Arthroscopic Treatment of Pigmented Villonodular Synovitis of the Knee

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Summary: Pigmented villonodular synovitis (PVNS) is a rare disease, with multiple forms, anatomic sites, and treatment methods having been described. During a 10-year period, 14 patients, 7 male and 7 female, average age 35 years (range, 19 to 64 years) were treated for PVNS with arthroscopic partial or total synovectomy. Average follow-up was 42 months (range, 8 to 83 months). Twelve patients had diffuse and 2 had a localized form. Results were assessed subjectively, clinically, and radiographically, and were rated as excellent, good, fair, or poor. There were no complications and 10 patients (72%) were rated as excellent or good, and 2 patients (14%) as fair. The recurrence rate was 14% and occurred in the group with diffuse PVNS. Radiographs did not show any bone erosion. The most widely accepted treatment for PVNS is synovectomy, and both open and arthroscopic synovectomy have been advocated as treatment. Advantages of arthroscopic treatment include accurate evaluation of the knee joint, treatment of other pathology, more rapid rehabilitation, decreased risk of joint stiffness, and less pain. In our experience, it appears that arthroscopic synovectomy is an effective method of treatment of this disorder. Key Words: Pigmented villonodular synovitis—Arthroscopy.

Pigmented villonodular synovitis (PVNS) of the knee is an uncommon disease. The cases of Myers et al.1 consisted of 166 patients over a 17-year period. They estimated an annual incidence of approximately two people per million population. Chassaignac was the first to describe the lesion in 1852. In 1941, Jaffe proposed the name of pigmented villonodular synovitis.2 Before that, the nomenclature varied widely from synovial endothelioma to chronic hemorrhagic villous synovitis. Jaffe grouped these lesions by reviewing the histology, which showed a fibrous stroma, pigment deposition, histiocytic infiltrate, and giant cells within the synovial membrane (Figs 1 and 2). Later, Granowitz et al.3 further classified types of PVNS as either localized or diffuse forms.

Before PVNS was recognized as a nonmalignant process, needless amputations were performed. Hirohata believed it was a condition of localized abnormal lipid metabolism that caused the higher levels of cholesterol found in histiocytes and higher levels of intracellular lipids.3,4 Others theorized the cause to be trauma-induced hemorrhage, an inflammatory process, or a benign neoplastic process. Although the exact cause is unknown, successful treatment consists of synovectomy.

PVNS is typically a monoarticular disease affecting adults in their third to fourth decade with an insidious course of symptoms.5 The knee joint is most commonly affected, and patients often present with symptoms of pain, swelling, and occasional locking, or signs of a palpable mass.6 Trauma may be associated with their symptomatology.1

It has been widely found that localized lesions have
a lower recurrence rate and respond to surgical treatment more favorably than diffuse lesions. Reports of using localized radiation for cases refractory to recurrent surgery have been documented.4 As arthroscopic surgery evolved, Ogilvie-Harris et al.7 reported their experience with arthroscopic treatment of PVNS. The purpose of this study was to review our results of arthroscopic treatment of PVNS of the knee.

MATERIALS AND METHODS

A review of patients’ records from 1987 to 1997 was undertaken. Fourteen patients were identified with PVNS of the knee. Two patients had localized lesions and 12 had diffuse lesions. Four patients with diffuse lesions had had previous synovectomies performed elsewhere before referral for recurrence of the disease. All patients consented to arthroscopic treatment rather than synovectomy through an open excision. All patients were available for follow-up. The average age of the patients was 34.6 years (range, 19 to 64 years); there were 7 men and 7 women. The right knee was affected in 8 patients and the left knee in 6.

All procedures were performed using a similar arthroscopic technique and portal placement. All patients had arthroscopy of the knee performed, which included both medial and lateral posterior portals. Arthroscopy was performed with the use of both a 30° and 70° arthroscope through all portals and the intercondylar notch. The 12 patients with diffuse lesions had total synovectomies, and the 2 with localized disease had partial synovectomies. All aspects of the anterior and posterior compartments were visualized and all synovectomies were performed with a full-radius resector. Postoperatively, the patients had a compressive dressing applied and began physical therapy the day after surgery. The goals of therapy were to achieve maximum range of motion, re-strengthen the quadriceps and hamstring muscles, and use modalities to decrease the swelling, pain, and inflammation in the acute postoperative period.

At follow-up, patients were rated as excellent, good,
fair, and poor. An excellent rating signified a knee returned to its premorbid state. A good rating signified the knee had significantly improved, but in which occasional symptoms prevented it from being rated as normal. A fair rating signified the knee had persistent symptoms but no evidence of recurrence. A poor rating signified cases of recurrence or unacceptable morbidity secondary to the procedure. Patients rated their activity, pain at rest, the ability to resume their pre-operative work status, swelling, sensation of locking, giving way, stiffness, and if any alteration in gait was noted. Objective data included residual intra-articular knee effusion, range of motion compared with the unaffected knee, and areas of palpable tenderness of the knee. An independent observer reviewed the charts and examined all patients.

RESULTS

All patients had preoperative symptoms of effusion and pain with 3 patients having symptomatic locking. An associated traumatic incident was noted in 5 patients. Symptoms were present an average of 13 months (range, 1 to 24 months) prior to seeking treatment. Ten patients were diagnosed with PVNS primarily and 4 patients had been referred with recurrent disease. Eight patients had previous surgery. Four patients had previous synovectomies for PVNS, 1 patient twice. The other 4 patients had partial meniscectomies, 2 of whom had concomitant anterior cruciate ligament reconstruction. Nine patients had magnetic resonance images (MRIs) consistent with the diagnosis of PVNS, which included a low signal on both T1- and T2-weighted images caused by hemosiderin deposition (Figs 3 and 4).

Average follow-up was 41.9 months (range, 8 to 83 months). The average follow-up for patients with localized disease was 47.5 months (range, 42 to 53 months) and for those with diffuse disease was 40.9 months (range, 8 to 83 months). Of the patients with localized disease, 1 had an associated meniscal tear; 3 patients with diffuse disease had associated meniscal tears.
The overall results were 4 excellent, 6 good, 2 fair, and 2 poor. One fair rating was from a woman with a localized lesion. Her main complaint was the inability to resume her previous level of running. The other patient with a localized lesion rated her activity level as excellent. For those with recurrent disease, 2 were rated good and 2 poor following a second occurrence. In rating pain with activity, 7 patients had no pain, 6 had occasional pain with activity, and 1 patient with a poor rating had constant pain. One patient had pain at rest but all were able to resume their previous occupational activities. Four patients at follow-up had symptoms of occasional swelling and 2 had symptoms of occasionally giving way. Three patients had occasional stiffness, but all believed their ambulation was unaffected postoperatively.

Radiographs were obtained in all patients and included anteroposterior, lateral, notch, and merchant views; no patient had bone erosion. Pathological findings were characterized by the typical findings described in the literature: fibrous stroma, hemosiderin deposition, histiocytic infiltrate, and giant cells. Localized lesions were more nodular in appearance. No obvious pathological differences were noted between the diffuse form and pathological tissue obtained at repeat arthroscopy of patients with recurrent disease. The average difference in range of motion between the affected and nonaffected knee was $6.7^\circ$ (range, $0^\circ$ to $17^\circ$).

There were two recurrences (14%), both in patients who had been referred with previous diffuse disease. Recurrence was identified by MRI findings and clinical symptoms of pain and swelling. This occurred at 16 and 46 months after surgery. Both had repeat total synovectomies and, at 16 and 34 months follow-up, they have had no recurring symptoms. One patient with a history of arthrofibrosis underwent a concurrent arthroscopic lysis of adhesions at the time of total synovectomy and later required manipulation under anesthesia for loss of range of motion. There were no complications of knee instability and no infections.

**DISCUSSION**

Multiple studies have shown that patients who have had excision for localized PVNS do well with recurrence rates being very low.8-10 There is considerable controversy regarding the treatment of diffuse form of PVNS as recurrence rates vary greatly from 8%-46%(10). Due to the high recurrence rate in the diffuse form of the disease, many surgeons are hesitant to treat this condition arthroscopically. Radiation therapy has been used in the past, but there have been severe side effects and there is a concern regarding radiation-induced sarcomas in younger patients. The most widely accepted treatment is synovectomy of the knee by means of an open arthrotomy, but there is a significant incidence of loss of range of motion and pain after this operation.7 In addition, even with an open incision, the high recurrence rate may actually represent a persistence of the disease because of
technical difficulties in accomplishing a total synovectomy. Recurrence of localized PVNS is much less common because total excision is not as technically challenging as in the diffuse form. It is our experience that, with the evolution of arthroscopic techniques and greater experience, a total synovectomy of the knee can be effectively performed. In particular, a more complete evaluation and synovectomy of the posterior compartment is possible by arthroscopic means.

In our study, there were no recurrences in localized lesions. This would correspond with the low incidence of recurrence in localized lesions reported in numerous articles in the literature regarding this type of PVNS. There were two recurrences (17%) in diffuse PVNS patients, both of whom had had prior synovectomies. There are two possible scenarios for the recurrence of the disease: either a spread of the pathological process about the joint or an incomplete synovectomy. On reviewing their operative notes, the patients who had recurrence in this study did not appear to have had a complete synovectomy of the posterior compartment of the knee at the initial operative procedure.

Stiffness has been widely reported to be a postoperative problem associated with a parapatellar incision. In the review of 25 patients by Flandry et al.,10 8 required manipulation under anesthesia because of loss of motion. One patient in our study required manipulation; however, this patient previously had limited motion and required arthroscopic lysis of adhesions in his initial operative procedure.

Because of the high recurrence rate, a variety of treatments have been recommended for the diffuse type of PVNS, including radiation synovectomy, partial synovectomy, and total synovectomy either open or arthroscopically. The treatment of choice in the literature for diffuse PVNS remains a total synovectomy. The recurrence rates with an open incision have varied greatly. Ogilvie-Harris’ study of 11 arthroscopic total synovectomies had one recurrence at 3.5 years.7 With the use of multiple portals which allow one to more fully evaluate the knee, a more complete total synovectomy including the anterior compartment, medial and lateral gutters, and posterior compartments can be achieved.

An arthroscopic procedure is less invasive than a classic arthrotomy. Arthroscopy allows for a more accurate diagnosis and facilitates the ability to ascertain small, localized areas of PVNS. In an arthroscopic procedure, the excision can be restricted to the areas of involvement in the localized form of PVNS. When total synovectomy is indicated, it is our belief that an experienced arthroscopist can more adequately perform a total synovectomy than an open procedure and with a much lower morbidity rate. In addition, with the advent of new tissue-ablation tools available for arthroscopic procedures, we may be able to reduce the recurrence rate of diffuse pathology. This concept will require further evaluation.

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REFERENCES