Hoffa's fat pad tumours: What do we know about them?

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Abstract

Purpose We report on a group of patients with tumours in the Hoffa's fat pad (HFP), their clinical presentation, histological type and treatment, including two synovial sarcomas with their clinical follow-up, which have not been described previously in the literature.

Methods We performed a retrospective review of our prospectively collected database of 25 cases of HFP tumours with at least six months follow-up.

Results The gender, age at presentation (over and under 16 years of age), clinical features, history of trauma, treatment chosen, and complications were recorded. The mean age of the patients was 32 years (three to 47). Six patients were under 16 years old. Pain was the most common symptom, present in 92 % ($n=23/25$). The final diagnoses included 23 (92 %) benign tumours and two (8 %) malignant tumours. The most common benign tumour was pigmented villonodular synovitis (PVNS) (48 % $n=12$). The two malignant tumours were synovial sarcomas and both presented in patients under 16 years old.

Conclusions Hoffa's fat pad tumours are an uncommon and rarely diagnosed group of lesions that can be misinterpreted as any knee pathology. Although the majority of HFP tumours are benign, malignant tumours should be considered in the differential diagnosis for the paediatric population.

Keywords Hoffa's fat pad · Knee · Tumours · PVNS · Malignant tumours · Synovial sarcomas

Introduction

The infrapatellar Hoffa's fat pad (HFP) is an intracapsular, but extrasynovial, constant structure in the knee, which may play a number of roles in knee joint function and pathology. It is commonly injured and pathology of the fat pad is a common cause of anterior knee pain [1, 2]. Abnormalities within it most commonly are the consequences of trauma and degeneration, but inflammatory and neoplastic diseases can arise in the fat pad [3, 4]. A variety of intrinsic and extrinsic tumours and tumour-like conditions may affect the infrapatellar HFP and have been already presented in the literature [3, 5]. The majority are benign lesions, although malignant tumours have been reported [6, 7].

The purpose of this paper is to report a group of patients treated at our institution with tumours in the HFP, their clinical presentation, histological type, and treatment. We also document two soft tissue sarcomas arising in the HFP with their clinical follow-up, which has not been described previously in the literature. We present our suggested flow chart in managing tumours of the HFP.

Patients and methods

A retrospective review of our prospectively collected database revealed 27 cases of HFP tumours. Our inclusion criteria were: patients diagnosed with a tumour of the HFP, confirmed by pathological examination after biopsy or surgical resection, and with more than six months follow-up. The gender, age at presentation (over 16 and under 16 years of age), clinical features, history of trauma, preoperative diagnosis, operative findings, treatment chosen, and complications were recorded. The patients were studied preoperatively with plain radiographs, ultrasound, and magnetic resonance imaging (MRI). A biopsy was done in all cases and the final diagnoses confirmed by surgical resection.

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Results

A total of 27 HFP tumours were identified but only 25 were included in this series. Two patients had imaging characteristics of haemangioma but were excluded because they did not undergo biopsy or surgical resection and the diagnoses were not confirmed as the patients were asymptomatic.

The median age of the patients was 32 years (range three to 47). Six patients were under 16 years old. Thirteen patients were male and median follow-up was 66 months (range six to 108).

Pain was the most common symptom, present in 92 % ($n=24/25$). In 19 patients, there was associated swelling. All patients were still able to perform activities of daily living with some discomfort. No patient reported inability to work or go to school. A palpable lump was present in nine patients and one case presented with a painless mass. The mean duration of symptoms before the first consultation was 179 weeks (range 0–364) and in 85 % there was no history of trauma.

The final diagnoses included 23 (92 %) benign tumours and two (8 %) malignant tumours. The most common benign tumours were focal type pigmented villonodular synovitis (PVNS) (48 %, $n=12$), followed by haemangioma (24 %, $n=6$), ganglions (8 %, $n=2$) and synovial osteochondroma ($n=1$), chondroma ($n=1$), and bizarre proliferative osteochondromatous proliferation (BPOP) ($n=1$). The two malignant tumours were synovial sarcomas and both presented in patients under 16 years old (Table 1).

All patients were studied with MRI scans but only 13 had a previous knee radiograph. Six radiographs were reported as normal.

Nineteen benign tumours were treated by surgical excision (Table 1). Usually the excision was extrasynovial apart from five patients where large volume tumours extended into the joint and thus required open arthrotomy for complete excision. Only one complication was reported, a post-operative neuro-
ma. No patients developed local recurrence after benign

Table 1 Patients' characteristics and treatment

Patient	Sex	Presenting symptoms	Age	Diagnosis	Treatment	Status	Follow-up
1	F	Pain + swelling + anterior lump	3	Synovial sarcoma	Wide resection	NED	50
2	M	Pain + swelling	5	Haemangioma	Conservative treatment	AWD	74
3	M	Pain + swelling	6	Haemangioma	Excision	NED	89
4	M	Pain + swelling	10	Haemangioma	Conservative treatment	AWD	28
5	M	Pain + swelling	15	Synovial sarcoma	Wide resection, EPR Local recurrence & lung mets (40 months follow-up) treated with amputation and chemotherapy	AFD	94
6	M	Pain + swelling	16	Haemangioma	Excision	NED	96
7	F	Pain	23	PVNS	Excision	NED	66
8	F	Pain + swelling + anterior lump	26	BPOP	Excision	NED	24
9	M	Pain + swelling	26	PVNS	Excision	NED	21
10	F	Pain + swelling + anterior lump	27	PVNS	Excision	NED	23
11	M	Pain	28	PVNS	Excision	NED	6
12	M	Pain + swelling	32	Haemangioma	Excision	NED	67
13	F	Pain + swelling	32	PVNS	Excision	NED	51
14	M	Pain + swelling	35	Chondroma	Excision	NED	101
15	F	Pain + swelling	37	PVNS	Excision	NED	96
16	F	Pain + swelling	42	PVNS	Excision	NED	27
17	M	Pain	43	PVNS	Excision	NED	28
18	M	Pain	46	Haemangioma	Excision	NED	93
19	M	Pain + swelling + anterior lump	46	PVNS	Excision	NED	106
20	F	Pain + swelling + anterior lump	47	Ganglion	Excision	NED	71
21	F	Pain + swelling + anterior lump	47	PVNS	Excision	NED	55
22	F	Pain + swelling + anterior lump	48	PVNS	Excision	NED	65
23	F	Pain	48	PVNS	Excision	NED	12
24	F	Pain + swelling	49	Ganglion	Conservative treatment	AWD	77
25	M	Anterior lump	57	Osteochondroma	Excision	NED	108

PVNS pigmented villonodular synovitis, BPOP bizarre proliferative osteochondromatous proliferation, EPR endoprosthesis replacement, NED no evidence of disease, AFD alive free of disease, AWD alive with disease

Fig. 1 **a** Plain radiographs showing a calcified mass within the HFP. **b** T2-weighted MRI scan showing the mass enhancing with gadolinium. Final diagnosis: synovial sarcoma. **c** Extra-articular resection of the tumour. **d** Endoprosthesis replacement at 30 months follow-up

tumour resection. The other four benign tumours received conservative treatment. All patients had improvement in their symptoms after treatment.

Group under 16 years old

There were six patients with diagnoses of HFP tumour under 16 years of age with five male patients (83 %). The mean age was nine years (range three to 16 years). Four were benign tumours (66 %), which were all haemangiomas, and two were malignant tumours (33 %). The only two malignant tumours of our series presented in this age group. All of these patients complained of pain and swelling of their knee. There were no differences in the clinical presentation between benign and malignant tumours.

Two patients with a haemangioma were treated surgically by open resection and the other two received conservative treatment with regular follow-up. All patients noted

improvement of their symptoms, although one of them (in the conservative group) complains of occasional anterior knee pain.

There were two patients diagnosed with synovial sarcoma (Table 1). Patient 5 was first treated in another hospital and initially presented with a seven year history of knee pain and a calcified mass within the HFP (Fig. 1). This was assumed to be benign and subsequent excision revealed a synovial sarcoma. Upon referral to our institution, he was treated with an extra-articular resection, endoprosthesis replacement, and post-operative radiotherapy. He developed local recurrence and pulmonary metastases after 40 months requiring an above knee amputation and chemotherapy. He is alive and free of disease at 94 months with the lung metastases resolving with chemotherapy. Patient 1 presented with swelling in the infrapatellar area of her knee. MRI showed a two centimetre solid mass within the HFP (Fig. 2). Needle biopsy revealed synovial sarcoma. She was treated with preoperative chemotherapy and wide resection

Fig. 2 MRI scan showing 2-cm homogeneous solid mass within the HFP in a 3-year-old girl. Final diagnosis: synovial sarcoma

Fig. 3 T2-weighted MRI image showing a mass arising from the HFP with high signal intensity, septation, and central low-signal-intensity dots. Final diagnosis: haemangioma

Fig. 4 Proposed management of Hoffa's fat pad (HFP) tumours. PVNS pigmented villonodular synovitis

including inferior patellectomy. She is disease free 50 months following treatment.

Discussion

In 2011, Dean et al. reported a large series of solitary HFP tumours [5]. Previous reports in the literature were mainly case reports [8–10] and small case series [11, 12]. The authors presented 19 patients (only one under 16 years) with benign HFP tumours, all treated by planned surgical excision with good results and few complications [5]. The most common diagnoses were PVNS (five cases) and ganglion cysts (four cases).

To our knowledge this series is the largest (25 patients) of HFP tumours and the only one reporting malignant HFP tumours with clinical follow-up after treatment. Stacy et al.

previously reported the imaging findings of a 25-year-old man with a synovial sarcoma of the HFP, without reporting treatment or follow-up [6]. Our series also included six patients under the age of 16 with haemangioma as the most common diagnosis.

It is important to remark that symptoms in these patients were not associated with a history of trauma and patients' activities and function were not significantly affected. Patients complained about anterior pain and swelling, most of the time non-specific and generally for a long time. Although an anterior knee mass was not a common presentation, it must make the clinician suspect an HFP pathology. The presence of non-specific symptoms and long-standing knee pain in children or adolescents should alert physicians about the suspicion of an HFP tumour, especially haemangioma.

MRI is the diagnostic imaging of choice for HFP tumours. MRI offers superior tissue contrast and is more accurate than

Fig. 5 **a** HFP tumour presenting as swelling on anterolateral aspect of the right knee. **b** Excision of 6-cm chondroma within the Hoffa's fat pad (HFP) by dissection from the patellar tendon (PT)

computed tomography (CT) in defining the size and extent of a soft tissue lesion (Figs. 1 and 2). We recommend a plain knee radiograph as an initial imaging study, as findings such as soft tissue mass (haemangioma) or fat pad calcification (chondroma, synovial sarcoma) may help to suspect a tumour pathology and consider the possibility of malignancy [12, 13]. An ultrasound demonstrating a hyperechoic, well-defined mass with phleboliths on plain radiographs and typical MRI features of high signal intensity on T2-weighted imaging, lobulation, septation, and central low-intensity dots may help arrive at the diagnosis of an haemangioma (Fig. 3) [14]. Our plan of evaluating and managing common tumours of the HFP is summarised in Fig. 4.

The combination of a juxta-articular soft tissue mass in a patient under 16 years old with calcification/ossification should raise the possibility of synovial sarcoma. Consequently biopsy is required to confirm the diagnosis by histology in order to avoid unplanned excision of a soft tissue sarcoma [15].

The majority of solitary HFP tumours are benign but in this series we have reported two synovial sarcomas of the HFP in patients less than 16 years of age. These two patients presented with features (less than five centimetres, superficial, not increasing size) that are often associated with benign tumours. Our study suggests that malignancy should be considered in a child or adolescent presenting with an HFP mass with the imaging characteristics previously described.

Open arthrotomy and excision ensures that the HFP tumours can be excised completely (Fig. 5) [5]. Different types of resection have been described for HFP and knee tumours [11, 16], but complete excision is not always possible arthroscopically. Conservative treatment is an alternative in patients with haemangioma, with good follow-up results.

Conclusions

HFP tumours are an uncommon and rarely diagnosed group of lesions that can be misinterpreted as any knee pathology. Increased awareness is required to diagnose this clinical condition early and to start the appropriate treatment in order to avoid morbidity. Although the majority of HFP tumours are benign, malignant tumours should be considered especially in the paediatric population.

Conflict of interest We can confirm that no financial or personal relationships with other people or organisations could inappropriately influence or bias this work.

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