ORIGINAL ARTICLE

Primary arthroscopic synovectomy for pigmented villo-nodular synovitis of the knee: Recurrence rate and functional outcomes after a mean follow-up of seven years

J.C. Aurégan a,*, Y. Bohu a, b, c, N. Lefevre b, c, S. Klouche a, b, c, J.F. Naouri c, S. Herman b, c, P. Hardy a, d

a Hôpitaux Universitaires Paris Île-de-France Ouest, AP–HP, 92100 Boulogne-Billancourt, France
b Institut de l’Appareil Locomoteur Nollet, 75017 Paris, France
c Sport Clinical Center, Paris V, 75005 Paris, France
d Université de Versailles Saint-Quentin-en-Yvelines, UFR des Sciences de la Santé, 78035 Versailles, France

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Synovitis; Pigmented villo-nodular; Knee; Surgery; Arthroscopic synovectomy

Summary
Background: Pigmented villo-nodular synovitis (PVNS) is an uncommon proliferative condition of the synovial membrane that chiefly affects the knee. Arthroscopic synovectomy may carry lower morbidity rates but higher recurrence rates than open synovectomy. Here, our objective was to evaluate recurrence rates and functional outcomes after primary arthroscopic synovectomy for PVNS of the knee.

Hypothesis: Primary arthroscopic synovectomy preserves knee function while producing low recurrence and complication rates.

Materials and methods: We retrospectively included consecutive patients with histologically documented PVNS managed with primary arthroscopic synovectomy at two centres between 1998 and 2011. Twenty-three patients, 13 men and 10 women with a mean age of 41 ± 12 years, were reviewed including 16 patients with nodular and 7 with diffuse form of this disease. Patients with localized disease underwent partial synovectomy and those with diffuse disease complete synovectomy followed by chemical synovectomy of any residual lesions. The primary outcome measure was recurrence. Secondary outcome measures were the Tegner-Lysholm and Ogilvie-Harris scores.

Results: Follow-up data were obtained after a mean of 7 ± 4 years in 21 patients (14 with nodular and 7 with diffuse disease), of whom 2 had recurrences, after 2 and 5 years, respectively.

* Corresponding author.
E-mail addresses: aureganjc@yahoo.fr, jean-charles.auregan@abc.aphp.fr (J.C. Aurégan).

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At last follow-up, neither patient had any evidence of recurrence. The mean Tegner-Lysholm score was significantly improved (from $68 \pm 10$ to $90 \pm 8$, $P=0.0004$) and the mean Ogilvie-Harris score indicated excellent function ($11 \pm 1$).

Discussion: Primary arthroscopic synovectomy ensures satisfactory control of PVNS while preserving knee function. A full recovery remains possible even in patients with diffuse disease. In the event of a recurrence, open synovectomy can be performed.

Level of evidence: Level IV, retrospective study of consecutive patients.

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Introduction

Pigmented villo-nodular synovitis (PVNS) is an idiopathic benign proliferative disorder of the synovial membrane with an estimated incidence of $1.8/10^6$ population [1]. Although no age group is exempt, younger patients seem predominantly affected, with no difference between genders [1]. The knee is the main site of involvement [2,3] but any joint can be affected [4]. Untreated PVNS rapidly results in irreversible joint destruction.

In 1976, Granowitz et al. [5] distinguished two variants of PVNS based on whether the intra-articular lesions were localised (nodular PVNS) or affected the entire synovium (diffuse PVNS). Extra-articular extension of the lesions to the adjacent muscles and tendons can occur, chiefly in diffuse forms [6].

Complete surgical excision of all the lesions is the standard treatment for PVNS [7]. The surgical modalities are poorly standardised, however, as the low incidence of PVNS precludes large treatment trials. In general, open total synovectomy is preferred in diffuse PVNS [8] and arthroscopic synovectomy is reserved for localised nodular PVNS [9,10]. Compared to open synovectomy, arthroscopic synovectomy may ensure better preservation of knee function while producing acceptable local recurrence rates and few complications [10,11]. Both the local recurrence rate and knee function recovery have been reported to vary with the extent of the lesions [12]. Nevertheless, PVNS is probably a continuum with no clear-cut separation between nodular and diffuse forms. The better functional outcomes with arthroscopy compared to open surgery constitute a rationale for broadening the indications of arthroscopic treatment.

Here, our main objective was to evaluate outcomes after primary arthroscopic synovectomy for nodular or diffuse PVNS. Our study hypothesis was that primary arthroscopic synovectomy would preserve knee function while producing low recurrence and complication rates.

Material and methods

We conducted a retrospective study in two centres specialised in arthroscopic surgery of the knee. In both centres, all patients with PVNS of the knee were managed with primary arthroscopic synovectomy.

Patient selection

All patients managed with arthroscopic synovectomy for histologically documented PVNS of the knee between 1998 and 2011 were eligible, including those with recurrent PVNS after arthroscopic synovectomy. We did not include patients with extra-articular lesions and/or a history of open synovectomy of the same knee and/or recurrent PVNS after open surgery at the same knee.

During the study period, 28 patients underwent surgery in either centre for PVNS of the knee (Fig. 1). Among them, 2 had superficial lesions extending extra-articularly and were managed with open surgery. Of the 26 arthroscopically treated patients, 3 had recurrent diffuse PVNS after primary open synovectomy performed elsewhere and were therefore not included in our study. Of the 23 included patients, 7 had diffuse and 16 nodular disease. There were 13 men and 10 women with a mean age of $41 \pm 12$ years. Among these 23 patients, 3 had recurrent PVNS, including 1 after partial arthroscopic synovectomy for nodular disease and 2 after incomplete arthroscopic synovectomy for diffuse disease. Mean maximum knee flexion was $126^\circ \pm 12^\circ$.

Magnetic resonance imaging (MRI) was performed in 22 of the 23 patients (Figs. 2 and 3). Changes suggesting PVNS were recorded including thickening and heterogeneity of the synovial membrane with post-gadolinium enhancement and low-signal foci consistent with hemosiderin deposits within the joint [13]. The findings indicated definite PVNS in 14 patients and possible PVNS in 6 patients, whereas 2 patients had no suggestive MRI features. MRI also served to assess the extent of the synovial lesions. In 1 patient, a metallic foreign body precluded MRI and computed arthrotomography was performed instead: no changes suggesting PVNS were found. The diagnosis was confirmed postoperatively in all 23 patients by histological examination of the synovial membrane specimen.

Surgical technique

The 23 procedures were performed by 3 senior surgeons. A 30° arthroscope was used. A synovial membrane biopsy was obtained routinely. Synovectomy was achieved using a motorised shaver with a 5.5-mm blade and the three standard portals (antero-medial, antero-lateral, and superolateral). In patients with nodular lesions confined to the anterior knee, the posterior knee was not explored routinely. Posterior synovectomy in patients with diffuse disease (Fig. 4) or posterior nodular disease (Fig. 5) was performed via the postero-medial and postero-lateral portals. The postero-medial approach was achieved by transillumination [9].
Postoperative chemical synovectomy

In patients with diffuse PVNS, the joint cavity was carefully explored after total synovectomy to assess the risk of residual lesions. When the risk was deemed non-existent, no additional treatment was given. Otherwise, chemical synovectomy was performed 3 to 6 months after the arthroscopic procedure. Osmic acid was used until 2007, when the French drug safety agency withdrew this compound, and triamcinolone hexacetonide (Hexatrione®) thereafter.

Postoperative management

A drain was placed routinely in the joint cavity then removed after 24 to 72 hours. Passive and active rehabilitation therapy was started on the first postoperative day and continued for 1 month. A knee-extension splint was worn between the rehabilitation sessions for 1 month to avoid flexion contracture. Patients were re-evaluated after 1, 3, 6, and 12 months then once a year. MRI with gadolinium injection was performed after 1 year. For this study, all patients were asked to come in for re-evaluation.

Outcome measures

The primary evaluation criterion was the rate of local recurrence at last follow-up. Local recurrence was suspected based on the clinical and or MRI findings then confirmed histologically.

Secondary outcome measures were the scores at last follow-up on two knee-function scales, the Tegner-Lysholm Knee Scoring Scale for general knee function [14] and the Ogilvie-Harris scale developed specifically for PVNS [12].

Tegner-Lysholm score categories were 0–64, poor; 65–83, fair; and 84–100, excellent. Ogilvie-Harris scores were categorized as follows: 0–3, poor; 4–6, fair; 7–9, good; and 10–12, excellent.

Statistical analysis

STATA.10 (StataCorp, College Station, TX, USA) was used for the statistical analyses. Given the small sample size, we chose non-parametric tests. Quantitative variables were compared using the Mann-Whitney test or Wilcoxon test for paired data. Values of P smaller than 0.05 were considered significant.

Results

Of the 23 patients, 2 were lost to follow-up, after 2 months and 13 years, respectively. Both had nodular disease and neither experienced recurrences. These 2 patients were excluded from the analyses. Mean follow-up in the remaining 21 patients was 7 ± 4 years.

Complications

A 25-year-old woman with diffuse PVNS managed by total arthroscopic synovectomy experienced postoperative haemarthrosis. Surgical drainage of the joint was required 1 month after surgery.

Recurrence rate

MRI was performed 1 year postoperatively in 17 of the 23 patients and showed no signs of recurrence. Nevertheless, histologically documented recurrences developed in
2 patients, both with diffuse disease. A 41-year-old man with diffuse PVNS of the right knee initially treated with total arthroscopic synovectomy followed 3 months later by chemical synovectomy had normal MRI findings after 1 year but was diagnosed with a recurrence 5 years after the arthroscopic procedure. He was managed with open total synovectomy and had no evidence of recurrence 3 years later. The other patient was a 27-year-old man with diffuse PVNS of the left knee. He underwent incomplete arthroscopic synovectomy at another centre then experienced a recurrence managed with arthroscopic total synovectomy at one of the study centres. The risk of residual lesions was deemed non-existent and chemical synovectomy was therefore not performed. A recurrence was diagnosed 2 years later and managed with arthroscopic total synovectomy. At last follow-up 6 months later, he had no signs of recurrence.

Repeat arthroscopy was performed in 2 patients with persistent pain suggesting a recurrence despite the absence of MRI abnormalities. The gross and histological features of the synovial membrane ruled out a recurrence.

**Functional outcomes**

The mean Tegner-Lysholm score improved significantly from $68 \pm 10$ pre-operatively to $90 \pm 8$ at last follow-up ($P=0.0004$). Mean values at last follow-up were not significantly different between the groups with diffuse and nodular disease ($90 \pm 7$ and $90 \pm 10$, respectively, $P=0.91$). The mean Ogilvie-Harris score at last follow-up was $11 \pm 1$ overall, with no significant difference between the groups with nodular and diffuse disease ($11 \pm 1$ and $10 \pm 1$, respectively; $P=0.53$). Both score values indicated excellent functional outcomes at last follow-up.
Discussion

This study shows that primary arthroscopic synovectomy for PVNS of the knee is associated with few complications and produces an overall low recurrence rate while preserving knee function.

Whereas nodular PVNS is associated with few or no recurrences [10,15], diffuse PVNS can recur regardless of the treatment modality used [16]. In our study, none of the patients with nodular disease experienced recurrences, in keeping with findings from two other case-series studies [10,15]. In contrast, in a study of 20 patients with nodular PVNS, 4 (20%) patients had recurrences [17]. Recurrence rates after open synovectomy for nodular PVNS have ranged from 0% [18] to 15% [19] and 29% [8]. In our patients with diffuse disease, the 29% (2/7 patients) recurrence rate is consistent with recurrence rates reported after open synovectomy (25% [20], 33%, [21], and 46% [19]). However, one group reported a recurrence rate of only 8% [22].

Mean functional scores in our study were excellent in both nodular and diffuse disease. No significant difference in function was found between these two groups, but only 7 patients had diffuse lesions. In previous studies, functional outcomes seemed better in nodular disease and varied with the treatment modality. In a study of 20 patients with nodular PVNS managed with arthroscopic synovectomy, the median Tegner-Lysholm score at last follow-up indicated excellent function (85.5; range, 83–88) [17]. In 25 patients managed arthroscopically for diffuse (n=20) or nodular (n=5) PVNS, the mean postoperative Ogilvie-Harris score was 11.3 (excellent) after nodule excision, 7.8 (good) after partial synovectomy, and 9.3 (good) after total synovectomy [22]. In contrast to arthroscopic surgery, open surgery is often associated with range-of-motion limitation (24% [22] to 50% [21] of patients).

Thus, routine primary arthroscopic synovectomy allows removal of the largest possible number of lesions while probably providing better function than open surgery and also...
producing a low complication rate. However, arthroscopic synovectomy for PVNS is a highly specialised procedure associated with a long and arduous learning curve.

In our patients, posterior synovectomy was performed via the standard posterior portals. Another option consists in the back-and-forth technique, which may be valuable particularly in patients with diffuse lesions [9,23].

Osmic acid was used for chemical synovectomy until 2007, when the French drug safety agency withdrew approval of this compound based on an unfavourable risk/benefit assessment [24]. Osmic acid is no longer used in humans. Alternatives for local chemical synovectomy are Hexatrione® and radiopharmaceuticals such as yttrium (89Y) citrate and yttrium (90Y) silicate. External beam radiation therapy combined with total synovectomy may provide good outcomes, most notably in patients at high risk for recurrence [25], but has not been proven effective by level-I evidence.

Factors associated with local PVNS recurrence include diffuse disease, involvement of a large joint, incomplete synovectomy, a history of recurrence, and extra-articular involvement [6,8,20,26]. In our study, both patients with recurrences had diffuse disease and 1 of them also had a history of prior recurrence. In this last patient, the surgeon felt the second procedure had removed all the lesions and consequently did not prescribe chemical synovectomy. The number of patients with recurrences was too small for a multivariate analysis aimed at identifying factors independently associated with recurrences.

Our study has several limitations. The data were collected retrospectively, but nearly all the patients were re-evaluated specifically for the study. The sample size was small, in keeping with the low incidence of PVNS. Among previous studies, few included more than 23 patients [8,20]. Finally, although the mean follow-up of 7 years is satisfactory, follow-up in some patients was only 12 months, limiting the validity of their final outcome assessments.

Conclusion

Primary arthroscopic synovectomy, either partial in nodular disease or total in diffuse disease, with subsequent chemical synovectomy if appropriate, ensures satisfactory disease control while preserving knee function. The chances for a full recovery are preserved even in patients with diffuse lesions. In addition, open synovectomy can be performed in the event of a recurrence.
Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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References


