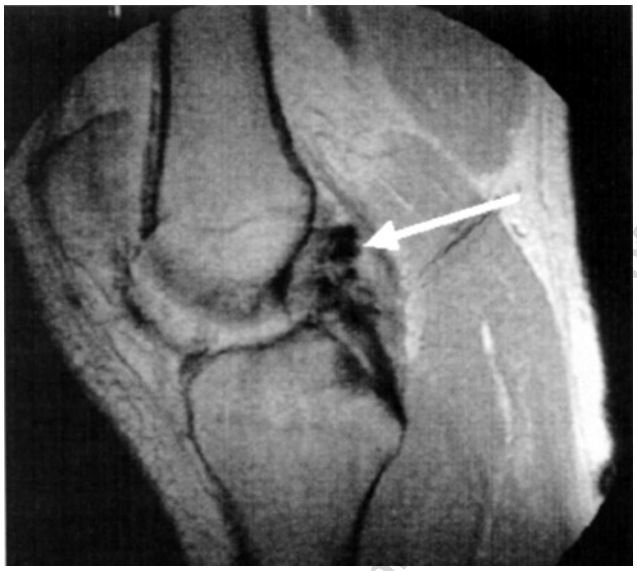

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Figure 3. A. Sagittal gradient echo MR image (TR 50, TE 15, flip angle 30°) through the lateral compartment reveals irregularly round and ovoid regions of intermediate and low signal intensity in the suprapatellar bursa and infrapatellar joint space consistent with hemosiderin deposit. B. Sagittal gradient echo MR image (TR 50, TE 15, flip angle 30°) midline at the level of posterior cruciate ligament reveals irregularly round and ovoid regions of intermediate and low signal intensity posteriorly at the distal femoral metaphysis consistent with hemosiderin deposit.

cause[9,11-13]. PVNS affects young adults in their third or fourth decades[10,14-16]. The incidence is 1.8 per 1 million per year[9,11,16,17]. Some studies have shown that men are almost twice as likely to be affected compared to women, but others report an equal distribution[2,10,15,16,18,19]. It is nearly always monoarticular[2,9,13,15]. The knee is the most common joint involved, representing 80% of cases, followed by the hip (15%) and the ankle (5%)[2,7,12,20]. PVNS presents in 2 forms, local and diffuse, the latter occurring more often[13]. It is usually slow-growing with subtle presentations[10,11]. Local recurrence can be as high as 45%[3,11,21]. The onset of symptoms is typically insidious[10]. The average duration of symptoms before diagnosis has been reported to be between 10 and 26 months (range 2–72)[10,22]. The acute onset in our patient is quite unusual.

The lesion is manifested by nonspecific clinical symptoms such as locking, giving away, localized tenderness, pain, diminished range of motion, mass effect, swelling, stiffness, snapping, or instability[12,14]. Aspirated synovial fluid is typically xanthochromic or serosanguinous[2,7,14,17,22]. That the synovial fluid was clear at presentation and even at followup arthrocentesis moved PVNS lower on the list of differential diagnoses.

Plain radiograph images are usually normal, but in 15% of cases there may be some bony changes like an increased density of the synovium or typical radiolucent cystic defects[14,16].

MRI is particularly useful because it depicts the complex intraarticular relationships of the joint and delineates the nature and extent of soft tissue lesions[11]. The signal intensity is decreased in both T1 and T2 weighted images[16,23,24]. This signal feature correlates with the varying amounts of hemosiderin in the lesion[1,16,23,24]. The MRI pattern in localized PVNS is less constant than in diffuse PVNS because of the difference in hemosiderin content[16]. In cases in which hemosiderin deposition is minimal, the characteristic low signal may not be apparent, as in our patient[17,23]. If less hemosiderin is present, signal intensity is more likely to be intermediate between that of diffuse PVNS and that of skeletal muscle[14]. Our case is unique not only because of the unusual acute presentation or the clear synovial fluid, which can occur occasionally, but also because of the progressive change in the MRI findings that reflect the varying amount of hemosiderin in the lesion at different times. Since hemosiderin may be less common in the lining cells in localized PVNS, this may account for an initially normal MRI in our patient. The MRI of the recurrence revealed hemosiderin deposits consistent with diffuse PVNS. Despite the sensitivity of MRI in describing images consistent with PVNS, it is not specific because other conditions may present with similar findings, such as fibrous tumors, chronic hemarthrosis, amyloid, gouty tophi, osteoarthritis, and rheumatoid arthritis[1,11,16,22-24].

The difference between diffuse and localized PVNS is clearly illustrated by the gross pathologic features. Diffuse PVNS is typified by formation of a thick, plush synovium consisting of matted masses of villi and synovial folds, with sessile or pedunculated nodules. Localized PVNS is typified by a pedunculated firm yellow nodule[2,12,18]. In the diffuse form the involved synovium is usually covered with tan to brown irregular papillary projections and larger nodular

protrusions[2]. Coarse papillae have been described to have a "mossy," "straggly beard," or "shaggy carpet" appearance, while fine villi are described as "fern-like"[7]. The localized form, however, is noted for its limited involvement and its pedunculated appearance[7]. In our case, the arthroscopy revealed several nodules on vascular pedicules with fibrotic loose bodies in the joint space, consistent with areas of localized PVNS, some normal synovium and the remaining synovium more diffusely involved compared to the initial arthroscopic appearance seen one year earlier. The lesions ranged from brown sessile polypoid to vascular pedunculated with occasional gray-white loose bodies, which were felt to represent torsed and infarcted "albino" tumor.

Microscopically, PVNS is characterized by a subsynovial mononuclear histiocytic reaction with the presence of occasional multinucleated giant cells, sheets of small ovoid or spindle-shaped cells, macrophage plasma cells, and a rich vascular plexus[14]. Mitotic figures are common[7]. The treatment of choice is a complete synovectomy performed arthroscopically or through an open arthrotomy. The use of adjuvant radiation therapy following primary resection for high-risk lesions may improve local disease control, but it is controversial[3,7,12,24,25]. In advanced disease, surgical arthrodesis or a total joint replacement has been suggested[10,15,17,19]. Major amputation should be avoided except in the most extreme cases of recurrent disease[3,12]. Recurrence is common, but malignant transformation is rare[2,3,7,11,18].

We propose that this case represents PVNS in evolution from local to diffuse form, which may have contributed to the initial difficulty in reaching the diagnosis. We warn about MRI as the *sine qua non* of noninvasive diagnosis, especially if the case is early in the evolution with low amounts of iron-laden macrophages. We believe that the diagnosis must be made with a high index of clinical suspicion and synovial biopsy until a more sensitive test can be developed for cases in the early evolution stage.

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