Arthroscopic resection of benign tumors of the knee posterior compartment: A report of 15 cases

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A B S T R A C T

Introduction: The management of tumors located in the posterior compartment of the knee, whatever the nature of the tumor, remains surgical excision and can be done by open surgery or under arthroscopic control. The objective of this study was to evaluate the arthroscopic management of intra-articular tumors of the posterior compartment of the knee. The hypothesis is that tumors or tumor-like lesions confined to the posterior compartment are accessible by arthroscopy with low iatrogenic risk.

Materials and methods: All patients with an intra-articular tumor of the posterior compartment of the knee were enrolled between 2009 and 2013. The surgical management consisted of arthroscopic resection. Patients underwent postoperative MRI, repeated at last follow-up. The outcomes were the occurrence of complications, functional evaluation using the Lysholm Knee Scoring Scale, and the recurrence rate.

Results: Fifteen patients were included. All patients had a complete resection. One case of delayed healing of the arthroscopic entry point was observed. At a mean 22 months, the mean Lysholm Knee Score increased from 74 (±8.5) preoperatively to 92 (±7.7) postoperatively, a significant increase of 18 points (P=0.001). One patient had a recurrence of osteochondromatosis, requiring removal of a foreign body.

Discussion: Resection of posterior intra-articular tumors of the knee using arthroscopy is possible, subject to a learning curve.

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1. Introduction

Intra-articular tumors or tumor-like diseases of the posterior compartment of the knee are rare. These are predominantly located in the anterior compartment. Posterior locations in certain knee diseases can suggest a tumor aspect.

Few intra-articular tumors of the posterior compartment of the knee have been described to date. Only cases of fibroma [1], synovial and meniscal cyst [2–4], mucoid cyst [5,6], synovial sarcoma [7–9], localized pigmented villonodular synovitis [10–17], and heman-gioma [18] have been reported.

The objective of surgical management is to obtain complete excision of the tumor with a minimal risk of complications and functional sequelae. Contrary to tumor resection or open synovectomy [19] via the posterior approach, arthroscopic management could reduce the functional sequelae of the knee and decrease the rate of complications, notably during posterior synovectomies, for a recurrence rate comparable to that already demonstrated for pigmented villonodular synovitis of the knee [20].

The objective of this study was to assess the arthroscopic management of 15 patients presenting an intra-articular tumor or a tumor-like disease of the posterior compartment of the knee.

We hypothesized that tumors or tumor-like diseases confined to the posterior compartment are accessible to arthroscopy with a low iatrogenic risk rate.

2. Material and methods

Fifteen patients treated between 2009 and 2013 presenting an intra-articular tumor of the knee involving at least the posterior compartment were retrospectively included. The medical files were discussed with osteoarticular radiologists and none of these tumors was considered malignant.

The patients’ mean age was 37 years (range, 17–59 years) with eight females and seven males. Of these 15 patients, one who had a synovial cyst was lost to follow-up. The mean follow-up of the remaining 14 patients was 22 months (range, 6–49 months).

Three of the patients were treated for localized pigmented villonodular synovitis in the posterior compartment (Figs. 1 and 2), three for posterior meniscus synovial cysts, three for osteochondromatosis, three for mucoid synovial cysts of the posterior cruciate...
ligament (PCL), two for aspecific chronic synovitis, and one for intra-articular hemangioma (Fig. 3). The series included seven diffuse locations in the two posterior compartments of the knee, six at the base of the PCL, one posterolateral, and one posteromedial.

Fig. 1. MRI, sagittal T1 and T2 sequences, located behind the posterior cruciate ligament.

Fig. 2. Arthroscopic view of localized pigmented villonodular synovitis.

In all cases, management consisted of arthroscopic surgical resection of the intra-articular tumor of the knee. The evaluation criteria were the quality of the resection, the occurrence of complications, and the functional evaluation of the knee using the Lysholm Knee Scoring Scale (LKSS). We also studied the overall recurrence rate.

Two senior surgeons operated on all the patients using a standardized procedure.

The mean duration of the intervention was 50 min (range, 40–90 min).

The patients were operated under general anaesthesia, in the decubitus dorsal position with a tourniquet. The knee was maintained in 90° flexion. In this position, the common fibular nerve and the popliteal artery were folded back, thus limiting iatrogenic risks [21–23], as was the sartorial branch of the saphenous nerve located approximately 10 mm behind the entry point of the posteromedial approach. All the patients underwent preliminary arthroscopic exploration of the anterior compartment of the knee with a 4.5-mm arthroscope and 30° fore oblique using the classic anterolateral, anteromedial approaches, alternatively for visualization and instrumentation. The anterolateral and anteromedial approaches were placed adjacent to the edge of the patellar tendon 1 cm above the joint space, thus allowing easier passage into the posterior compartment of the knee going through the femoral notch [24,25].

For reasons of symmetry, the arthroscopy of the posterior compartment was always initiated by the posteromedial approach. This entry point was positioned using anterolateral arthroscopic guidance, passing the arthroscope at the medial edge of the PCL so as to access the posterior compartment. The entry point was identified using transillumination [26,27].

Located behind the lateral collateral ligament and above the tendon of the femoral biceps muscle and thus avoiding the common fibular nerve, the posterolateral approach was established in the same way, passing the arthroscope in the posterior compartment via the anteromedial approach, at the lateral edge of the anterior cruciate ligament (ACL).

One patient (synovial cyst) required resection via the exclusively posterolateral instrument portal and the anteromedial optical portal. Two other resections were exclusively performed via the posteromedial arthroscopy portal and the anteromedial optical portal, for a medial posterior meniscal cyst and a synovial cyst. The three cases of diffuse osteochondromatosis in both posterior compartments were treated by alternating the posteromedial
and posterolateral arthroscopy portals, obviating the need for a transeptal approach.

Nine patients required a transeptal approach established using the “back and forth” technique with a Wissinger obturator according to the technique described by Louisa et al. [28]. These were three cases of localized pigmented villonodular synovitis, one in the medial compartment and two in the lateral compartment; three cases of mucoid synovial cysts of the PCL; two cases of diffuse aspecific chronic synovitis in both posterior compartments; and one case of localized hemangioma located behind the PCL. The posteromedial and posterolateral approaches combined in this transeptal approach made it possible to obtain a single posterior compartment, since the instrument and optical portals were interchangeable.

Once the mass had been resected, a final verification of the knee joint was made to determine the quality of the resection and detect any bleeding before closing with a suction Redon drain inserted into the anterior compartment.

The tissue samples were all immersed in formoll and then embedded in paraffin; five 1-mm-thick sections of paraffin were made and colored with hematoxylin–eosin–safron (HES) for the anatomopathological examination.

The drain was removed 48 h later and passive and active rehabilitation was initiated immediately. Weight-bearing was allowed with a knee extension orthosis for 4 weeks.

The patients retrospectively underwent a functional assessment based on the pre- and postoperative LKSS, which provided the means of paired series with the Friedman test; P < 0.05 was considered significant. The patients also underwent postoperative MRI to determine the quality of the resection at 1 year and then every year.

### 3. Results

The mean hospital stay was 4 days (range, 3–11 days). No serious intraoperative or postoperative complications were observed. One patient presented a joint fistula from a posterolateral arthroscopic orifice, resulting in delayed healing with no other consequences [29]. For the 14 patients evaluated (Table 1), the preoperative mean Lysholm Score was 74 (±8.5) and the postoperative score was 92 (±7.7), a significant increase of 18 points (P = 0.001) (Table 2).

All the resections were deemed complete on MRI. A single recurrence was noted: a case of diffuse osteochondromatosis of the posterior compartment that was reoperated at 18 months to remove a loose body arthroscopically. Of the 14 patients followed up, postoperative MRI assessment of the knee joint showed complete exclusion with absence of recurrence at a mean follow-up of 22 months in 13 patients (93%).

### 4. Discussion

The main result of this study is that benign tumors or tumor-like diseases of the posterior compartment of the knee are accessible to arthroscopy with low iatrogenic risk. Treatment is surgical, either by open excision or arthroscopy. In the present arthroscopic series, a significant increase in the functional score was noted. Despite the learning curve, no serious complication was observed. One posterior joint fistula that resolved spontaneously was observed, a relatively specific complication of posterior arthroscopic procedures [29].

The low statistical power as well as the retrospective design are limitations of this study. The study of recurrence rates also remains highly debatable given the very heterogeneous population because the recurrence rate is closely related to the type of tumor. However, the recurrence rate in this series was very low for a surgical technique that showed no intraoperative complications.

Loriaut et al. [30] observed four recurrences in a group of cases of localized pigmented villonodular synovitis (20%) and reported a median Lysholm Score of 85 at 75 months of follow-up.

Many authors have developed arthroscopic management of pigmented villonodular synovitis for both localized and diffused forms. The recurrence rates remain comparable with open synovectomy. Auregan et al. [20] reported 29% recurrence. Zvijac et al. [31] reported that arthroscopic treatment of pigmented villonodular synovitis could improve functional recuperation, reduce the incidence of postoperative stiffness, and decrease joint pain.

The recent meta-analysis published by Auregan et al. [32] analyzing 60 studies with a total of 1019 patients found no difference in terms of local recurrence of localized or diffuse pigmented villonodular synovitis after arthroscopic or open management. However, there was a low level of postoperative complications.

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### Table 1

Population.

<table>
<thead>
<tr>
<th>Patients</th>
<th>Sex</th>
<th>Age</th>
<th>Preoperative Lysholm</th>
<th>Postoperative Lysholm</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior synovial cyst</td>
<td>M</td>
<td>34</td>
<td>73</td>
<td>100</td>
<td>No recurrence</td>
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<tr>
<td>Aspecific chronic synovitis</td>
<td>F</td>
<td>43</td>
<td>78</td>
<td>86</td>
<td>No recurrence</td>
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<tr>
<td>Osteochondromatosis</td>
<td>M</td>
<td>59</td>
<td>60</td>
<td>90</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Mucoid synovial cyst of PCL</td>
<td>F</td>
<td>22</td>
<td>65</td>
<td>90</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Osteochondromatosis</td>
<td>M</td>
<td>41</td>
<td>65</td>
<td>80</td>
<td>Recurrence</td>
</tr>
<tr>
<td>Osteochondromatosis</td>
<td>M</td>
<td>30</td>
<td>70</td>
<td>90</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Aspecific chronic synovitis</td>
<td>F</td>
<td>55</td>
<td>65</td>
<td>75</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Localized posterior villonodular synovitis</td>
<td>M</td>
<td>43</td>
<td>75</td>
<td>95</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Localized posterior villonodular synovitis</td>
<td>M</td>
<td>17</td>
<td>70</td>
<td>100</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Mucoid synovial cyst of PCL</td>
<td>M</td>
<td>42</td>
<td>75</td>
<td>90</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Localized posterior hemangioma</td>
<td>F</td>
<td>37</td>
<td>82</td>
<td>100</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Localized posterior villonodular synovitis</td>
<td>F</td>
<td>19</td>
<td>86</td>
<td>95</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Mucoid synovial cyst of PCL</td>
<td>M</td>
<td>25</td>
<td>85</td>
<td>100</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Medial posterior meniscal synovial cyst</td>
<td>M</td>
<td>42</td>
<td>85</td>
<td>95</td>
<td>No recurrence</td>
</tr>
<tr>
<td>Posterior synovial cyst</td>
<td>M</td>
<td>40</td>
<td>Lost to follow-up</td>
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<td></td>
</tr>
</tbody>
</table>

PCL: posterior cruciate ligament.

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### Table 2

Functional results assessed using the Lysholm Knee Scoring Scale.

<table>
<thead>
<tr>
<th></th>
<th>Preoperative (mean ± standard deviation; range)</th>
<th>Postoperative (mean ± standard deviation; range)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysholm Score</td>
<td>71.8 ± 8.5; 60–86</td>
<td>91.8 ± 7.7; 75–100</td>
<td>P &lt; 0.001</td>
</tr>
</tbody>
</table>
after arthroscopic management of diffuse pigmented villonodular synovitis cases. Arthroscopy of the posterior compartment remains a difficult technical procedure, possibly leading to a high iatrogenic risk in inexperienced hands. The technical risks of arthroscopy of the posterior compartment correspond to the basic risks of any anterior arthroscopic procedure [29]. More specifically, even if there is a theoretical vascular risk [23], most importantly a popliteal artery lesion [33,34], to our knowledge, its incidence has not been established [27,35]. Among the nerve lesions (saphenous nerve [36], common fibular nerve, and tibial nerve), the most frequent neurological complication remains saphenous nerve branch lesions: 7–22% depending on the series [21].

We nevertheless had no intraoperative complications in our patients treated with posterior arthroscopy.

Postoperative recovery was uneventful compared to open surgery. Arthroscopy reduces surgical morbidity, limits the surgical insult of the anterior and posterior compartments, and allows better exploration of the knee compartments. The postoperative risk of infection is lower [37], as is the risk of thromboembolic events [38,39]. The technical difficulties mean that there is a learning curve. After arthroscopy, the return to professional and sports activities is more rapid. In case of recurrence, revision, notably with Trickey approach, remains possible.

The study’s hypothesis has been confirmed and the study shows that excision of benign intra-articular tumors of the posterior compartment of the knee is accessible with arthroscopy.

This technique seems effective, providing a good functional result and low iatrogenic risk. It remains a demanding surgical technique, however, requiring a high level of skill in the posterior arthroscopic approaches because iatrogenic risks do exist.

Disclosure of interest

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

References