

Posterior Hoffa's fat pad impingement secondary to a thickened infrapatellar plica: a case report and review of the literature

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ABSTRACT

We report a case of posterior hofitis in a middle-aged woman with no prior history of significant major trauma. Her symptoms of anterior knee pain and limited extension failed conservative measures. Preoperative magnetic resonance imaging demonstrated a significantly thickened infrapatellar plica tethering Hoffa's fat pad in the anterior interval of the knee. Arthroscopic resection of the infrapatellar plica resulted in complete resolution of symptoms within six months following the surgery.

CASE REPORT

CASE REPORT

A 53-year-old female nurse living a sedentary lifestyle with no regular sporting activities in her past was referred to our hospital with a two-year history of left knee symptoms gradually worsening over the last six months. Initially, she experienced occasional episodes of moderate to severe anterior knee pain lasting for two to three days not significantly affecting her daily activities. On most occasions the pain resolved spontaneously. The patient sought medical attention when she started having difficulty ambulating, which occurred 8 months prior to her visit to our facility. Her symptoms were described as an inability to achieve full leg extension accompanied by severe anterior knee pain and swelling during walking while carrying out her daily duties.

On physical examination, the patient demonstrated a 20-degree flexion contracture of the left knee with a small joint effusion. There was also a moderate degree of tenderness upon full weight bearing with mild difficulty upon ambulation from the inability to fully extend the left lower leg. However, no medial instability, muscular atrophy, neurological findings or erythema were observed.

Imaging Findings

Magnetic resonance imaging (MRI) of her left knee was performed and reviewed by two musculoskeletal radiologists at our institution (Siemens Magnetom SymphonyTim 1.5 Tesla, Proton Density Turbo Spin Echo TR=2700ms, TE=26ms, ET=7, Flip angle=180 deg and 3D Double Echo Steady State TR=17.81ms, TE=4.95ms, ET=1, Flip angle=25 degrees with 3D acquisition and 2mm slice thickness). The study revealed a fan-shaped low signal structure coursing anterior to the anterior cruciate ligament (ACL). Thin fibers originated from the femoral intercondylar notch region and became wider anteriorly, blending into Hoffa's fat pad which demonstrated edema at its infero-posterior apex (Fig. 1). A diagnosis of a thickened infrapatellar plica causing impingement and posterior hofitis was made at MRI examination.

Management

A sports medicine trained orthopedic surgeon performed arthroscopy once the patient had failed all prior non-operative measures (physiotherapy and hinged knee brace). Intraoperatively, a thickened fibrous structure was observed anterior to the ACL and distinct from it, in keeping with a

separate type IPP (Fig. 2). The abnormal IPP caused impingement of the posterior aspect of Hoffa's fat pad at the intercondylar notch and femoral trochlea, limiting full extension of the knee. Subsequently, the IPP was shaved down completely, resulting in release of the posteriorly tethered portion of Hoffa's fat pad. This allowed for immediate improvement in the range of extension of the patient's knee. The cruciate ligaments and menisci were confirmed to be intact, and there were no intra-articular bodies within the joint to explain diminished range of motion. There were no immediate postoperative complications and the patient was allowed to bear weight as tolerated.

Upon histological examination, the portion of the fat pad that was biopsied demonstrated fibro-fatty tissue with degenerative changes, suggesting a longstanding mechanism of impingement. Moreover, the histological analysis also revealed the presence of a cavernous hemangioma within the IPP, further supporting an embryological origin for this structure (Fig. 3).

Follow-Up

At one-month follow-up, she regained almost full knee extension with occasional mild residual knee pain that was treated with non steroidal anti-inflammatory drugs as needed. Six months later, full knee extension was achieved and the patient's pain completely resolved.

DISCUSSION

Etiology & Demographics

There are four plicae named according to their relation to the patella: infrapatellar, suprapatellar, lateral patellar and mediopatellar. These are usually asymptomatic; however, they can cause various symptoms when they become thickened, inflamed or in cases of rupture. The first anatomical description of the infrapatellar plica (IPP) was by Vesalius in 1555 and he called it the ligamentum mucosum [1]. Embryologically, the infrapatellar plica (IPP) forms between eight and twelve weeks of gestation from synovial mesenchyme. During this period, the knee is divided into medial, lateral and suprapatellar compartments by different membranes. Between 16 and 20 weeks, these membranes are normally resorbed and the knee becomes a single cavity. In some individuals, one or several membranes can persist, which subsequently form plicae. The infrapatellar plica is slightly more common in males, with a gender ratio of 1.25:1 (M:F) and a mean age of 39.0 (6-90) when they become symptomatic [5]. Arthroscopically, the IPP is by far the most commonly observed plica of the knee (incidence of 65% - 85.5%), followed by the suprapatellar (55%) and mediopatellar plica (24.5%) [2]. However, routine MRI has a low detection rate of 0.4% when it comes to the normal IPP due to its minute structure and its close apposition to the ACL [3]. However, if clinically necessary, the radiological detection rate can be improved up to 78.3% using 3 tesla MR arthrography [4].

Clinical & Imaging Findings

Depending on its arthroscopic morphology, the IPP has been classified in four different types: vertical septum, separate, split and fenestrated (Fig. 4) [5]. Anatomically, the IPP originates from the intercondylar notch of the femur, coursing anterior to the ACL and blending into Hoffa's fat pad with a few distal fibers inserting on the inferior pole of the patella [3].

The IPP has the highest incidence of thickening among all plicae but it is the least likely to become symptomatic [6]. In cases of knee trauma, the intra-articular inflammatory process can cause thickening, hyalinization, fibrosis and even intra-substance calcification of this plica resulting in loss of its elastic properties. The gradual accumulation of scar tissue interferes with normal mechanics of the knee by impingement at the intercondylar notch and trochlea. Clinically, this will most often manifest as a flexion contracture with anterior knee pain on full extension attempts [7]. Occasionally, snapping, popping and giving way were also reported [8].

Rarely, the IPP can also cause severe pain after a traumatic rupture with the patient presenting with unexplained hemarthrosis [9]. On MRI, this manifests as an abnormally increased curvilinear T2 signal along the expected course of the IPP with occasional extension to Hoffa's fat pad. However, since only a few cases have been reported, it remains a diagnosis of exclusion, requiring arthroscopic confirmation that there are no other internal derangements of the knee [1, 10].

What is interesting in our case is that the patient had no prior history of a major knee injury or surgery. She was a practicing nurse without a history of regular sporting activities in the past. She likely had repetitive occupational related microtraumas in the region of the IPP, which triggered a local inflammatory process that over time altered the pliability of this synovial tissue through fibrous hyperplasia [11]. Subsequently, it tethered Hoffa's fat pad into the intercondylar notch causing hoffitis limited to the posterior apex (Fig. 1B) [12]. This explains the fibrofatty degenerative changes found on histology in the infero-posterior area of the fat pad that was found to limit full extension intraoperatively (Fig. 3 and Fig. 5).

We believe that this aspect of the case is contrasting with most IPPs, which become symptomatic only after a significant traumatic event or a surgical intervention [13]. To our knowledge, there is a single case series in the current literature reporting 42% (5/12) of symptomatic IPPs without history of previous trauma [14]. However, the aforementioned cases attributed the patients' symptoms to the IPP itself, due to its rich nerve supply that can trigger anterior knee pain when irritated or inflamed. A case of a thickened IPP secondary to repetitive microtraumas causing posterior hoffitis has not been described in such detail.

Treatment & Prognosis

When the presence of an IPP with surrounding inflammatory changes has been MRI proven in a patient with infrapatellar anterior knee pain, the first recommended

measures are conservative using non steroidal anti-inflammatory drugs and physiotherapy [15]. If the symptoms are refractory, arthroscopic resection of the fibrosed IPP has been shown to be an effective treatment, with 85.7 - 91 % good to excellent outcomes 1 year post surgery [8].

The IPP remains an important entity even in asymptomatic cases. It is of surgical importance as it can obstruct the passage of instruments, hinder adequate visualization of the cruciate ligaments and interfere with the retrieval of intra-articular bodies. Moreover, when correctly identified, the type of IPP can also instigate a search for additional pathology.

When the IPP is continuous with the anterior surface of the ACL, dividing the medial and lateral compartments of the knee it is considered of the vertical septum type. This can be associated with intra-articular anomalies such as a discoid meniscus and can also coincide with a posteriorly displaced ACL attachment on the tibia [16]. In contrast, when the IPP is completely distinct from the ACL, it is considered of separate subtype and this was the case of our patient [17].

Differential Diagnosis

Radiologically, when present and thickened, the IPP can easily be mistaken for the ACL in a knee where the latter is avulsed. In doubtful cases, MR arthrography (MRA) can be helpful in distinguishing between the IPP and the ACL [4]. This latter study also demonstrated that MRA has IPP detection rates similar to those of arthroscopy, potentially helping to avoid an unnecessary surgical intervention.

TEACHING POINT

A symptomatic infrapatellar plica (IPP) causing posterior Hoffa's fat pad impingement should be considered in the differential diagnosis of anterior knee pain with flexion contracture in patients without a history of a previous trauma to the knee. MRI is the optimal imaging modality to confirm the presence and morphology of the plica but more importantly, to evaluate the presence of inflammatory changes within Hoffa's fat pad. This information helps guide the clinician's decision to pursue arthroscopy in cases where conservative measures fail to alleviate patient symptoms.

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FIGURES



Figure 1: 52 year old female with thickened infrapatellar plica causing posterior hoffitis. FINDINGS: Sagittal proton density (a), sagittal double echo steady state (b) and coronal proton density fat saturated (c) images demonstrating a separate type of infrapatellar plica appearing as a fan-shaped thickened hypointense structure (arrow) coursing anterior to the anterior cruciate ligament (star). The fibers gradually become thinner anteriorly as they blend into Hoffa's fat pad (triangle). Moreover, there are edematous changes localized to the posterior apex of Hoffa's fat pad in keeping with focal hoffitis. TECHNIQUE: Siemens Magnetom SymphonyTim 1.5 Tesla magnet, Proton Density Turbo Spin Echo (TR=2700ms, TE=26ms, ET=7, Flip angle=180 deg), 3D Double Echo Steady State (TR=17.81ms, TE=4.95ms, ET=1, Flip angle=25 deg) with 2mm slice thickness, Proton Density Turbo Spin Echo Fat Saturated (TR=2500.0 ms, TE=26.0ms, ET=5, Flip angle=180.0 deg) with 3.5mm slice thickness and separation.

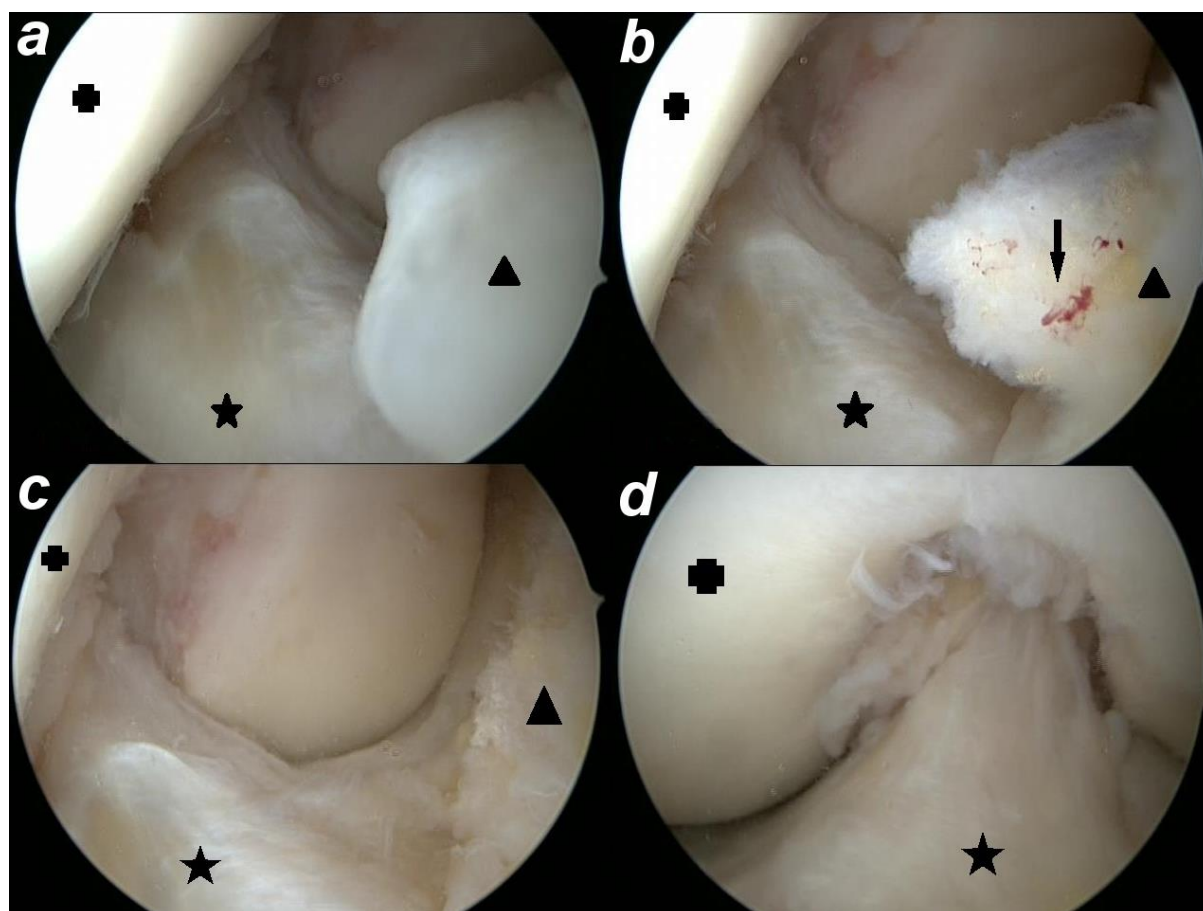


Figure 2: 52 year old female with thickened infrapatellar plica causing posterior hoffitis. (a) Intraoperative arthroscopic anteromedial portal views demonstrating a separate type infrapatellar plica (triangle) coursing anterior to the anterior cruciate ligament (star) and medial to the lateral femoral condyle (cross). (b) Debridement of this infrapatellar plica caused punctate areas of hemorrhage, which corresponded to a hemangioma on pathological analysis. (c) Fully debrided infrapatellar plica demonstrating decreased tissue burden and (d) subsequent full extension view without impingement.

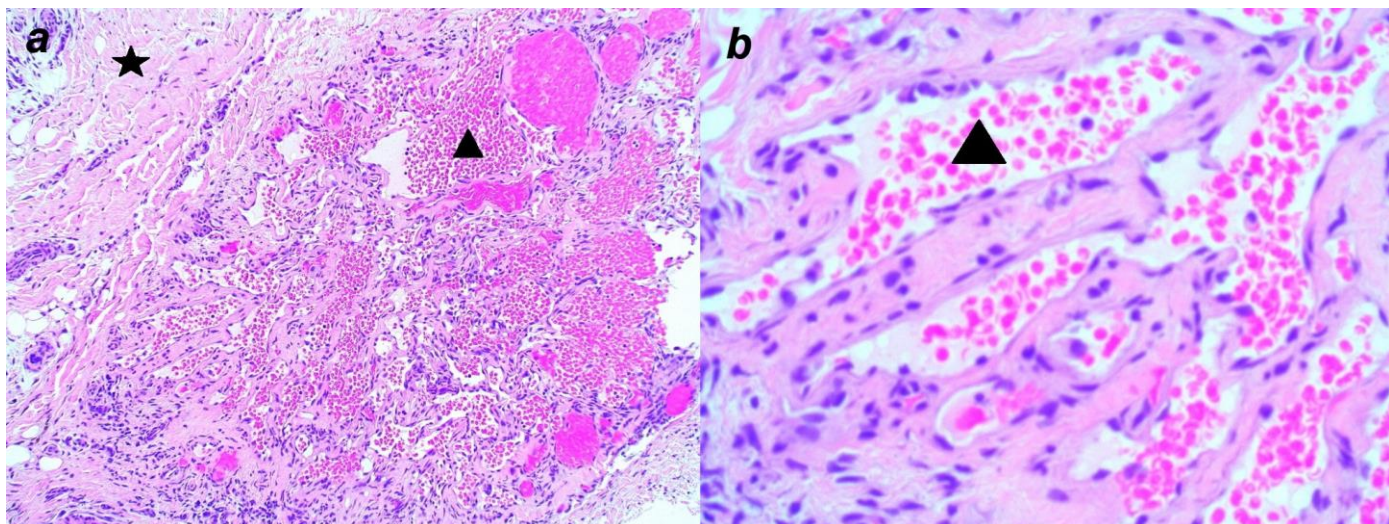


Figure 3: (a) x100 hematoxylin and eosin stain of the infrapatellar plica demonstrating fibrofatty tissue (star) with cavernous blood spaces lined by mature endothelium (triangle). (b) x400 hematoxylin and eosin stain showing the blood spaces of the hemangioma (triangle) lined by flattened endothelial cells without nuclear atypia.

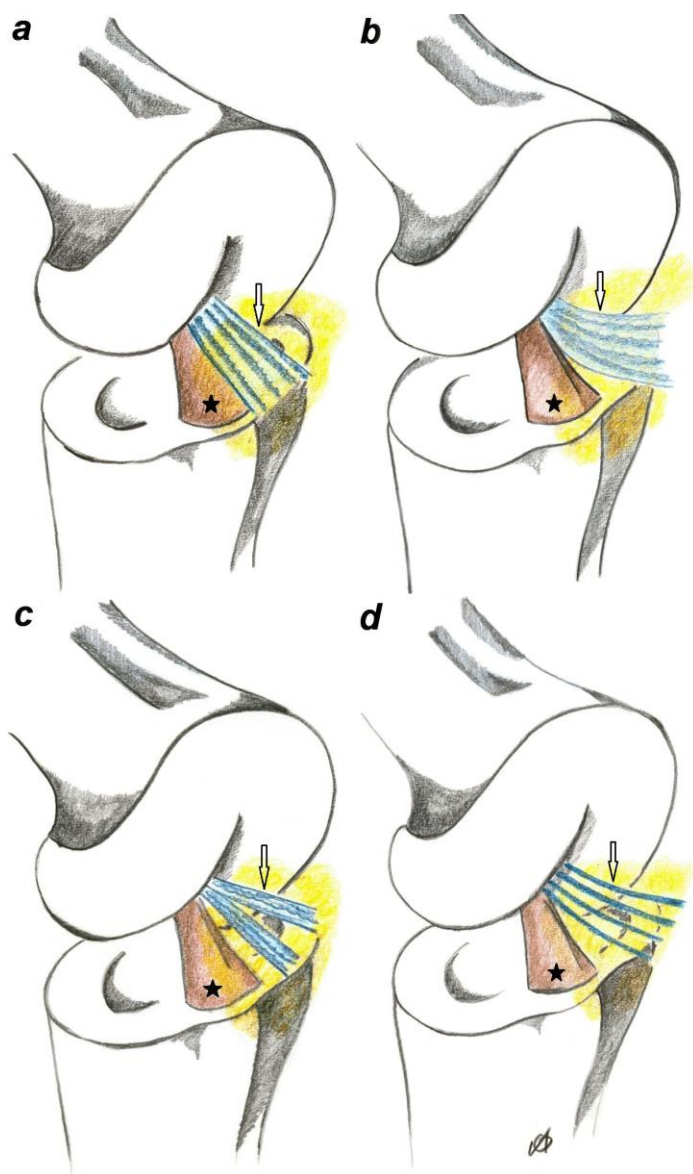


Figure 4 (left): Schematic illustration of the four different types of infrapatellar plicae (arrow) in relationship to the anterior cruciate ligament (star). (a) Vertical septum type, (b) separate type, (c) split type and (d) fenestrated type.

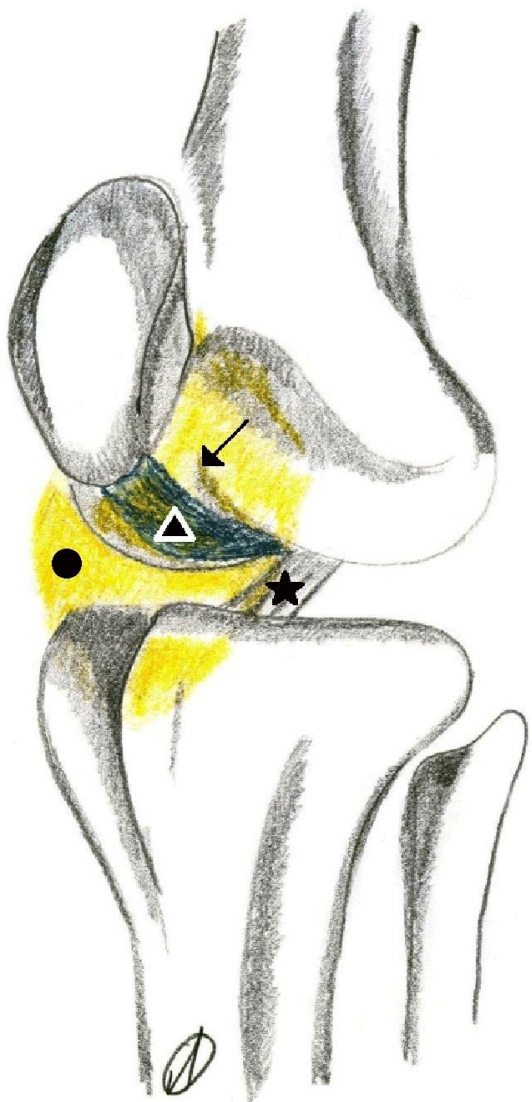


Figure 5 (left): Oblique illustration of the knee demonstrating a thickened infrapatellar plica (triangle) separate from the anterior cruciate ligament (star) as it courses through and tethers Hoffa's fat pad (circle) in the intercondylar notch of the femur during extension (arrow).

Etiology	Posterior Hoffa's fat pad impingement secondary to a thickened infrapatellar plica
Incidence	The overall incidence of the infrapatellar plica is reported between 65% - 85.5%. No data is available on the proportion that becomes symptomatic.
Gender Ratio	1.25 : 1 (M:F)
Age Predilection	Mean of 39.0 (6-90)
Risk Factors	When present, an infrapatellar plica may be symptomatic secondary to: <ul style="list-style-type: none"> • Repetitive minor traumas from daily activities • Blunt trauma • Congenital thickening
Treatment	First, conservative management using non-steroidal anti-inflammatory drugs and physiotherapy. If the symptoms are refractory, arthroscopic resection of the fibrosed IPP has been shown to be an effective treatment.
Prognosis	Among patients who fail conservative management, 85.7 – 91 % have good to excellent outcomes 1 year after arthroscopic resection of the infrapatellar plica.
Finding on Imaging	Fan-shaped low PD and T2 structure coursing anterior to the anterior cruciate ligament. The fibers originate from the femoral intercondylar notch and become wider anteriorly, blending into Hoffa's fat pad which often demonstrates high T2 signal edematous changes.

Table 1: Summary table synthesizing the main facts about a thickened infrapatellar plica causing impingement of the posterior aspect of Hoffa's fat pad.

Diagnosis	MRI Findings (PD and T2)
Thickened infrapatellar plica	Fan-shaped low PD and T2 structure coursing anterior to the anterior cruciate ligament. The fibers originate from the femoral intercondylar notch and become wider anteriorly, blending into Hoffa's fat pad which often demonstrates high T2 signal edematous changes.
Anterior cruciate ligament	Since a normal anterior cruciate ligament has the same location and low PD and T2 signal, a thickened infrapatellar plica can easily be mistaken for the ACL in a knee where the latter is avulsed or ruptured.

Table 2: Differential diagnosis table for a thickened infrapatellar plica.

ABBREVIATIONS

ACL = Anterior cruciate ligament
IPP = Infrapatellar plica
MRA = Magnetic resonance arthrography
MRI = Magnetic resonance imaging

KEYWORDS

Knee; Hoffa's fat pad; posterior hoffitis; impingement; infrapatellar plica; plica syndrome; magnetic resonance imaging; arthroscopy

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