

Result of Arthroscopic Treatment of Pigmented Villonodular Synovitis of the Knee

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Purpose: We report 10 years' experience in arthroscopic treatment of pigmented villonodular synovitis (PVNS) of the knee in a series of patients affected by the localized or diffuse form of the disease. The purpose of the study is to critically examine the results of arthroscopic synovectomy in the knee affected by PVNS, to determine the safety and effectiveness of the procedure. **Type of Study:** Retrospective case analysis. **Methods:** The study population consists of 19 patients, with an average follow-up of 60 months (minimum, 12; maximum, 128). All patients underwent knee arthroscopy. The 3 standard portals were used; posteromedial and posterolateral portals were added if required. Four patients were affected by localized PVNS and were subject to partial synovectomy with excision of the pathologic tissue. The remaining 15 patients presented a diffuse form of PVNS; 7 of them underwent extended arthroscopic synovectomy and 8 underwent partial synovectomy. The diagnosis was confirmed by synovial biopsy. **Results:** In the group affected by the localized form of PVNS, the arthroscopic local excision resulted in a complete and persistent regression of the pathology. Among the patients affected by the diffuse form of PVNS, clinical results were better and the recurrence rate was lower in the group treated with extended synovectomy. No relevant complications were encountered. In particular, no cases of infection, stiffness, or neurovascular lesions were seen. **Conclusions:** Arthroscopic synovectomy is an appropriate treatment for knee PVNS. Extended synovectomy must be performed in all cases of diffuse PVNS. **Key Words:** Pigmented villonodular synovitis—Arthroscopic synovectomy—Knee.

Pigmented villonodular synovitis (PVNS) is a proliferative pathology of the synovial membrane, often localized in the knee. It is seen much less frequently in other joints.^{1,2} It is a rare pathology; the annual incidence has been calculated as 1.8 cases per million population.³

Because of the rarity of cases and the difficulty of collecting numerically consistent case histories, the treatment of PVNS is under discussion to this day. However synovectomy, extended or limited to the area of PVNS, appears to be the treatment modality

with the best results. In particular, with the advent of modern techniques of arthroscopic surgery, the question was posed whether it is more appropriate to treat cases of PVNS with traditional synovectomy or whether arthroscopic synovectomy⁴ is more effective. In this article, we report 10 years' experience in the arthroscopic treatment of PVNS of the knee.

METHODS

The study population consisted of 19 consecutive patients (9 men, 10 women) treated at our institution from 1990 through 1999 diagnosed with PVNS. The average patient age was 59 years (minimum, 37; maximum, 83).

All patients underwent knee arthroscopy, independent of previous treatment or whether PVNS was localized or diffused. The 3 standard portals were used (anteromedial, anterolateral, and superomedial). Posteromedial and posterolateral portals were added if

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TABLE 1. *Criteria for Assessment of Results According to Ogilvie-Harris⁵*

	No Points	1 Point	2 Points	3 Points
Pain	Severe	Moderate	Slight	None
Synovitis/swelling	Severe	Moderate	Slight	None
Range of motion	More than 20% loss	10% to 20% loss	0% to 10% loss	Normal
Function	Minimal activity	Reduced activity	Almost complete activity	Complete activity

required. We routinely used a 30° arthroscope; when required, a 70° arthroscope was introduced through the posteromedial and posterolateral portals and the intercondylar notch.

The patients with localized lesions underwent partial synovectomy. In these cases, we carefully explored the knee to disclose the presence of other lesions. Patients showing the diffused form of the disease underwent partial or extended synovectomy. The synovectomy was performed using a 5.5-mm full-radius resector in the oscillating mode. Synovial biopsy was performed in all cases. A standard H&E stain was used for histologic examination.

All the patients had an intra-articular suction drain that was removed 24 hours after surgery. The patients began physical therapy (passive range of motion and isometric quadriceps contraction exercises) the same day.

Each patient was evaluated before treatment and 3 months after it. At follow-up, the patient's condition was rated as excellent, good, fair, or poor, following the evaluation criteria proposed by Ogilvie-Harris et al.⁵ The following parameters were considered: articular pain, synovitis or articular effusion, range of motion, and functional ability. Scores from 0 to 3 were assigned to each of these parameters (Table 1). To globally evaluate the results of the arthroscopic treatment, we calculated the arithmetic average of the scoring obtained by the various parameters considered in homogeneous classes of treatment. We considered scores between 0 and 3 as poor, between 4 and 6 as fair, between 7 and 9 as good, and between 10 and 12 as excellent.

RESULTS

All 19 patients were available for follow-up. Mean follow-up was 60 months (minimum, 12; maximum, 128). The right side was affected in 10 cases and the left side in 9. Five patients had been treated previously in other hospitals. However, none had been previously diagnosed with PVNS or received surgical treatment specific for PVNS. In 2 cases, a diagnosis of medial and lateral meniscal tears was made, respectively. One of these patients underwent selective arthroscopic meniscectomy without the PVNS being noticed. In 1 case, a diagnosis of popliteal cyst was made, and the patient underwent surgical removal of the cyst itself. The cyst recurred after 6 months. In the remaining 2 cases, gonarthrosis was diagnosed.

In no case was a certain diagnosis made before the arthroscopy. In 6 cases, PVNS was suspected on the basis of clinical and instrumental findings. In 6 cases, a magnetic resonance imaging (MRI) study was made before surgery. In 5 cases, the MRI showed a synovial hypertrophy compatible with PVNS. In 1 case, the MRI was interpreted as a tear of the lateral meniscus. At arthroscopic examination, the presence of a nodular lesion near the anterior horn of the lateral meniscus was found. Successive review of the MRIs showed a case compatible with formerly misdiagnosed PVNS.

The average time between the beginning of symptoms and surgical treatment was 20 months. In these patients, the most frequent preoperative symptoms (Table 2) were joint effusion, true recurring hemarthrosis, and spontaneous pain. In some cases, the

TABLE 2. *Preoperative Signs and Symptoms in the Study Population*

	Hemarthrosis/ Swelling	Locking/ Pseudolocking	Pain	Popliteal Cyst	Decreased ROM	Instability	Palpable Mass
No. of patients	17	6	17	3	13	2	1
Percentage	89.5	31.6	89.5	15.8	68.4	10.5	5.3

TABLE 3. Results of Treatment

Patients	Sex	Age (yrs)	Pain		Synovitis		ROM		Function		Total Score	
			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Diffuse PVNS												
extended synovectomy												
LO	F	42	0	3	0	3	1	3	1	3	2	12
TT	M	37	1	3	1	3	1	3	1	3	4	12
BG	M	66	1	3	0	3	0	2	0	2	1	10
BL	F	55	1	3	0	2	1	3	0	2	2	10
BA	F	76	0	3	0	2	1	3	0	2	1	10
CE	M	76	0	1	0	2	0	2	0	1	0	6
MR	F	52	1	3	0	2	1	3	1	3	3	11
Mean			0.57	2.71	0.14	2.43	0.71	2.71	0.43	2.29	1.86	10.14
Diffuse PVNS												
partial synovectomy												
RA	F	47	0	2	0	0	0	1	0	1	0	4
PV	F	73	0	1	0	1	1	2	0	1	1	5
TA	M	68	1	3	1	2	2	3	2	3	6	11
BE	M	83	3	3	0	2	3	3	2	3	8	11
CP	M	69	1	2	1	2	1	2	1	2	4	8
CM	F	73	1	2	1	2	1	2	1	2	4	8
CC	M	43	1	3	1	2	3	3	2	3	7	11
GR	F	62	1	2	1	2	1	2	1	2	4	8
Mean			1	2.25	0.62	1.62	1.5	2.25	1.12	2.12	4.25	8.25
Localized PVNS												
EP	F	40	1	3	3	3	3	3	1	3	8	12
RR	M	78	1	3	1	3	2	3	1	3	5	12
PP	F	50	1	3	1	3	2	3	1	3	5	12
BM	M	37	3	3	1	3	1	3	1	3	6	12
Mean			1.5	3	1.5	3	2	3	1	3	6	12

NOTE. Pre and post refer to evaluation (see Table 1) before and after surgery.

presence of articular locking or pseudolocking was noticed, especially in the localized disease.

Four patients (21%) were diagnosed with the localized form. In these cases, a resection of the nodular lesion and of the surrounding synovial tissue was performed. In the other 15 cases (79%), the diffuse form of the disease was noted. In 8 of these cases, a partial synovectomy was performed using the 3 standard portals. In the remaining 7 cases, an extended synovectomy was performed using the 3 standard portals and 1 or 2 supplementary portals (including posteromedial and posterolateral portals). In 1 case in this last group, after the arthroscopy, removal of a voluminous popliteal cyst was performed using a posterior open approach.

The histologic appearance was the one classically described in literature. It was similar for localized and diffused forms and was characterized by the active proliferation of fibroblasts and histiocytic cells containing hemosiderin deposits. A variable number of multinucleated giant cells and inflammatory elements, predominantly lymphoplasmocytes, were also seen.⁶

The results are listed in detail in Table 3, both regarding the parameters for single patients and the parameters for the various homogeneous treatment classes: diffuse PVNS treated with extensive synovectomy, diffuse PVNS treated with partial synovectomy, and nodular PVNS treated with resection of the nodule.

Considering the average global score for each group, we noted that the group of patients with diffuse PVNS treated with extensive synovectomy improved from an average preoperative score of 1.86 points to an average postoperative score of 10.14 points. Scores for patients with diffuse PVNS treated with partial synovectomy went from an average preoperative score of 4.25 to a postoperative average score of 8.25 points. Finally, scores for the group of patients with nodular PVNS rose from an average preoperative score of 6 points to an average postoperative score of 12 points.

In cases of nodular disease, the result was excellent from the beginning; no recurrence was seen. For patients with diffuse disease who underwent extensive

synovectomy, immediate good results were maintained in 80% of cases. In 50% of the cases treated with partial synovectomy, symptoms (effusion, pain, movement impairment) recurred in the first 2 years. A further 25% of patients experienced a progressive deterioration of clinical condition but did not request a new surgical treatment.

No relevant complications were encountered. In particular, no cases of infection, stiffness, or neurovascular lesions were seen. In patients with the diffuse form, especially those treated with extensive synovectomy, slower functional recovery was noted. This was mainly affected by the presence of joint effusion in the first month after surgery, with a consequent delay in recovery of the last degrees of flexion. However, the postoperative course was considered normal in all cases.

DISCUSSION

PVNS is rarely encountered³ and difficult to diagnose. Often, diagnosis is delayed 2 to 3 years after symptoms begin.⁷ Also, many of the patients in our study lamented long-term inconvenience from the delay in diagnosis (average, 20 months). Some had even undergone surgical treatment for other intra-articular pathologies without being correctly diagnosed. In some cases, the diagnosis was proven only after arthroscopy and biopsy. All of this testifies to the difficulty of correctly diagnosing PVNS. In fact, nodular forms can simulate an internal knee derangement,^{8,9} such as meniscal lesions^{10,11} or loose bodies.¹² Diffused forms can simulate chronic phlogistic forms (such as arthritic or rheumatic arthrosynovitis).

MRI can be helpful, thanks to the paramagnetic effects of the hemosiderin deposits in the synovial macrophages.^{9,13-18} This is also helpful if the MRI appearance is not always pathognomic.

The presence of repeated hemarthrosis in the absence of traumatic events is strongly suggestive of PVNS. In our case histories, recurrent hemarthrosis is the most frequent clinical sign, and is particularly specific in cases of PVNS. Sometimes the underlying pathology is revealed by the presence of a popliteal cyst¹⁹ in recurrent or chronic inflammation and joint effusion.

Currently, surgical treatment is considered the best form of therapy. In our case histories, similar to what is described in the literature,²⁰⁻²³ the best results were obtained in the nodular form of PVNS. In this form, resection of the synovial localization almost always

resulted in a nearly complete resolution of symptoms. Some authors suggest removing the implant portion of the synovial nodule with an electrocautery to control bleeding.¹² In our experience, however, we did not encounter particular problems with bleeding at the resection site of localized PVNS.

In some reports,^{9,24,25} nodular PVNS treated arthroscopically showed a complete resolution of clinical symptoms without noteworthy complications. Recurrence of the illness after resection of the localized form is rare.^{26,27} In the diffused form, the commonly suggested treatment is partial or extensive synovectomy.^{4,5,10,21,23,24,27} The main problem appears to be the high rate of recurrence. In our cases, we obtained an improved clinical result and lower rate of recurrences with extensive synovectomy, using 4 or 5 access points to reach the posteromedial and posterolateral part of the joint cavity.

The cases in which we performed partial synovectomy presented with apparently better preoperative conditions. In fact, The average preoperative score in this group was 4.25 points, better than the initial average score of the group who underwent extended synovectomy (1.86 points). This induced us to limit synovectomy to the anterior part of the joint, through the 3 standard access points (anteromedial, anterolateral, and superomedial). However, this group of patients experienced the worst results, both in clinical improvement and recurrence rate.

Our recurrence results are comparable to the best results with the traditional open surgical approach. The reported rates of recurrence after open synovectomy for diffuse PVNS of the knee vary in the literature. Byers et al.²⁷ reported 46%; Johansson et al.²¹ reported 33%; and Schwartz et al.²⁸ reported 25%, increasing to 35% after 25 years. The best results are those obtained by Flandry et al.,²³ who reporting a recurrence rate of 8% with a radical open-approach synovectomy. Many authors suggest that recurrence is due to an incomplete resection of the pathological tissue, highlighting the fact that it is fundamental to execute a radical resection of the lesion. However, this is not easy to accomplish arthroscopically. As with all technical procedures, a definite learning curve exists for radical arthroscopic synovectomy.²⁹ Contrary to cases treated arthroscopically, complications such as pain and joint stiffness are frequently noted after open synovectomy.^{21,28} We do not currently have direct experience using radiation therapy²⁶ in association with synovectomy to reduce the recurrence rate.²⁹

We can conclude that arthroscopic treatment has an

efficacy similar to that with the open approach. Therefore, in case of unforeseen PVNS found during arthroscopy, it appears appropriate to proceed with the same surgical technique. The advantage of arthroscopic treatment is in the lower rate of complications (e.g., joint stiffness, infections) and quicker functional recovery due to more limited invasiveness. In localized forms, resection of the synovial area is generally simple, and the results are excellent and long lasting. Arthroscopy also allows a more accurate diagnosis and localization of limited lesions. Finally, in cases of recurrence, it is possible to examine the joint safely and noninvasively. Arthrotomy revision would be more demanding and is associated with a high frequency of complications.

Therefore, arthroscopy is preferable to traditional open synovectomy. In the diffused forms, a radical resection of the synovial lesion is imperative but not always viable arthroscopically. However, we believe arthroscopic synovectomy is preferable if feasible and only if it is not possible to completely resect the synovial lesion arthroscopically should an open approach be used. The latter is also recommended if associated lesions such as a popliteal cyst are present. Although a purely arthroscopic treatment for popliteal cysts communicating with the joint was recently suggested,³⁰ in PVNS cases, we believe it is appropriate to proceed with a combined, 1-stage treatment. After the arthroscopic synovectomy, removal of the popliteal cyst through an open posterior approach should be performed. This is because a possible extra-articular synovial localization, if not resected, could induce recurrence of the intra-articular synovitis.

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