Arthroscopic Treatment of Localized Pigmented Villonodular Synovitis: Long-Term Functional Results

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Abstract

Pigmented villonodular synovitis (PVNS) is a proliferative disorder that may lead to joint destruction and activity limitation.

We conducted a retrospective study to determine the long-term results of localized PVNS (LPVNS) treated with arthroscopic excision, specifically with respect to postoperative activity level and symptom resolution. We reviewed the cases of 11 patients who had been treated with arthroscopic excision and partial synovectomy of LPVNS and were observed for a mean of 112 months. Preoperative and postoperative Ogilvie-Harris scores, Tegner activity level scores, and UCLA activity level scores were calculated to determine disease-specific and general functional outcomes, respectively.

We noted recurrence of posteromedial lesions in 2 cases, moderate resolution of preoperative symptoms in most cases, and the development of secondary osteoarthritis requiring surgical intervention in 2 cases. Arthroscopic excision of LPVNS can improve symptoms with a return to preoperative activity levels, but patients may develop secondary osteoarthritis after treatment, as noted in long-term follow-up.

Pigmented villonodular synovitis (PVNS) is a proliferation of synovial cells and histiocytes with subsequent deposition of hemosiderin and cholesterol within the joint space.[1] This disease process can lead to significant erosion of joint surfaces and can invade surrounding soft tissues. PVNS is classically described as a monoarticular process, most commonly involving the knee, occurring in either a diffuse or a localized form.[2] Incidence of localized PVNS (LPVNS) has been reported to be 1.8 cases per million in the general population.[3]

LPVNS has been reported to respond well to arthroscopic or open local excision in short- to mid-term follow-up.[4,5] Recurrence rates have been reported to be 0% in patients treated with arthroscopic excision of LPVNS.[6,7] In a study of 10 patients treated with arthroscopic excision, Dines and colleagues[8] found no recurrences over a mean follow-up of 65.8 months. Six of these 10 patients received perfect Lysholm knee scores during follow-up evaluations. However, a common complaint in those without perfect scores was knee pain with exertion. This may represent a potential setback in return to activity, whether competitive or recreational.

Commonly reported signs and symptoms of LPVNS include pain, recurrent effusion, and decreased range of motion (ROM).[8] These have been quantified in the scoring system proposed by Ogilvie-Harris and colleagues.[4] This system provides a scale of clinical severity for patients with PVNS. Ogilvie-Harris (OH) scores have been used to specifically assess patients with both forms of PVNS.[4,9]

Activity level can be affected significantly by LPVNS, and, therefore, functional outcome is a significant concern. UCLA and Tegner activity level scores provide a continuum of activities ranging in participant effort required.[10,11] The literature does not include any reports of long-term studies evaluating preoperative and postoperative activity levels for patients with LPVNS treated with arthroscopic excision.

We conducted a study to assess the functional outcomes of patients with LPVNS treated with arthroscopic excision. We used OH, Tegner, and UCLA scores to determine the long-term results of treatment. We hypothesized that, after arthroscopic excision of LPVNS, there would be no recurrences, activity levels would be improved, and symptoms would be decreased.

Materials and Methods

After obtaining review board approval, we searched our institution's medical records for cases of treated LPVNS. Localized, solitary lesions of PVNS had been confirmed by arthroscopy. Inclusion criteria were pathologic confirmation of LPVNS, arthroscopic excision with partial synovectomy, and minimum follow-up of 2 years. No

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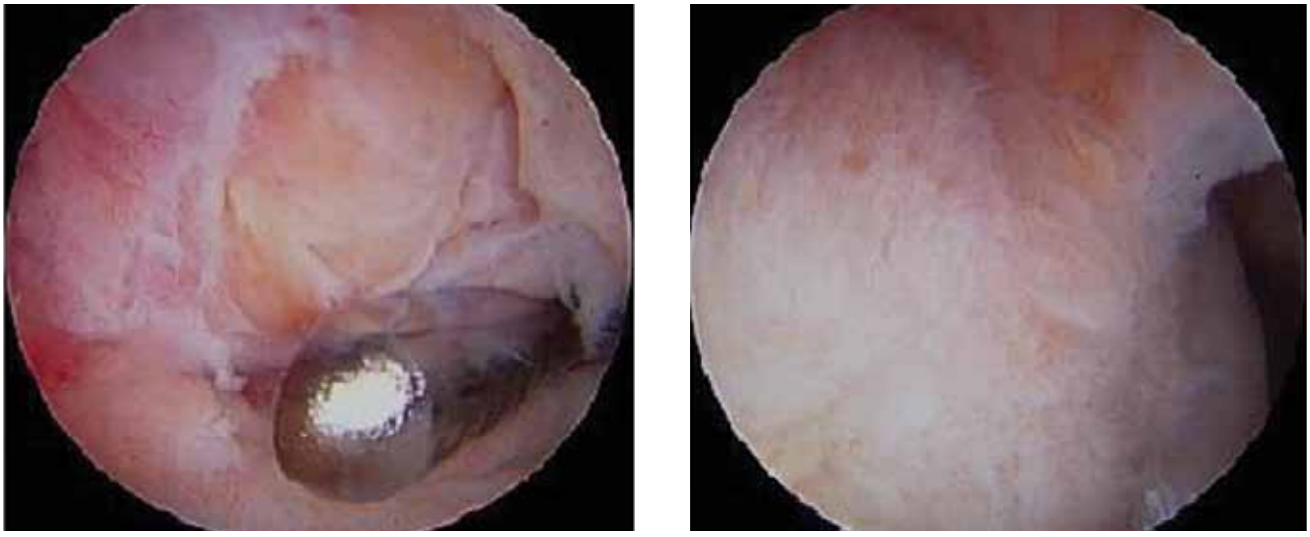

Figure 1. Posteromedial localized pigmented villonodular synovitis before and after excision and partial synovectomy procedure.

patients were excluded. Eleven patients were identified as being treated for LPVNS with arthroscopic excision between 1983 and 2006. We reviewed the medical records and contacted the patients for follow-up information.

Investigated variables were age at presentation, sex, body mass index (kg/m^2), patient-reported leg dominance, trauma history, time from injury or symptom onset to surgery (months), lesion location, pathologic size, need for further procedures within index joint (eg, total knee arthroplasty [TKA], high tibial osteotomy), and preoperative and postoperative Tegner and UCLA activity level scores. Recurrence was defined by pathologic confirmation during re-excision of LPVNS. Preoperative and postoperative OH scores for PVNS also were determined using articular pain, synovitis or effusion, ROM, and functional ability. Scores from 0 to 3 were given to each parameter and summed to classify a poor (0 to 3), fair (4 to 6), good (7 to 9), or excellent (10 to 12) condition (Table I).[4]

Results

The 11 patients consisted of 9 men and 2 women. Mean age at presentation was 34.1 years (range, 16 to 72 years), mean follow-up was 112 months (range, 25 to 223 months), mean body mass index was 28 kg/m^2 (range, 22.5 to 42.2 kg/m^2), and mean time from symptom onset to surgery was 40.3 months (range, 2 days to 223 months). The index extremity was the dominant leg in 4 (36.4%) of the 11 patients, and 4 patients (36.4%) reported a history of trauma.

Lesion locations were retropatellar (5), posteromedial (3), and medial gutter (3). Associated diagnoses in the index knees at time of treatment were osteochondral lesions (3), tricompartmental chondromalacia (2), hypertrophied plica bands (2), patellofemoral chondromalacia (1), trochlear chondromalacia (1), posterior cruciate ligament laxity (1), popliteal cyst (1), and medial meniscus tear (1). Additional nonrecurrence-related surgical interventions were performed in 7 (63.6%) of the 11 patients: 5 in the index knee and 2 in the contralateral knee.

Subsequent index knee procedures included high tibial osteotomy for medial compartment osteoarthritis (2 patients, with subsequent TKA in 1 patient), negative diagnostic arthroscopy (1), lateral femoral condyle microfracture for osteochondral defect (1), and lateral retinacular release (1). The 1 patient who developed medial compartment osteoarthritis requiring a high tibial osteotomy and subsequent TKA had retropatellar LPVNS. Direct visualization of the medial compartment at time of arthroscopic excision revealed no evidence of degenerative wear or chondromalacia (Table II).

Two (18%) of the 11 patients had a recurrence requiring re-excision. Both lesions were located posteromedially, behind the medial femoral condyle within the posterior compartment (Figure 1). In one of these cases, there was a delay of 16 months from symptom onset to index surgery, which was performed at another institution. Recurrence was noted 6 months after surgery. In 1 other case, there was a delay of 25 months from symptom onset to surgery. Recurrence was noted on magnetic resonance imaging (MRI) (Figure 2) for recurrent symptoms 9 months after surgery. This patient also had a lateral femoral condyle osteochondral defect requiring microfracture in the index

Table I. Ogilvie-Harris Scores for Pigmented Villonodular Synovitis

Parameter	Points			
	0	1	2	3
Pain	Severe	Moderate	Slight	None
Synovitis/effusion	Severe	Moderate	Slight	None
Range of motion[a]	>20% loss	10%-20% loss	0%-10% loss	No loss
Functional capacity	Minimal activity	Some activity	Most activities	All activities

[a]Normal was defined as 150° (loss of 15° of flexion/extension represents a loss of 10%).

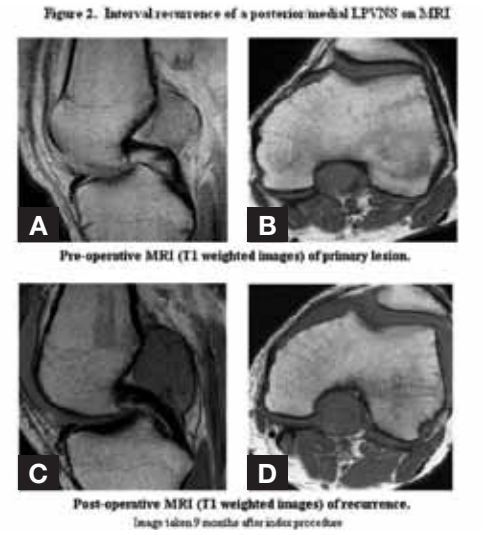

Figure 2. Interval recurrence of posteromedial localized pigmented villonodular synovitis on magnetic resonance imaging. (A,B) Preoperative T_1-weighted images of primary lesion. (C,D) T_1-weighted images of recurrence 9 months after index.

limb. Both recurrences were confirmed with pathologic examination on re-excision.

Mean Tegner scores were 6.73 (range, 4 to 9) before surgery and 6.09 (range, 4 to 9) at latest follow-up; mean change was –0.64 (range, –2 to +1). Mean UCLA scores were 7.73 (range, 2 to 10) before surgery and 8.27 (range, 5 to 10) at latest follow-up; mean change was +0.55 (range, –2 to +7). Both patients who underwent resection of a recurrent lesion had a decrease in activity level scores from before surgery to after surgery (Table III).

OH scores indicated that 4 patients were in good condition before surgery and 7 in fair condition. At latest follow-up, 5 were in excellent condition, 3 in good condition, 1 in fair condition, and 2 in poor condition, according to OH scores. Mean OH scores were 5.91 (range, 4 to 9) before surgery and 8.09 (range, 1 to 12) at latest follow-up; mean change was +1.82 (range, –4 to +7). These findings are summarized in Table IV.

Discussion

PVNS, a disorder that causes inflammation and deposition of hemosiderin within the synovial membranes, can exist in a diffuse form or a localized form. The disease process can manifest clinically with symptoms of pain, effusion, instability, catching, and locking.[3,8,12,13] Treatment of LPVNS with arthroscopic excision has been reported to provide cessation of clinical symptoms and to have a recurrence rate of 0%.[4,5,8,9,12,14,15] In our series of 11 patients, we noted 2 recurrences (18%) at a mean follow-up of 112 months. In addition, we noted development of secondary osteoarthritis requiring surgical intervention in 2 patients. Overall, return to baseline activity level was found, and there was moderate resolution of preoperative symptoms.

The limitations of this study are those inherent to retrospective case series. Patients were contacted by telephone at the latest follow-up. In addition, patients were treated with arthroscopic excision and partial synovectomy by a variety of orthopedic surgeons at our institution—a possible treatment bias. The subjective and functional outcomes measures could have been influenced by distinct conditions apart from the sequelae of prior LPVNS, such as primary degenerative

Table II. Patient Data and Incidence of Recurrence and Further Surgical Intervention

Patient	Sex	Age (y)	FU (mo)	Location	Associated Diagnosis(s)[a]	Recurrence	Secondary Osteoarthritis	Value Change From Before to After Surgery			Further Intervention
								Tegner	UCLA	OH	
1	M	16	25	Posteromedial	Lateral femoral condyle OCL	Yes	No	–2	–1	+1	Reexcision, microfracture of OCL
2	M	31	30	Retropatellar	Posterior cruciate ligament laxity	No	No	+1	+7	+5	None
3	M	72	36	Retropatellar	Tricompartmental chondromalacia	No	No	–1	–1	+1	None
4	F	52	55	Retropatellar	Tricompartmental chondromalacia, popliteal cyst	No	No	+1	0	–4	None
5	M	34	87	Medial gutter	Patellofemoral chondromalacia, medial plica	No	No	0	+1	+3	None
6	M	28	110	Posteromedial	None	No	No	0	0	+7	Right knee meniscectomy[b]
7	M	37	138	Medial gutter	Medial femoral condyle OCL	No	No	–2	–2	–1	Left knee high tibial osteotomy for osteoarthritis[c]
8	M	18	139	Retropatellar	None	No	No	–2	–1	+5	Repeat arthroscopy with negative findings[c]
9	M	21	174	Medial gutter	Medial meniscus tear, OCL	No	No	–2	0	+6	Reduction of traumatic patellar dislocation, repair of patellar tendon rupture[b]
10	M	39	216	Retropatellar	Suprapatellar/infrapatellar plica	No	Yes	+1	+5	–4	Right knee high tibial osteotomy,[c] subsequent bilateral total knee arthroplasty[b,c]
11	F	26	223	Posteromedial	Trochlear chondromalacia	Yes	No	–1	–2	+5	Re-excision, lateral release[c]

Abbreviations: FU, follow-up; Tegner, Tegner activity level score; UCLA, UCLA activity level score; OH, Ogilvie-Harris score; OCL, osteochondral lesion.

[a]As noted on magnetic resonance imaging or radiograph or by consulting surgeon. [b]Additional surgical intervention in contralateral knee.
[c]Additional surgical intervention in index knee.

Table III. Changes in Activity Level Scores From Before to After Surgery

Patient	Tegner Activity Level Score			UCLA Activity Level Score		
	Before	After	Change	Before	After	Change
1[a]	9	7	–2	10	9	–1
2	4	5	+1	2	9	+7
3	6	5	–1	9	8	–1
4	4	5	+1	5	5	0
5	7	7	0	8	9	+1
6	9	9	0	10	10	0
7	6	4	–2	9	7	–2
8	9	7	–2	10	9	–1
9	9	7	–2	10	10	0
10	4	5	+1	3	8	+5
11[a]	7	6	–1	9	7	–2
Mean changes			**–0.64**			**+0.55**

[a]Patient with recurrence.

Table IV. Changes in Ogilvie-Harris Scores for Pigmented Villonodular Synovitis From Before to After Surgery

Patient	Pain		Synovitis/Effusion		Range of Motion		Function		Total Score		
	Before	After	Before	After	Before	After	Before	After	Before	After	Change
1[a]	2	1	2	1	0	2	1	2	5	6	+1
2	1	2	2	2	1	3	1	3	5	10	+5
3	1	1	1	1	3	3	2	3	7	8	+1
4	1	0	2	0	1	1	1	1	5	1	–4
5	2	3	2	3	3	3	2	3	9	12	+3
6	1	3	2	3	0	3	2	3	5	12	+7
7	1	2	3	1	2	1	2	1	8	7	–1
8	1	2	1	3	1	2	1	2	4	9	+5
9	0	3	1	3	3	2	1	2	5	11	+6
10	1	3	2	0	2	0	2	0	7	3	–4
11[a]	1	2	1	3	1	2	2	2	5	10	+5
Means	**1.09**	**2.00**	**1.72**	**1.81**	**1.55**	**2.00**	**1.55**	**2.00**	**5.90**	**8.09**	**+1.82**

[a]Patient with recurrence.

arthritis, chondral lesions, or other unknown internal derangements. However, our study is the largest case series with documentation of recurrence and development of secondary arthritis at a mean follow-up of nearly 10 years.

Previous studies have reported no LPVNS recurrences after arthroscopic excision.[4,5,8,9,12,14,15] In the largest series of arthroscopically treated LPVNS cases to date, Ozalay and colleagues[15] noted no recurrences in 15 patients at a mean follow-up of 52.5 months. Similarly, other studies have not observed any recurrences (defined by symptom return, increasing pain, decreasing ROM without explanation, or new palpable mass) at a mean follow-up of 29 to 65.8 months.[5,8,16] Contrary to those studies, we noted 2 recurrences, at 6 and 9 months after arthroscopic excision, that required secondary re-excision with pathologic confirmation of LPVNS. Both patients had a primary lesion posteromedially within the knee. Recurrence of these posteromedial lesions could represent inadequate resection secondary to incomplete visualization of the lesion, or conservative excision and partial synovectomy because of extracapsular extension and/or close proximity of neurovascular structures (Figure 1). Reported recurrence rates may be understated because of the relatively uncommon location of posteromedial LPVNS lesions.

In addition, we noted only modest improvements in patient activity levels after arthroscopic excision for LPVNS. Other studies did not examine the change in activity levels from before to after surgery as part of their outcome measures.[16,17] Kim and colleagues[5] noted that all the patients in their series returned to preoperative activities, yet 3 patients still had pain on walking. In our study, we noted a mean decrease of 0.64 points (range, –2 to +1) in Tegner scores and a mean increase of 0.55 points (range, –2 to +7) in UCLA scores. Both patients with recurrence of LPVNS had worse activity level scores after surgery. These findings suggest that preoperative activity level scores are indicative of postoperative activity level scores in long-term follow-up after arthroscopic excision of a LPVNS lesion.

Independent of activity level, the common symptoms of LPVNS improved after arthroscopic excision, even in long-term follow-up. Dines and colleagues[8] reported that pain, effusion, and joint-line tenderness were the common presenting signs and symptoms of LPVNS. De Ponti and colleagues[9] also noted that effusion, pain, and decreased ROM were the most common preop-

erative signs and symptoms. In an attempt to provide a disease-specific outcome measure, Ogilvie-Harris and colleagues[4] proposed the OH scoring system for PVNS, evaluating pain, function, ROM, and synovitis/effusion. Investigators who have used this scoring system have found improvements in all criteria of the OH score at a mean follow-up of 44 to 60 months.[4,9] The most improvement was noted in pain, synovitis/effusion, and function.[9] In our series, we noted overall improvement in OH score, specifically with regard to pain and ROM, even after long-term follow-up.

Although pain and ROM improved following treatment, synovitis and/or effusion remained present in 4 patients at latest follow-up. Three of these patients had significant osteoarthritis at latest follow-up, and 2 of these 3 had undergone high tibial osteotomies. None of these patients showed evidence of significant degenerative arthritis at time of the index procedure—raising the possibility of the development of osteoarthritis secondary to LPVNS. Vastel and colleagues[18] recently reported that all patients treated with complete synovectomy for PVNS of the hip developed secondary osteoarthritis, though no recurrences were noted. Results from our long-term case series suggest that patients may be predisposed to develop arthritis, despite arthroscopic excision and partial synovectomy of LPVNS in the knee.

Arthroscopic excision of LPVNS has been very successful in intermediate-term follow-up without any prior reports of recurrences or long-term sequelae. However, we present the largest case series of long-term follow-up after arthroscopic excision and partial synovectomy of LPVNS, with the first report of recurrence. Given that the recurrences in our series occurred in primary lesions located posteromedially, similar patients should undergo vigilant follow-up with repeat MRI. Finally, our findings illustrate minimal changes in activity level scores from before to after surgery, yet fairly predictable improvement in pain and ROM. Despite apparent eradication of local disease, osteoarthritis progression is occasionally seen in long-term follow-up.

Authors' Disclosure Statement

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This paper will be judged for the Resident Writer's Award.