



MRI Characteristics of Infrapatellar Cysts

İnfrapatellar Kistlerin MR özellikleri

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ABSTRACT

Aim: The infrapatellar fat pad is one of the knee fat pads and is particularly important for knee movements. The volume and shape of this fat pad varies individually and can be affected by a variety of tumor and tumor-like pathologies. Cystic structures, which are extremely common in and around the knee joint, can cause various symptoms, especially pain.

Material and Method: 69 knee MRI examinations performed in our center between October 2021 and December 2021 were included in the study. Presence, localization, contours and intensities of infrapatellar cysts and whether there is a compression effect on neighboring structures were investigated in MR images.

Result: The mean age of 69 subjects (41 females, 29 males) included in the study was 53.471±15.23 (52.08±17.375 in females, 58±3.367 in males). Findings of infrapatellar cysts were found in 17 (24.64%) of 69 patients. When 13 (76.5%) of detected infrapatellar cysts were in posterior position, the other 4 (23.5%) were anterior. Although the cyst was in the lateral position in 14 (82.4%) patients, it was medial in 3 (17.6%) patients. While 16 (94.1%) patients with cysts in the inferior position were detected, 1 (5.9%) patient was observed in the superior position. According to the analysis results of spatial data, infrapatellar cysts are most commonly located posterior, lateral and inferior. The mean volume of the detected cysts was found to be 773.91±700.73 mm³. Cysts with smooth surface were observed in 12 (70.59%) patients and with lobulated contours in 5 (29.41%) patients. None of the cystic structures showed a compression effect. Finally, when the intensity structure of the cyst is examined, it has a homogeneous cystic appearance in 16 (94.12%) patients, while it has soft tissue intensity in 1 (5.88%) patient.

Conclusion: Cystic structures within the infrapatellar fat pad are not as rare as previously reported in the literature. Infrapatellar cysts, which are usually located posteriorly and laterally, should be carefully evaluated during MRI reporting, in terms of both its close relationship with anterior cruciate ligament lesions and the clinical symptoms it may cause alone.

Keywords: Infrapatellar cyst, ankle magnetic resonance imaging

ÖZ

Giriş: İnfrapatellar yağ yastığı, dizin yağ yastıklarından biridir ve diz hareketleri açısından son derece önemlidir. Bu yağ yastığının hacmi kişinin şekline bağlı olarak değişir ve çeşitli tümör ve tümör benzeri patolojilerden etkilenebilir. Diz eklemi içi ve çevresinde son derece yaygın olarak bulunan kistik yapılar ağrı başta olmak üzere çeşitli semptomlar verebilir.

Gereç ve Yöntem: Çalışmaya merkezimizde Ekim 2021 – Aralık 2021 tarihleri arasında yapılan 69 Diz MR tetkiki dahil edilmiştir. MR görüntülerinde öncelikle infrapatellar kistlerin mevcudiyeti, lokalizasyonu, konturları ve intensiteleri ile komşu yapılara bası etkisi bulunup bulunmadığı araştırıldı.

Bulgular: Çalışmaya dahil edilen 69 kişinin (41 kadın, 29 erkek) yaş ortalaması 53,471±15,23 (kadınlarda 52,08±17,375, erkeklerde 58±3,367) idi. 69 hastanın 17'sinde (%24.64) infrapatellar kist bulgusuna rastlanmıştır. Tespit edilen infrapatellar kistlerin 13'ü (%76.5) posterior konumda, 4'ü (%23.5) ise anterior konumdadır. 14 (%82.4) hastada kist lateral konumda iken, 3 (%17.6) hastada medial konumdadır. İnferior konumda kiste sahip 16 (%94.1) hasta saptanırken, superior konumlu 1 (%5.9) hasta gözlenmiştir. Konumsal verilerin analiz sonuçlarına göre infrapatellar kistler en sık posterior, lateral ve inferior yerleşimlidir. Tespit edilen kistlerin hacim ortalamasının 773.91±700.73 mm³ olduğu bulunmuştur. Kistin yüzey incelemesinde 12 (%70.59) hastada düzgün yüzeyli, 5 (%29.41) hastada lobule konturlu kist görülmüştür. Kistik yapıların hiçbirisi bası etkisi göstermemiştir. Son olarak kistin intensite yapısına bakıldığında 16 (%94.12) hastada lezyon homojen kistik görünümdeyken 1'inde (%5.88) yumuşak doku intensitesindedir.

Sonuç: İnfrapatellar yağ yastığı içerisinde kistik yapılar daha önce literatürde belirtildiği kadar nadir değildir. Genellikle posterior ve lateral yerleşimli olan infrapatellar kistlerin gerek ön çapraz bağ lezyonlarıyla yakın ilişkisi, gerekse tek başına sebep olabileceği klinik belirtiler açısından MRG raporlamaları esnasında hassasiyetle değerlendirilmesi gerekmektedir.

Anahtar kelimeler: İnfrapatellar kist, ayak bileği manyetik rezonans görüntüleme

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INTRODUCTION

The infrapatellar fat pad is one of the fat pads of the knee and is extremely important in terms of knee movements, especially during flexion (1,2). It is bounded superiorly by the inferior pole of the patella, anteriorly by the joint capsule and patellar tendon, posteriorly by the articular cavity, and inferiorly by the proximal tibia. It attaches inferiorly to the anterior horns of the menisci and the tibia and extends superiorly to the intercondylar notch via the two alar folds forming the infrapatellar fold. The volume of this fat pad varies from person to person (1,3). Infrapatellar fat pads may be affected by various tumors and tumor-like pathologies (4).

Cystic structures, which are extremely common in and around the knee joint, can cause various symptoms, especially pain (4). The content and localization of cystic structures associated with the knee joint may differ (5). There are not enough studies on the cystic construction in the infrapatellar fat pad (6). We aim to evaluate the detailed features of these cysts, about which there are limited studies in the literature, in knee MRI examinations and to contribute to the literature.

MATERIAL AND METHOD

This retrospective study was approved by the Ankara Medipol University Non-Interventional Clinical Research Ethics Committee (Date: 24.01.2022, Decision No: 73). All procedures were carried out in accordance under the ethical rules and the principles of the Declaration of Helsinki.

The study included 69 of 146 patients over 18 age, who had not undergone any operation and had no destructive mass, who underwent knee MRI between October 2021 and December 2021 in our center. Knee MRI examinations of the patients were evaluated retrospectively by a radiologist with 22 years of experience using image archives and transmission systems. MRI examinations were performed with a 1.5 Tesla (Signa Explorer, GE Healthcare, USA) device. Routine sequences (transverse fat suppressed PD, coronal T1A and fat suppressed PD, sagittal T1A, fat-suppressed PD, GE T2) were evaluated. Standard protocols for the sequences are given in **Table 1**.

The presence of infrapatellar cysts, then their contours and intensities were examined on MR images. The infrapatellar adipose tissue was divided into two equal parts in the transverse, coronal and sagittal planes, and

it was noted in which of the medial-lateral, superior-inferior and anterior-posterior parts of the entire cystic structure or the predominant part was located. It was investigated whether there is a compression effect on neighboring structures (such as patellar tendon, medial and lateral patellar retinaculum).

Statistical Analysis

Data such as age and gender findings of the cases were analyzed using the IBM SPSS v22 program. Data expressed as mean±standard deviation, percentage (%), and number (n). Due to the irregularity of the case distribution and the low number of cases in each group, the statistical study did not yield significant results.

RESULTS

The mean age of 69 subjects (41 females, 29 males) included in the study was 53.471 ± 15.23 (52.08 ± 17.375 in females, 58 ± 3.367 in males).

Findings of infrapatellar cysts were found in 17 (24.64%) of 69 patients (**Figure 1-3**). Of the patients with on infrapatellar cyst, 4 (23.5%) were male and 13 (76.5%) were female. The mean age of patients with infrapatellar cysts was 53.47 ± 15.23 , and the mean age of individuals without cysts was 41.35 ± 15.23 .

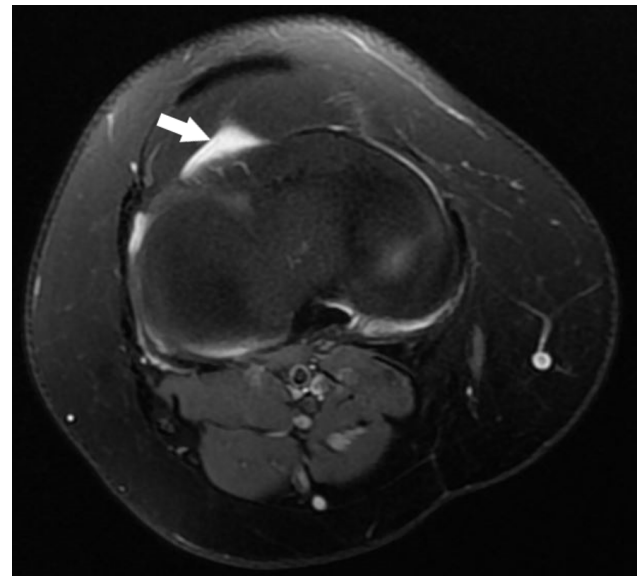


Figure 1. MR image (fat-suppressed axial PD) White arrow: Infrapatellar cyst

Table 1. Mean values of routine sequences in knee MRI examination.

	TR(ms)	TE (ms)	FOV (mm ²)	Matrix	ST (mm)	SS (gap) (mm)
CORONAL T1W	560	18	18x15	384x256	3.5	1.0
CORONAL FS PD	1600	30	18x15	320x192	3.5	1.0
AXIAL FS PD	560	10	18x18	320x192	4	1.0
SAGITAL T1W	540	9	18x16	320x224	3.5	1.0
SAGITAL FS PD	2200	55	18x16	320x192	3.5	1.0
SAGITAL GE	40	18	18x16	320x192	2	1.0

TR: Repetition time, TE: Echo time, FOV: Field of view, ST: Slice thickness, SS: Slice spacing, FS: Fat saturated, PD: Proton density.

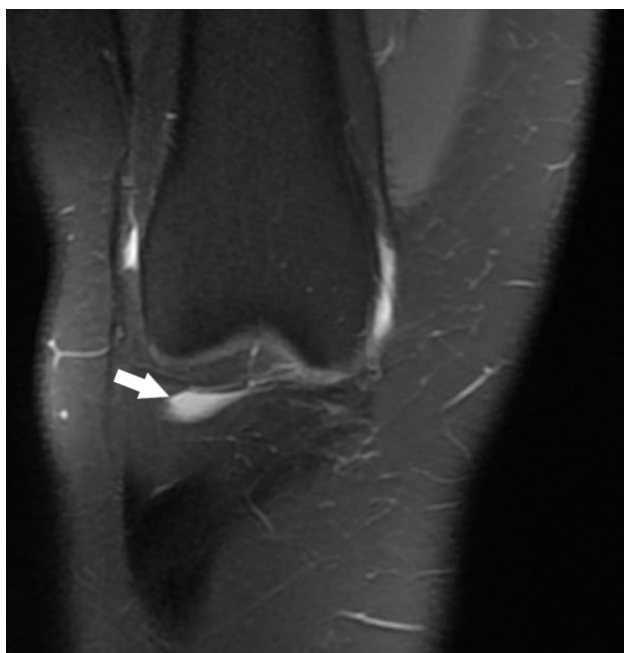


Figure 2. MR image (coronal PD with fat suppression) White arrow: Infrapatellar cyst



Figure 3. MR image (sagittal PD with fat suppression) White arrow: Infrapatellar cyst

Of the detected infrapatellar cysts, 13 (76.5%) were in the posterior and 4 (23.5%) were the anterior position. Those were 4 (30.8%) male patients and 9 (69.2%) female patients with a posterior cyst. All patients (4 patients) with cysts in the anterior position are women. While the cyst was in the lateral position in 14 (82.4%) patients, it was medial in 3 (17.6%) patients. Of the patients with lateral cysts, 3 (21.4%) were male and 11 (78.6%) were female. On the other hand, 1 (33.3%) of the patients with a cyst in the medial position were male and 2 (66.7%) were female. While 16 (94.1%) patients with cysts in the inferior location were detected, 1 (5.9%) patient the superior position were observed. 4 (25%) of the patients with inferior cysts were male and 12 (75%) were female. The only patient with a cyst in the superior position is a woman. According to the analysis results of spatial data, infrapatellar cyst localization is most commonly located posterior, lateral and inferior (**Table 2**).

According to the localization of the cyst, the mean age of individuals with posterior cysts is 51.23 ± 16.95 . In patients with anterior position, it is 60.75 ± 3.59 . The mean age of individuals with lateral localized cysts is 52 ± 16.50 . It is 60.33 ± 5.13 in patients with medial cysts. When the average age of individuals with inferior location is considered, it is observed that it is 55.50 ± 13.28 years, while the age of a single individual with a superior position is 21.

The mean volume of the detected cysts was found to be $773.91 \pm 700.73 \text{ mm}^3$. It was calculated that the cysts had a minimum volume of 35 mm^3 ($7 \times 5 \times 2 \text{ mm}$) and a maximum volume of 2800 mm^3 ($20 \times 17 \times 15 \text{ mm}$). In the surface examination of the cyst, 12 (70.59%) patients had a smooth surface and 5 (29.41%) patients had lobulated contoured cysts.

None of the cystic structures showed a compression effect.

Finally, when the intensity structure of the cyst is examined, it has a homogeneous cystic appearance in 16 (94.12%) patients, while it has soft tissue intensity in 1 (5.88%) patient.

DISCUSSION

In the differential diagnosis of infrapatellar swellings, lipoma, meniscal cyst, synovial cyst, ganglion cyst, osteochondroma are prominent (7,8). Synovial sarcoma, pigmented villonodular synovitis, hemangioma, arborescent lipoma, postoperative changes, horizontal cleft in the infrapatellar fat pad have been reported less frequently (1).

Table 2. Distribution of infrapatellar cyst localization in male and female patients

Gender	Localization					
	Posterior	Anterior	Lateral	Medial	Superior	Inferior
Male	4 (30.8%)	—	3 (21.4%)	1 (33.3%)	—	4 (25%)
Female	9 (69.2%)	4 (100%)	11 (78.6%)	2 (66.7%)	1 (100%)	12 (75%)
Total	13 (76.5%)	4 (23.5%)	14 (82.4%)	3 (17.6%)	1 (5.9%)	16 (94.1%)



Ganglion cyst of the knee joint was first reported by Caan in 1924 in an autopsy examination and connected to the ACL (9). Until 1996, only 30 intra-knee ganglion cysts were reported (10). According to the results of studies conducted in recent years, ganglion cysts in the knee joint are rare, and it has been reported to be found between 0.2-1.3% in MRI examinations and 0.1-0.6% in arthroscopy (7,11-13). However, the increasing number of MRI scans in recent years has also increased the detection of incidentally encountered cystic and cyst-like formations (5,14). In our study, the detection of more cystic formations compared to the previous radiology literature can be explained by this situation. This difference in rate can also attribute to the fact that most of the previous studies focused on ganglion cysts.

MRI examinations are a successful method in evaluating cystic lesions in the knee joint (14). However, lesions such as hemangioma or synovial sarcoma are seen in infrapatellar cystic intensity in routine MRI examinations may be mistakenly interpreted as ganglion cysts. Contrast-enhanced fat-suppressed MRI helps in differential diagnosis (5, 15).

The characteristic findings of a ganglion cyst are a fluid-filled lesion with low T1-weighted and high T2-weighted signal intensities on MRI (16). However, the radiological distinction between a synovial cyst and a ganglion cyst is often impossible (17,18).

Infrapatellar cysts are seen four times more laterally than medially (1,19). In our study, we found this ratio as 3/15. In addition, our study is the first to report that cysts are located more posteriorly and inferiorly.

Ganglion cysts in the knee have a close relationship with cruciate ligaments and meniscus lesions (20). Cystic lesions in the knee often occur as a result of meniscal tears (4). In the presence of an intact meniscus, infrapatellar cysts are generally said to originate from the joint capsule, ligaments, tendon sheaths, subchondral bone, or rarely infrapatellar adipose tissue (2,21).

Intra-articular ganglion cysts of the knee do not have specific symptoms, and the symptoms depend on their size and location within the knee joint (12). Ganglion cysts are often asymptomatic. However, it can sometimes give symptoms in the form of pain, swelling and locking (2). The most common symptom of infrapatellar swelling is anterior knee pain. Locked knee may cause limitation of movement, joint tenderness, and feeling of being stuck (4,22,23). Because the Hoffa fat pad is relatively large, it may take time for the mass to reach a size large enough to cause symptoms (6). Depending on the severity of clinical symptoms, surgical excision may be required (2).

It has been stated that cysts in the Hoffa fat area are generally seen as well-circumscribed, multiloculated cysts (5,24). In our study, 29.41% of cystic structures were lobulated contours. The reason for the difference may be that the prominent infrapatellar extension of parameniscal cysts was not ignored in our study.

There are infrapatellar cystic lesions between 1.8-65 cm in the literature (1,7,16). In our study, the largest cyst dimensions were 20 x 17 x 15 mm and its volume was 2.8 cc. Our study is the first research in the literature that takes the cyst dimensions in three dimensions and calculates the volume.

The study has some limitations. These limitations are primarily that the study was retrospective, arthroscopy was not performed on the cases, and the measurements were made by a single specialist. In addition, the number of patients with cysts is not high enough to establish a statistically significant relationship. Because the analysis group did not undergo the required randomization process, the sample obtained may consider insufficient to represent the population. However, our study is the first in the literature to examine the frequency, size, shape and localization of infrapatellar cysts. Due to the limited number of studies on infrapatellar cysts in the literature, we think that our study will contribute to the literature.

CONCLUSION

Cystic structures within the infrapatellar fat pad are not as rare as previously reported in the literature. Infrapatellar cysts, which are usually located posteriorly and laterally, should be carefully evaluated during MRI reporting in terms of both their close relationship with anterior cruciate ligament lesions and the clinical symptoms that they may cause alone.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by the Ankara Medipol University Non-Interventional Clinical Research Ethics Committee (Date: 24.01.2022, Decision No: 73).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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