



Giant infrapatellar ganglion cyst of Hoffa's fat pad

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ABSTRACT

We present the case of a 36-year-old woman who works as a kindergarten teacher, often she is kneeling on her knees due to the nature of the job. Since a year ago, she noticed that her right knee was swelling. She had an orthopaedic examination when she could no longer bend her knee. Inspection and palpation revealed the swelling of the anterior and anterior-lateral aspect of the knee. MRI imaging revealed a large, sharply defined, lobulated lesion of the infrapatellar fat pad. After the surgical incision, a lobular lesion was found and surgically removed. Histological analysis confirmed a ganglion cyst.

1. Introduction

Cysts and cystic-appearing soft-tissue lesions in and around the knee are common and can create a diagnostic dilemma if one is not aware of the potential diagnoses and pitfalls. Most of these lesions are benign and are related to the collection of fluid in bursae, herniation of synovium from the joint, or ganglia arising from tendons and ligaments [1–4].

Ganglia are myxoid lesions of unknown cause which are characterised by dense connective tissue filled with gelatinous fluid rich in hyaluronic acid and other mucopolysaccharides. Unlike synovial cysts, ganglia do not communicate with the joint space and lack a cellular lining. Ganglia around the knee can occur at any tendon insertion, but are most common at the tendon insertion of the medial and lateral gastrocnemius and the popliteus. It is rare to find them originating in infrapatellar Hoffa's fat pad [5–7].

Ganglion cysts have a controversial pathogenesis. Some theories include the shift of synovial tissue during embryogenesis, the proliferation of pluripotent mesenchymal cells, mucinous degeneration of connective tissue after trauma and migration of the synovial fluid to the surrounding tissue. Congenital abnormality is not excluded [8–11].

A ganglion cyst is often presented as a polycyclic, septic fluid collection. It can occur anywhere, intra or extra-articular, beside an articular cartridge, a ligament, a tendon sheath or bursa, inside the subchondral bone, a fatty tissue or a muscle. Ganglion cysts can be found in

all joints, with varying frequency depending on the location of the cyst [12,13]. The prevalence of ganglion cysts in knees is reported 0.2–1% by MR imaging and 0.6% by knee arthroscopy, where most ganglions are associated with cruciate-ligaments [14].

Cystic lesions around the knee are common and primarily consist of popliteal cysts. Other cystic lesions are rarer, including meningeal and ganglion cysts [15,16]. The ganglion cyst of infrapatellar Hoffa's fatty tissue is even less frequent. An infrapatellar fat tissue known as Hoffa's fatty tissue is a triangularly formed tissue that is located behind the patellar ligament and separated from the knee joint by a synovial sheath. Therefore, its location can be described as extra-synovial, intra-capsular, but extra-articular. According to the findings in the literature, the size of Hoffa's ganglion cysts range from 1.8 to 4.5 cm and are occasionally found bilaterally. Those larger than 4.5 cm are considered giant ganglion cysts and are extremely rare. The majority of those diagnosed are a random finding, in patients with no symptoms. Some people experience pain and limitation of function, and some of find a palpable mass of soft tissue structure below the knee [17].

2. Case report

We present the case of a 36-year-old woman who works as a kindergarten teacher, often she is kneeling on her knees due to the nature of the job. Since a year ago, she noticed that her right knee was swelling. She had an orthopaedic examination when she could no longer

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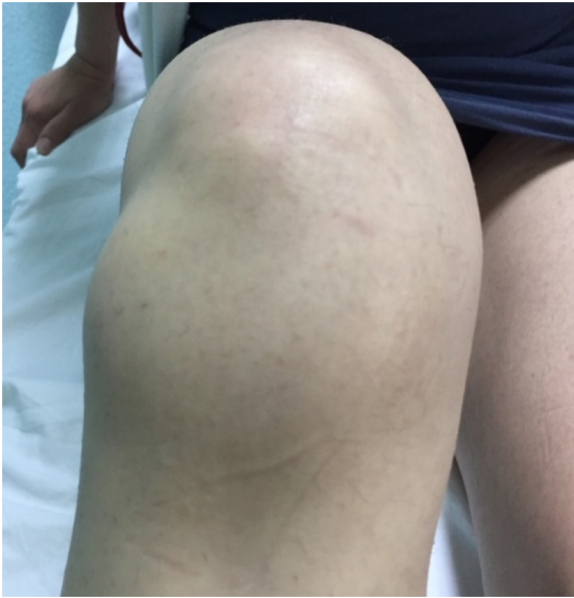


Fig. 1. Soft tissue swelling in the antero-lateral aspect of the knee.

bend her knee. Clinical examination revealed full extension with painful flexion performed up to 100 degrees. Inspection and palpation revealed the swelling of the anterior and anterior-lateral aspect of the knee, which was harder in consistence (Fig. 1).

Lachman, Apley and McMurray tests were negative. Knee radiographs did not show any bone abnormalities. Magnetic resonance (MR) imaging of the knee was subsequently ordered and performed as standard protocol. Native and post contrast Gadovist (gadobutrol) MRI imaging revealed a large, sharply defined, lobulated lesion of the following sizes: transversal display 54.6 x 30.6 mm (Fig. 2); sagittal display 39.2 x 24.5 mm (Fig. 3); and coronal display 53.7 x 40.6 mm (Fig. 4). Thin lines of low-signal intensity indicated the appearance of septations inside the lesion. The lesion in T1 and T1 fat suppression (with dimensional fat saturation) showed low-signal intensities (Figs. 5 and 6), while in proton density fat suppression sequences (Figs. 2 and 3) and STIR sequences (Short Tau Inversion Recovery) showed high-signal intensity (Fig. 4).

Thin lines indicating septations inside the lesion (arrowheads in

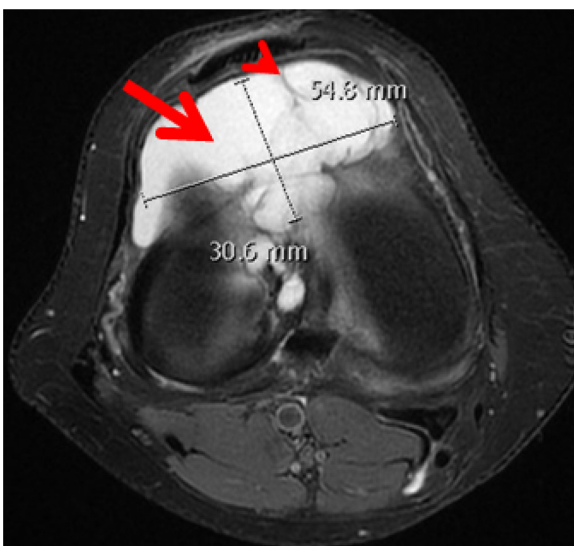


Fig. 2. Proton density fat saturated axial view – high intensity signal lesion in Hoffa's fat pad (arrow); low intensity signal septations (arrowhead).



Fig. 3. Proton density fat saturated sagittal view – high intensity signal lesion in Hoffa's fat pad (arrow); low intensity signal septations (arrowhead).

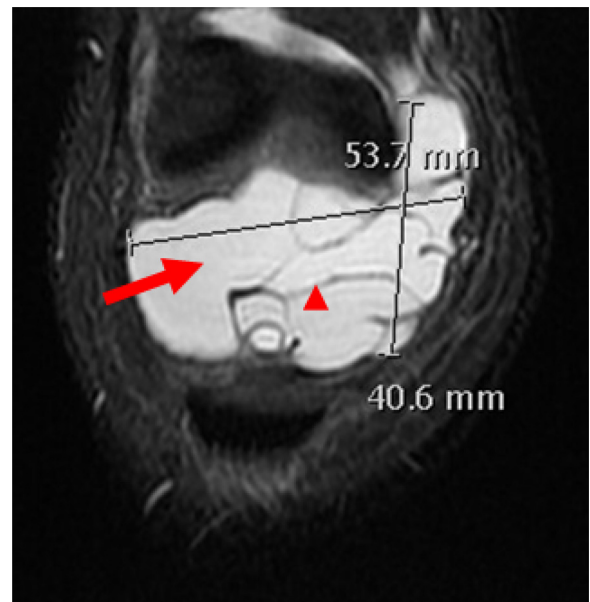


Fig. 4. Proton density fat saturated coronal view – high intensity signal lesion in Hoffa's fat pad (arrow); low intensity signal septations (arrowhead).

Figs. 2, 3 and 4) had low-signal intensity in all sequences. MR imaging showed normal morphology and signal intensities of the meniscus and cruciate ligaments of the knee. There were no signs of joint effusion. After the intravenous application of the paramagnetic contrast agent, there was a marginal increase in signal intensity of the joint capsule and an irregular linear increase of signal intensity within the corresponding lesion in the septations (Figs. 7 and 8).

Patient had been suggested for a surgical procedure. After the preparation, spinal anaesthesia was administered considering the locality and size of the lesion, which required an open surgical procedure (Fig. 9). After the surgical incision, a lobular lesion was found within the infra-patellar Hoffa's fatty tissue, which was folded and partially adhered to the joint cuff. After careful dissection, the lesion was completely removed, and a smaller defect of the synovial sheath after the



Fig. 5. T1 sagittal view low intensity signal lesion in Hoffa's fat pad (arrow).

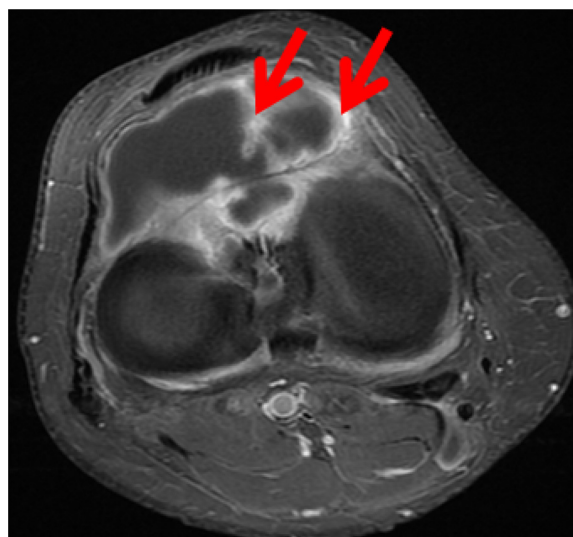


Fig. 7. T1 fat saturated contrast enhanced axial view showing high intensity signal of the joint capsule and septations (arrows).

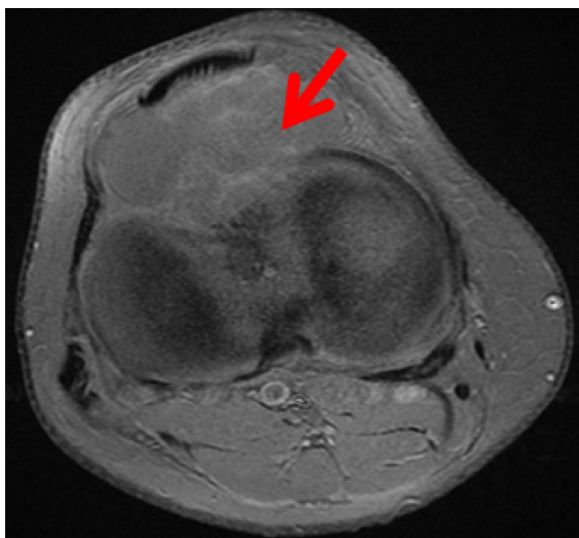


Fig. 6. T1 fat saturated low intensity signal lesion axial view in Hoffa's fat pad.

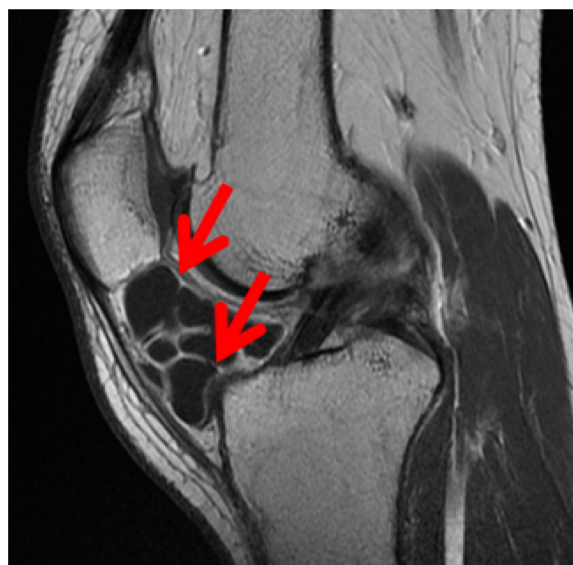


Fig. 8. T1 contrast enhanced axial view showing high intensity signal of the joint capsule and septations (arrows).

excision was managed surgically. The wound was sealed in layers. The macroscopic appearance of the lesion was characterised by a reddish surface and a clear liquid inside the lesion (Fig. 10). Histological analysis of the lesion confirmed that

it was a ganglion cyst of Hoffa's fat pad (Figs. 11 and 12). The postoperative period was without any complications, and the patient returned to work in four weeks after physical therapy.

Follow-up native and post contrast (gadobutrol-Gadovist) MRI imaging was performed six months after the operation and showed no signs of recidivism or residual ganglion cysts (Figs. 13–16). The changes in the intensity of the signal in the infrapatellar knee section corresponded to the expected post-operative finding. There were changes in the proximal part of the patellar ligament, indicating patellar tendinitis, probably due to repeated, daily multiple-hour squatting and kneeling.

3. Discussion

Hoffa's fat pad is an intracapsular but extrasynovial structure of the knee. It is believed to play a role in mechanical support in the front

knee section, which absorbs shock. Nociceptive as well as endocrine functions have been reported, which contribute to its potential in inducing osteoarthritis. It can be a subject of trauma, impingement, inflammation and tumour. Ganglion cysts are highly restricted cystic soft tissue tumours filled with gelatinous contents. They are typically shaped in the form of a sharp, rounded structure, which raises the surface of the skin if they are closer to superficial structures; they are mostly small in diameter and rarely exceed the size of 2 cm. Gigantic ganglion cysts, as in our case, exceeding the size of 4.5 cm are very rare [5–7].

Ganglion cysts are more often around the knee than inside the knee. When located inside the knee, they are most often around the cruciate ligaments and ruptured meniscus [14]. When located intraarticular in the knee, ganglion cysts most commonly occur at the front of anterior cruciate ligament and the posterior cruciate ligament but very rarely arise from the infrapatellar fat pad [18]. In 1924, Caan first described an intra-articular ganglion of the knee at the anterior cruciate ligament as an accidental finding during an autopsy [19]. Krudwiget and al. found 76 cases of ganglion cysts in 8000 knee arthroscopic

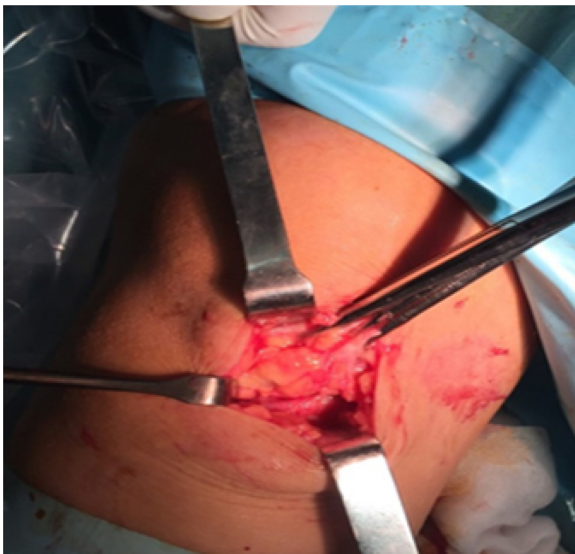


Fig. 9. Lateral patellar incision and ganglion cyst revealed.

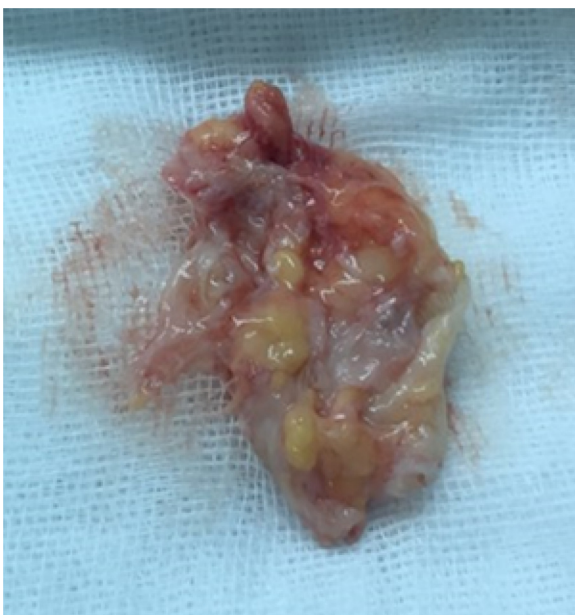


Fig. 10. Completely resected ganglion cyst of Hoffa's fat pad.

examinations. Most of them originated from the anterior or posterior cruciate ligament. In contrast, only three cases originated from the infra-patellar fat pad [20]. Sugiura et al. reported a ganglion cyst arising from the infra-patellar fat pad of a 10-year-old boy [14]. A differential diagnosis of knee cystic lesions must include ganglia, lipoma, synovial myxoma, meniscal or parameniscal cysts, synovial cysts, pigmented villonodular synovitis, synovial hemangioma, aneurysm, synovial sarcoma, and synovial chondromatosis [13]. Patients most often presented with impaired flexion and knee extension and frontal knee pain. The mechanism of the pathogenesis of ganglionic cyst development is controversial. Several theories have been proposed, including displacement of synovial tissue during embryogenesis, proliferation of pluripotential mesenchymal cells, Mucinous degeneration of connective tissue after trauma, and migration of synovial fluid into the surrounding tissues (synovial herniation theory). It could also represent a congenital abnormality. Although many reports have emphasized that trauma is required for ganglion cyst development, it is postulated that repetitive microtrauma from joint and soft tissue motion

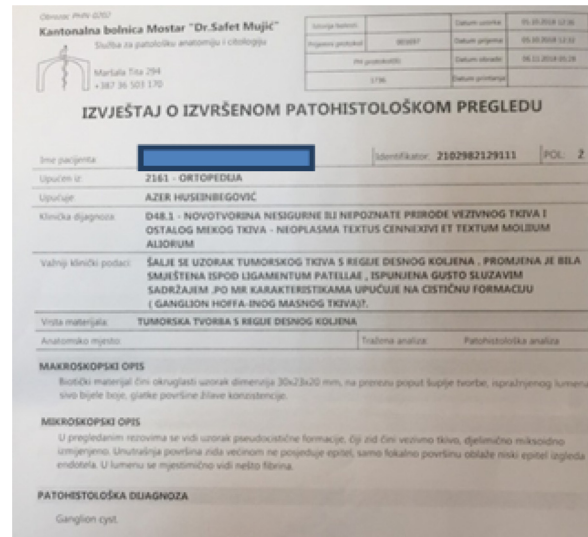


Fig. 11. Pathohistological report confirming ganglion cyst.

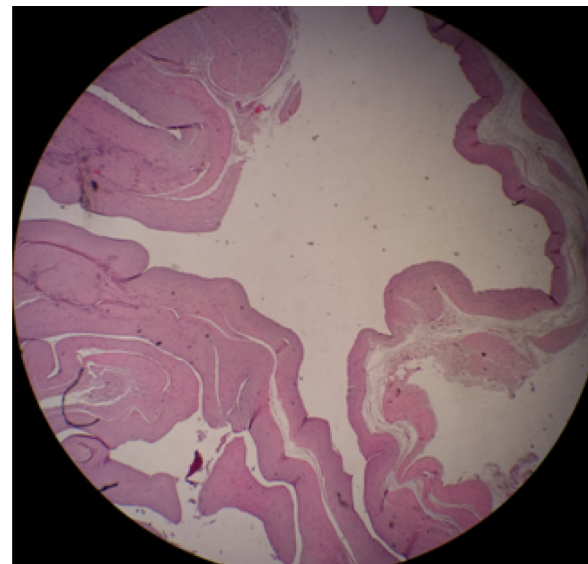


Fig. 12. The histological section of the tissue shows a multilobular cyst with a fibrous wall inside which is a gelatinous tissue, confirming the diagnosis of ganglion cyst.

may play an important role, which would be in accordance with our patients who displayed a history of repeated knee injury [11]. Due to repeated microtrauma that can contribute to the emergence of ganglion cysts, our patient provides an opportunity to test this theory by performing a knee follow-up one or two years after she performs her daily work.

The diagnosis of an intra-articular ganglion cyst of the knee requires more than just a clinical examination. Imaging studies that include plain X-rays are necessary to exclude pathologies such as a loose body or other bone abnormalities. Ultrasound, computed tomography scan and arthrography are helpful examinations. However, MRI is the most sensitive, specific, accurate, and non invasive method for depicting cystic masses, including their size and location. In addition, MRI helps to exclude neoplastic lesions and to detect other intra-articular pathologies [12]. In summary, MRI is the most important diagnostic modality.

Our patient MRI findings exhibited homogeneous low-signal intensity on native T1-weighted images and high-signal intensity on PD and STIR-weighted images (Figs. 2–6). There was an increase in signal



Fig. 13. T1 sagittal view showing low intensity signal in Hoffa's fat pad (arrow); low intensity signal in enlarged proximal segment of patellar ligament (arrowhead).



Fig. 15. T1 contrast enhanced sagittal view showing higher intensity signal in Hoffa's fat pad (arrow-Hoffitis); high intensity signal in enlarged proximal segment of patellar ligament (arrowhead-patellar tendinosis).



Fig. 14. Proton density fat saturated high intensity signal in Hoffa's fat pad (arrow); high intensity signal in enlarged proximal segment of patellar ligament (arrowhead).

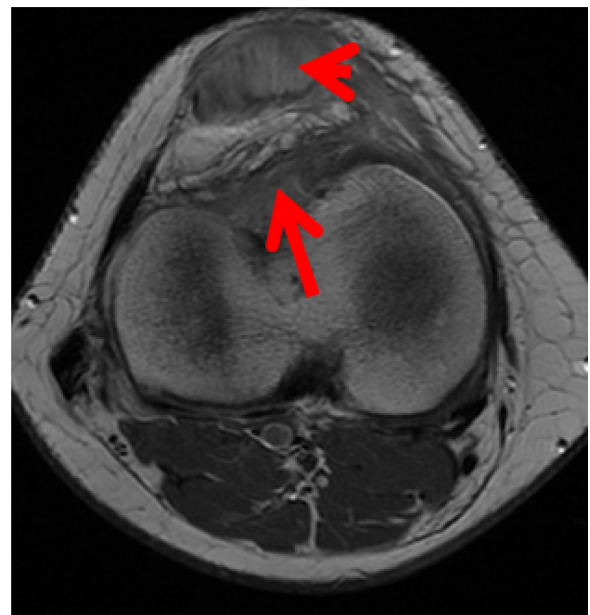


Fig. 16. T1 contrast enhanced axial view showing higher intensity signal in Hoffa's fat pad (arrow-Hoffitis); high intensity signal in enlarged proximal segment of patellar ligament (arrowhead-patellar tendinosis).

intensity after the intravenous administration of gadolinium contrast agent (Figs. 7 and 8). A variety of treatment modalities have been employed to treat intra-articular ganglion cysts of the knee. Spontaneous size reduction has been reported [21]. Excellent results with percutaneous aspiration using ultrasound and computed tomography guidance have also been obtained [16]. Recently, arthroscopic excision of intra-articular cysts is the trend [22]. Bisicchia and associates reported the recurrence of infrapatellar fat pad cysts after ultrasound-guided aspiration [23]. Sahaet and associates described that the subcutaneous extension of an infrapatellar fat pad ganglion may lead to incomplete arthroscopic resection and leave behind the residual tissue, which may result in recurrence [24]. Open surgery is necessary only in

particular cases. It has been reported that the possibility of incomplete removal of a huge cyst exists with arthroscopic surgery when the cyst diameter is greater than 4.5 cm [25]. Bojanić et al. [7] and Nikolopoulos et al. [26] described that when there is a large ganglion, treatment should be an open and thorough resection. Therefore, open surgery should be performed when a ganglion cyst in the infrapatellar fat pad of the knee is suspected because there are no reports in the literature on recurrence following open resection methods [15].

4. Conclusions

Intra-articular ganglion cysts of the knee, although rare, should be included in the list of differential diagnoses when the patient complains

of pain or swelling with mechanical symptoms of the knee. Primary imaging should be plain film radiographs of the symptomatic joint to rule out bony abnormalities or deformity of the joint. Secondary imaging of the knee should be an MRI, as it has been recommended and proven as the most sensitive, specific, accurate, and non-invasive method for detecting cystic lesions of knees due to its multi-planar capability, superior identification of the anatomic and morphological interrelation of the synovial tissues relative to the surrounding structures such as bone and vessels, and detection of additional joint diseases. MRI analysis also significantly contributes to the determination of the nature, location, and size of a ganglion cyst. MRI helps in treatment decision making, as was demonstrated in our case, in which the ganglion cyst was large and was located outside the synovium but within the fat pad. This patient's findings suggest it is probably the largest Hoffa's fat pad ever to be published in the literature. Our opinion is that open surgical excision should be reserved solely for large cysts arising from the infrapatellar fat pad because it can provide a complete resection of the lesion and minimize the risk of recurrence.

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Declaration of Competing Interest

All of the authors declare that there is no conflict of interest.

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