scientific reports

Check for updates

OPEN

"Diagnostic pathways in femoroacetabular impingement, patterns of clinical visits, and MRI utilization before hip arthroscopy in Türkiye"

Saygin Kamaci[1✉], Barlas Goker[2], Izzet Bingol[3], Ulas Can Kolac[1], Niyazi Erdem Yasar[4], Ali Aykut Fidanci[5], Naim Ata[5], M. Mahir Ulgu[5], Suayip Birinci[6], Asim Kayaalp[7], Tahsin Beyzadeoglu[8], Bulent Atilla[1] & Baris Kocaoglu[9✉]

Diagnosing femoroacetabular impingement (FAI) is challenging and surgical indications for hip arthroscopy are still evolving. This study analyzes the two years leading up to surgery in a large cohort of patients with FAI. We hypothesized that patients with FAI experience diagnostic challenges causing delayed treatment. We assessed the 2-year diagnostic journeys of patients prior to hip arthroscopy by analyzing recurring hip-related hospital visits, magnetic resonance imaging (MRI), the geographical distribution, and healthcare settings of these visits related to hip pain using data from a nationwide database. Medical records in the national e-health database were reviewed to identify patients who underwent hip arthroscopy between January 2017 and May 2023. Patients aged 18–65 years with a minimum of 2 years of prior medical records were included. The number of clinic visits and MRI scans in the 2 years prior to hip arthroscopic FAI surgery were analyzed with distributions of age and sex. 1754 patients who were confirmed to have complete procedure notes were included in the study. Only 30 of the 81 provinces of Türkiye had hip arthroscopy entries (37.0%). The majority of patients presented at university hospitals on their first visit (35.3%), and 1544 patients (88%) underwent MRI prior to surgery. The median number of clinic visits was 9 (SD: 7.7) and that of MRI scans was 2 (range: 1–7) per patient. Patients under 40 years had a higher mean of orthopedic surgery clinic visits (M: 8.8, SD: 5.1) than those over 40 years (M: 8.1, SD: 6.0) ($p = 0.01$). There was no significant difference between men and women in mean orthopedic clinic visits (8.5 vs. 8.4, respectively). The findings suggest that patients with FAI undergo a considerable number of physician visits (median of 9) and MRI scans (median of 2) in the 2 years preceding hip arthroscopy in Türkiye. These results may indicate diagnostic challenges, delays in determining the need for surgery, and potential reluctance to undergo hip arthroscopy. Addressing these issues would require implementing strategies to reduce the time from symptom onset to treatment initiation and alleviate the financial burden associated with delayed diagnosis.

Keywords Femoroacetabular impingement, Hip arthroscopy, Diagnosis, MRI, Diagnostic challenges

Femoroacetabular impingement (FAI) occurs due to femoral head and/or acetabular deformities, leading to abnormal forces within the hip joint, chondral and labral damage, which leads to hospital visits with hip

[1]Department of Orthopedic Surgery, Hacettepe University, Ankara, Türkiye, Turkey. [2]Department of Orthopedic Surgery, Montefiore Medical Center, New York, NY, USA. [3]Department of Orthopedics and Traumatology, Ankara Yildirim Beyazit University, Ankara, Türkiye, Turkey. [4]Ankara Bilkent City Hospital, Department of Orthopedics and Traumatology, Health Sciences University, Ankara, Türkiye, Turkey. [5]Ministry of Health, General Directorate of Health Information Systems, Ankara, Türkiye, Turkey. [6]Deputy Minister, Ministry of Health, Ankara, Türkiye, Turkey. [7]Department of Orthopedic Surgery, Ankara Cankaya Hospital, Ankara, Türkiye, Turkey. [8]Halic University, Beyzadeoglu Clinic, Istanbul, Türkiye, Turkey. [9]Faculty of Medicine, Acibadem University, Istanbul, Türkiye, Turkey. ✉email: sayginkamaci@gmail.com; bariskocaoglu@gmail.com

pain[1]. With advancements in the field of hip preservation surgery, the importance of FAI has recently become prominent, but the diagnosis of this disease is difficult for many clinicians. The diagnostic challenges stem from its overlapping symptoms with other hip pathologies, the subtlety of physical examination findings, and the need for advanced imaging to confirm the diagnosis[2]. When conservative treatments fail, surgical restoration of normal anatomy through open or arthroscopic methods can relieve symptoms[3]. The success of hip arthroscopy in surgically addressing FAI, labral tears, and cysts has been consistently demonstrated[4]. Despite its steep learning curve and potential complications like nerve injuries, chondral damage, or instrument breakage, hip arthroscopy is the gold standard for treating intra-articular injuries due to its minimally invasive nature, early rehabilitation benefits, and avoidance of trochanteric osteotomy[5–7].

The difficulty of diagnosing labrum tears leads to delayed definitive diagnosis and a previous report from the USA showed that an average of 21 months and 3.3 healthcare providers may be required before hip arthroscopy[8]. On the other hand, since hip arthroscopy is considered an advanced technique, surgeons who have experience in this field tend to be concentrated in referral centers and specialized institutions. Taken together, these factors could contribute to high numbers of clinic visits and imaging studies prior to hip arthroscopy surgery. If such a problem could be demonstrated and identified, measures could be taken to reduce the number of these recurring visits to alleviate the stress on the healthcare system, thereby leading to higher efficiency, lower costs, and shorter waiting lists.

As the popularity of hip preservation surgeries has risen in the last decade, numerous registries have been developed to collect data from nationwide sources[4,7]. These registries not only allow researchers the advantages of stronger statistical power by analyzing "big data," but they can also demonstrate epidemiological trends to show overlooked aspects of care. Despite the great benefits of these registries, only a few countries have implemented efficiently running systems due to the challenges of widespread adoption, mainly in populous healthcare systems with high-volume clinics. The Turkish Ministry of Health has been using a national database named e-Nabız to facilitate remote access to healthcare information for both patients and clinicians by centralizing healthcare data through an online platform[5]. This database provides a basis for epidemiological studies and information for clinicians comparable to a registry.

In this study, we aimed to investigate the 2-year diagnostic journeys of patients before undergoing hip arthroscopy surgery by analyzing recurring hospital visits due to hip pain and magnetic resonance imaging (MRI) as well as the geographical distribution and healthcare settings of these visits by using data from a nationwide database. We hypothesized that patients with FAI experience diagnostic challenges and low referral numbers to hip preservation centers[9].

Materials and methods

Data collection from the database

The electronic health records of individuals of all ages who were admitted to government-based, private, and university-affiliated healthcare institutions were obtained using e-Nabız, a national e-health database provided by the Turkish Ministry of Health. The study was conducted in accordance with the Declaration of Helsinki and received approval from the Turkish Ministry of Health with a waiver of informed consent for retrospective data analysis and the health information privacy law (ID: 95741342-020/27112019). The e-Nabız database is a nationwide personal health records system offering 30 different services for treatment, imaging, prevention, and other health-related areas. The user base of this system has grown significantly in recent years, reaching 68 million active users (i.e., over 80% of the population of Türkiye) by 2022.

A computerized research query of medical records was conducted for the procedure codes "612,750: interventional hip arthroscopy "and "612751: arthroscopic hip labral repair" to identify patients who underwent hip arthroscopy between January 2017 and May 2023. All patient information was retrieved from the system in a deidentified state. Only patients between the ages of 18 and 65 with a minimum of 2 years of prior medical records in the e-Nabız database were included. Patient demographics (age, sex), date of surgery, and healthcare facility information were collected. Clinical notes for each patient were scanned to eliminate records with wrong procedure codes or incomplete procedural information. Patients with a history of previous ipsilateral or contralateral hip arthroscopic FAI surgery, those who underwent hip arthroscopy primarily for indications such as loose bodies, synovial hypertrophy, or osteonecrosis without an underlying FAI etiology, a history of rheumatological disease or malignancy, and incomplete medical records were excluded. Detailed exclusion criteria and corresponding numbers are presented in Fig. 1.

Türkiye operates a public healthcare system wherein the government offers public health insurance to its citizens. Notably, there are no restrictions on the number of clinical visits individuals can make. They have the freedom to visit any hospital without prior approval. Furthermore, for any interventional procedure, a diagnosis by a physician suffices, eliminating the need for pre-approval. In cases requiring surgical procedures, there's no obligatory initial conservative treatment before surgery. Additionally, individuals can undergo repeated diagnostic procedures like MRI upon a physician's decision.

A retrospective review was performed to assess the number of medical visits to orthopedic surgery units (code: 171), primary care sports medicine units (code: 183), and rheumatology clinics (code: 141) across different healthcare settings, as well as the total number of International Classification of Diseases (ICD) codes per visit. Hospital visits related to hip pain were included for analysis (ICD 10: M25.55 S79, S73, M16). Additionally, the number of diagnostic imaging methods such as hip (R104180, R104200, 804.240) and pelvis (R103600) MRI scans and hip MRI arthrograms (R104600, R104610) were recorded (https://skrs.saglik.gov.tr/). All of the patients who met the inclusion criteria were categorized into one of four groups based on the type of healthcare facility to which they presented for their first visit: secondary and tertiary public referral centers (including government hospitals and government training hospitals), university hospitals, private hospitals, and private ambulatory care centers.

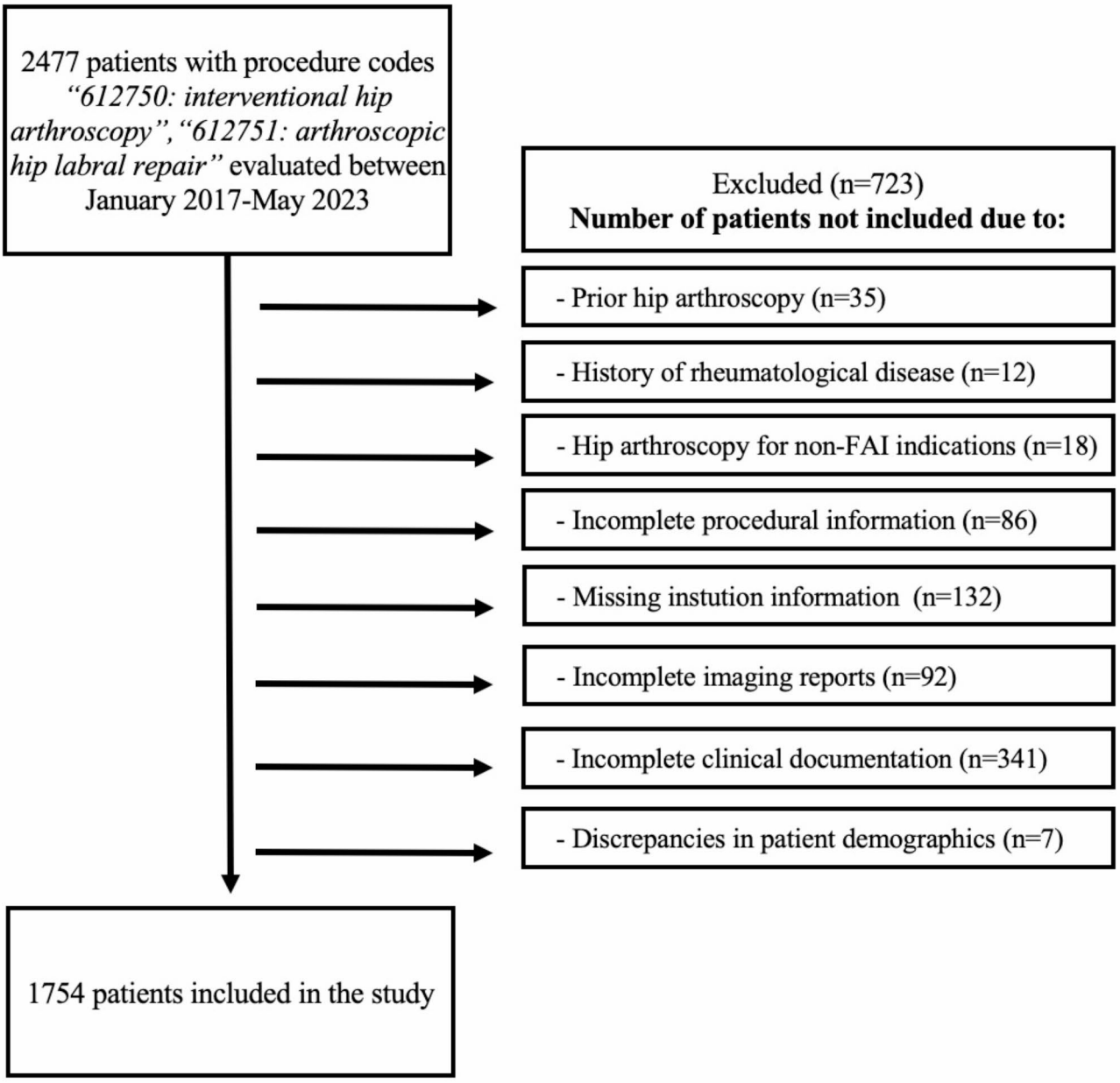

Fig. 1. Flow chart presenting the inclusion and exclusion criteria.

Patient demographics were analyzed in terms of sex and age groups (18–29 years, 30–39 years, 40–49 years, and > 50 years) for physician visit numbers and MRI scan counts in the 2 years leading up to surgery. Additionally, patients under the age of 40 and above 40 years were compared for the number of clinic visits.

Statistical analysis

IBM SPSS Statistics 25 (IBM Corp., Armonk, NY, USA) was used in the analysis of the data. Frequency and percentage statistics were used for descriptive measures. Chi-square tests (Pearson) were used for categorical variables. The numbers of clinic visits between age groups and sexes were compared with independent sample t-tests.

Results

Among 2477 patient records with hip arthroscopy surgical codes, 1754 patients who were confirmed to have complete procedure notes were included in this study (Fig. 1). Hip arthroscopic FAI surgeries had the highest incidence in 2021 with 397 cases (22.6%), followed by 372 cases (21.2%) in 2022 (Fig. 2). There was a decrease in the incidence in 2020 (12.4%), which was in line with the cancelation of elective procedures during the COVID-19 pandemic. Overall, the mean annual incidence was 272.1 cases (range: 121–397). Among the total treated patients, 997 (56.8%) were male and 757 (43.2%) were female. There were no significant differences

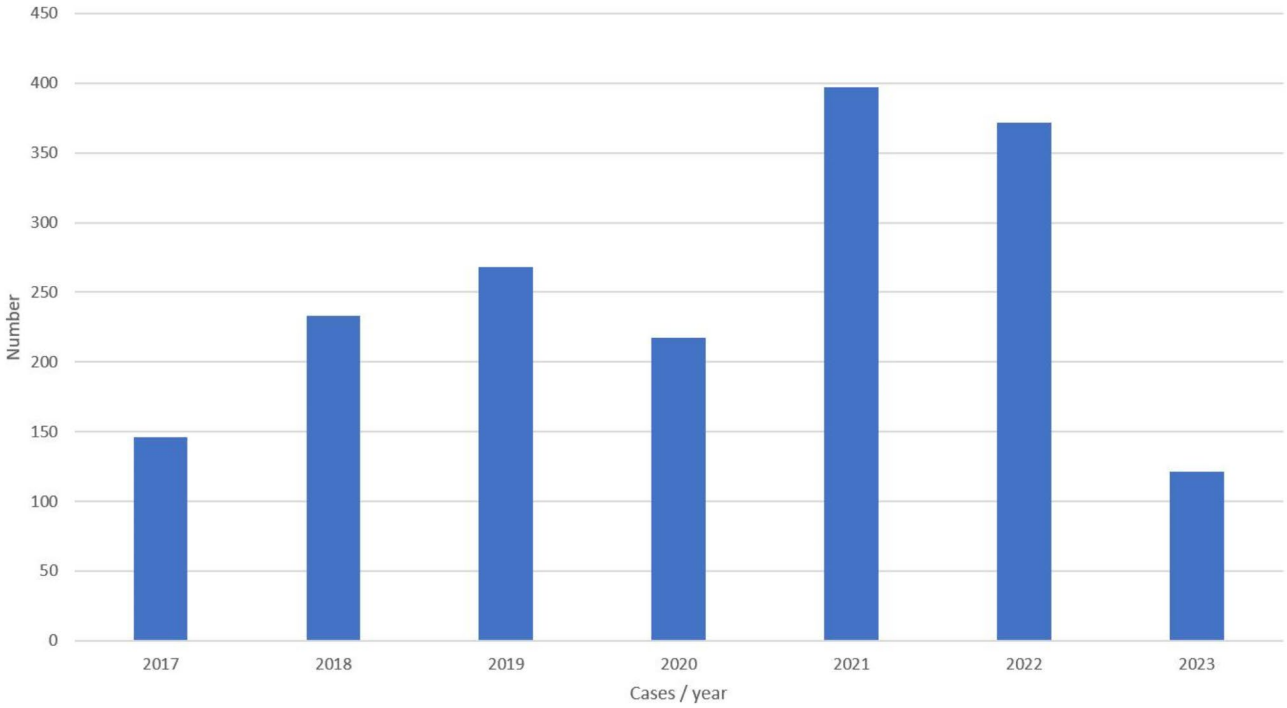

Fig. 2. The distribution of femoroacetabular impingement surgeries throughout the years.

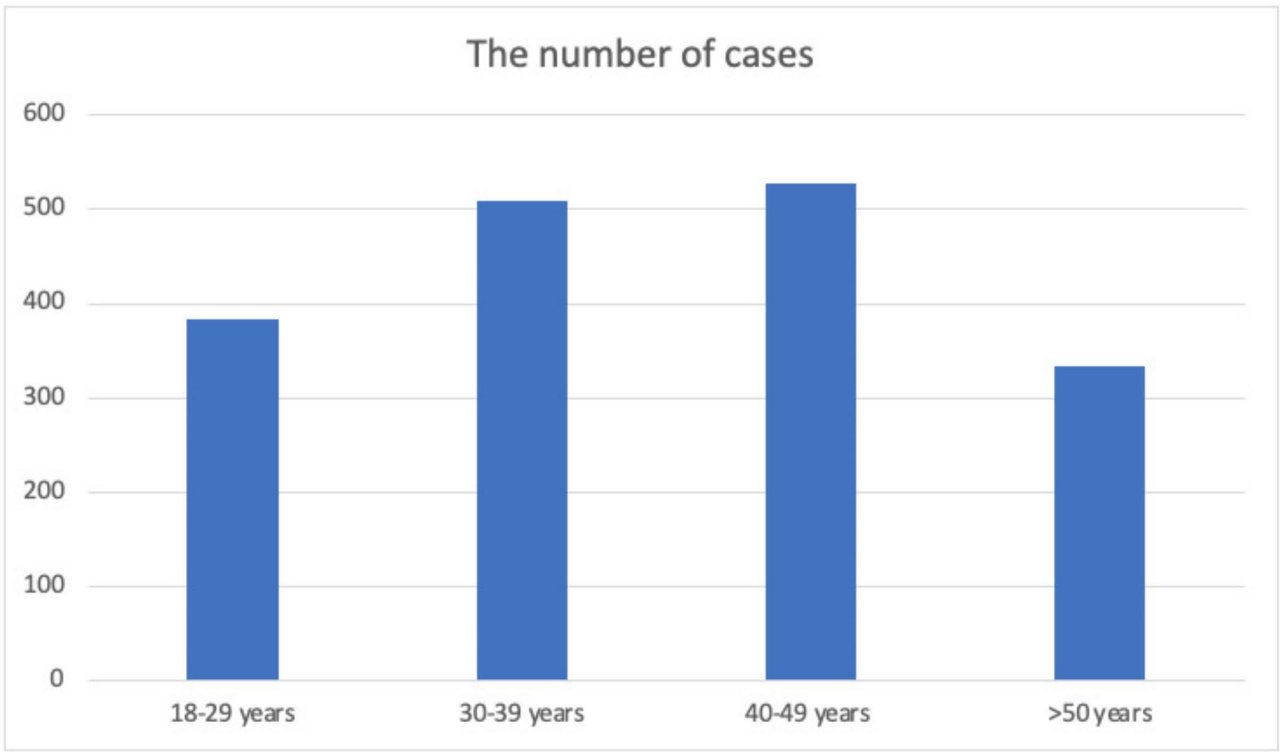

Fig. 3. The distribution of cases based on age groups.

between age groups ($P > 0.05$) in terms of clinic visits, and patients aged 40–49 years were the most common ($n = 528$, 30.1%) (Fig. 3). Nearly 70% of all hip arthroscopies were performed in two major cities (Istanbul: 41.4%; Ankara: 28%). As the most populous city in the country, Istanbul had the highest number of surgeries with 726 cases (4.5/100,000), followed by Ankara, the second most populous city, with 491 cases (8.6/100,000).

	N	Mean	Median	Std. Deviation	Minimum	Maximum
MRI	1544	2.46	2	1,8	1	7
Orthopedic surgery	1751	8.49	7	5,6	1	45
Rheumatology	60	2.93	2	3,3	1	17
Sports medicine	870	4.38	3	4,2	1	28
Total	1754	10.74	9	7,7	1	45

Table 1. Numbers, mean, median, minimum, and maximum values of clinic visits per department.

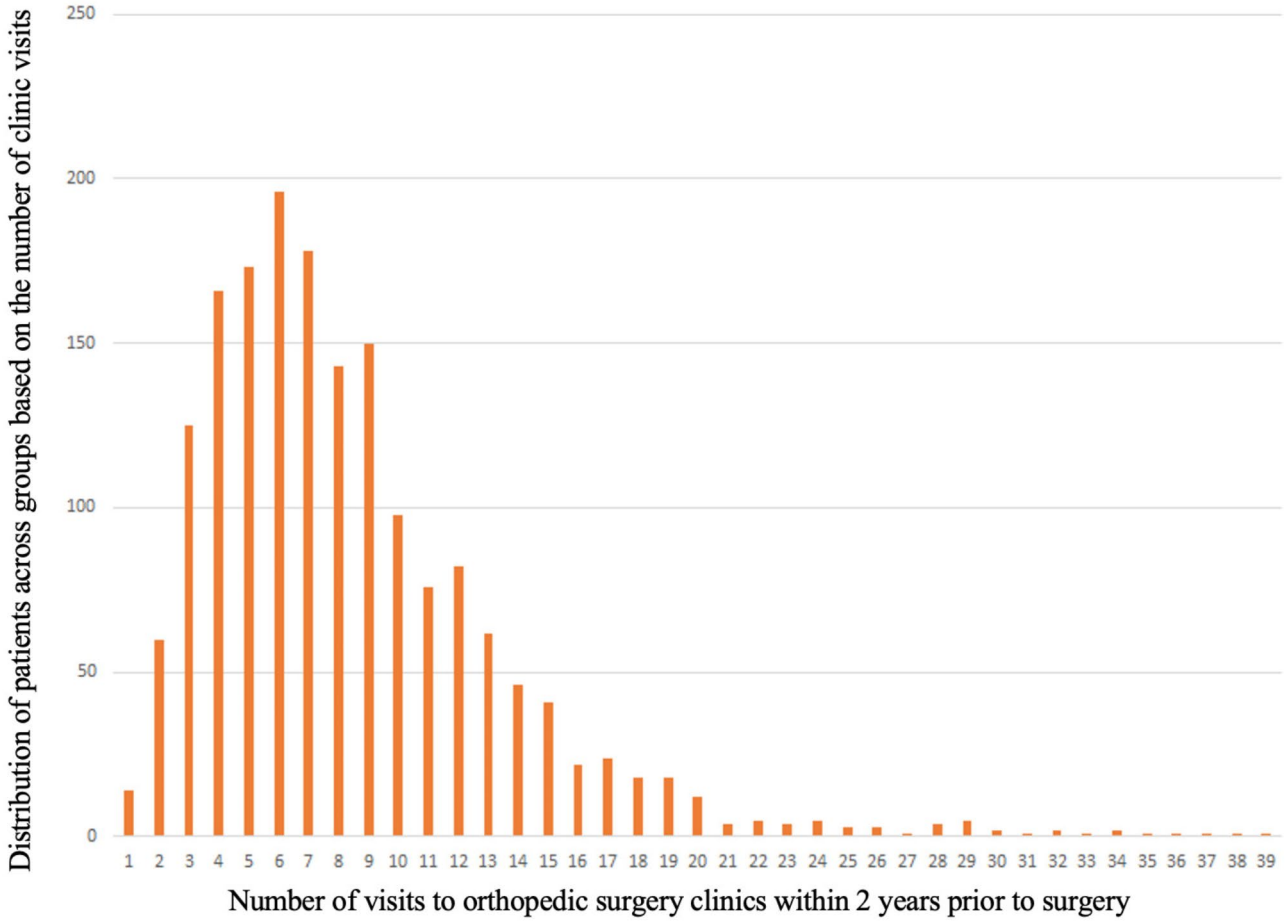

Fig. 4. The distribution of patients based on the number of visits to orthopedic surgery clinics within 2 years prior to surgery.

Only 30 provinces had hip arthroscopy entries from among the 81 provinces of Türkiye (37.0%). The majority of patients presented at university hospitals at their first visits (35.3%), followed by private hospitals (33.9%). Only 5 patients (0.3%) initially presented at private ambulatory care centers.

The vast majority of patients in our study population, accounting for 99.2%, had documented repeated hospital visits related to hip problems before the date of surgery. The median number of clinic visits per patient was 9 (SD: 7.7, range: 1–45) and the mean was 10.7 (Table 1). Furthermore, 1544 patients (88%) underwent MRI prior to surgery. The median number of MRI scans per patient was 2 and the mean was 2.4 (range: 1–7). The most common department of clinic visits was orthopedic surgery (99.7%) (Fig. 4), followed by sports medicine (49.5%) and rheumatology (3.4%). There was no significant difference between men and women in terms of the mean number of clinic visits per patient ($P > 0.05$). Patients under 40 years of age had a higher mean number of orthopedic surgery clinic visits (M: 8.8, SD: 5.1) than those over 40 years (M: 8.1, SD: 6.0) ($p = 0.01$).

Discussion

The most important finding of the study is that patients with FAI underwent a median of 9 physician visits related to hip issues and 2 MRI scans 2 years prior to hip arthroscopic FAI surgery. These results suggest the existence of diagnostic challenges, as well as difficulties in determining the need for surgery and the potential avoidance of

hip arthroscopy. Previous studies have shown that the average time to diagnose FAI and labral tears can exceed 30 months, with patients often consulting multiple healthcare providers before receiving a definitive diagnosis[10]. However, since no established benchmark exists for the ideal time to diagnosis, our study highlights the need for further studies to define appropriate diagnostic timelines and strategies for FAI. Additionally, younger patients, specifically those under 40 years of age, exhibited a higher mean number of physician clinic visits compared to older patients aged over 40 years. This underscores the importance of addressing diagnostic delays and improving access to appropriate care for patients with FAI, particularly among younger demographics.

In the era of "big data," healthcare trends collected from nationwide databases play a crucial role in policymaking to provide more equitable and accessible healthcare in a resource-efficient manner. This study illustrates important demographic trends such as increasing frequencies over the years (albeit with an acute drop due to the COVID-19 pandemic) and shows an increased share of the practice of FAI surgery in major metropolitan areas. Another important outcome of this study is the demonstration of recurring physician visits before undergoing hip arthroscopy. FAI can be difficult to diagnose and in some cases the use of imaging modalities and different opinions may be helpful. On the other hand, miscommunication between providers and failure to implement appropriate MRI techniques can lead to repeated MRI scans, which can burden and obstruct healthcare systems that are already strained under high patient volumes.

The advancement of hip arthroscopy techniques and increased knowledge in this field have encouraged more surgeons to perform these surgeries over the years, as hip arthroscopy has become a thriving procedure around the world. According to our findings, 1754 patients underwent hip arthroscopy and arthroscopic labral repair in Türkiye between the years 2017 and 2023. The prevalence corresponds to nearly 0.002% of the population of the country. A Danish study published in 2020 reported 5565 patients (0.09% of the population) over 6 years in their registry and data from the UK reflected 4963 cases in 7 years (0.007% of the population), which are higher numbers compared to our study[6,11]. This difference can be explained by the early implementation of a registry in Denmark, in addition to the high level of awareness and training in this field of hip arthroscopy in both countries. A Swedish registry study reported 606 cases in 14 months with prevalence rates closer to our findings[7]. Nonetheless, there are only a few registry studies of hip arthroscopy that can provide large-scale data for interpreting demographic trends to identify systematic problems and create appropriate solutions. Our study also illustrated the concentration of hip arthroscopy in more populous and developed areas of the country. Nearly two-thirds of the country's provinces, which represent a sizeable population, were not able to implement this surgical procedure. It can be argued that this is an elective procedure and that patients can be referred to urban centers for advanced surgeries. It should be kept in mind, however, that many such patients are deprived of these services due to a lack of access to transportation, as well as financial or social limitations. There is also a shortage of adequately trained surgeons. Recent evidence highlights the significant impact of surgical volume on patient outcomes in hip arthroscopy[12]. A study from New York State demonstrated increased 90-day readmissions and complication rates in low-volume centers, reinforcing the critical role of surgical expertise in this technically demanding procedure[12]. Similarly, surgeons with lower caseloads may face greater challenges in achieving optimal outcomes compared to high-volume specialists[12]. Therefore, the findings of this study are invaluable for highlighting issues such as imbalances between geographical areas.

The findings from previous demographic studies on patients undergoing hip arthroscopy suggested that there are no significant differences between sexes or age groups in this patient population[4,7,13]. This aligns with the conclusions drawn by Montgomery et al. and is consistent with the existing literature in this field[14]. Therefore, our findings parallel those of previous research and further support the notion that sex and age do not play a significant role in determining the characteristics of patients undergoing hip arthroscopy.

Our results have shown that a majority of patients in Türkiye present to clinics multiple times before undergoing hip arthroscopy. One reason for this might be the absence of a chain of referral since hip arthroscopy is mostly performed at care facilities with specialized equipment and adequately trained surgeons. Another potential reason is the tendency of patients to seek second opinions. Some countries have implemented second-opinion programs to increase patient satisfaction with the surgical decision[15].With these second-opinion guidelines, the uncertainty of treatment can be reduced[16]. As a third reason, inexperienced physicians and physical therapists may sometimes struggle to diagnose FAI due to the inconspicuous nature of the symptoms and examination findings. FAI is a common diagnosis among hip pain-related clinic visits in sports medicine clinics[17]. On the other hand, the failure to diagnose the distinction between hip-related and non-hip-related groin pain also contributes to this mismanagement by sending unrelated patients to the orthopedic surgery departments of tertiary referral centers[18]. For these reasons, it is crucial to properly educate healthcare providers about the share of FAI cases in current diagnostic practices as well as differential diagnoses to avoid unnecessary referrals.

The literature on FAI is still an emerging field and best practice guidelines have been recently published[19,20]. Unfortunately, these have not yet led to a consensus among different specialties and study groups. Anatomic abnormalities such as femoral and acetabular cartilage defects and even labral tears can be detected in hip MRI in asymptomatic individuals[21]. Due to inconsistent guidelines for the selection of surgical candidates, conservative treatment is still indicated in the management of FAI, mainly for patients with milder symptoms. According to one study, 70% of patients received physical therapy before visiting a hip surgeon[22]. Our results support these findings, as many patients presented to non-surgical clinics in the 2 years prior to their arthroscopy surgeries. MRI has been useful in the diagnosis of patients with clinical suspicion of FAI associated lesions like labral tears, bony edema, chondrolabral junction pathologies and can help identify risk factors for suboptimal outcomes in hip arthroscopy, such as advanced chondral damage or irreparable labral tears.

MRI has been useful in the diagnosis of patients with clinical suspicion of FAI associated lesions like labral tears, bony edema, chondrolabral junction pathologies and can help identify risk factors for suboptimal outcomes in hip arthroscopy, such as advanced chondral damage or irreparable labral tears. However, the

need for preoperative MRI is still controversial, as some reports suggest that it delays surgery and increases costs[23–25]. Our findings have shown that some patients had multiple MRI scans prior to undergoing surgery. This may be the result of miscommunication between healthcare providers and patients, low-quality images, uncertainty about the procedure, or efforts to "buy time." Regardless, ordering unnecessary imaging wastes resources and is an indicator of systemic flaws in healthcare. The collective evidence against ordering MRI for low back pain has prompted medical authorities to create guidelines to reduce the number of unwarranted imaging sessions[3,26]. Similar measures can be taken to at least reduce the number of MRI scans. Additionally, implementing standardized imaging protocols, like the European Society of Musculoskeletal Radiology (ESSR) guidelines for hip MRI, can improve diagnostic accuracy and minimize the necessity for repeat studies. Another solution might be issuing warnings on the user interface whenever physicians attempt to order MRI scans in the case of previously existing scans. Unless some measures are taken against the ordering of inappropriate MRI procedures, the healthcare system may not be able to match the demand in the future[27]. Indeed, this study has several strengths that enhance the robustness of its findings. The high number of patients included, and the extensive duration of 6 years covered by the national registry data provide a comprehensive and representative sample for analysis. Additionally, the confirmation of data accuracy through clinical information, in addition to procedure codes, helps to mitigate the potential for coding errors, which are a common limitation in population-based studies. By addressing these issues, the study is better positioned to provide reliable insights into hip arthroscopy utilization and outcomes in the population under investigation.

This study boasts several strengths. Firstly, it benefits from a large patient cohort, ensuring robust statistical power. Secondly, it draws upon an extensive dataset, spanning six years of national registry data concerning patients who underwent hip arthroscopy. Moreover, data accuracy was meticulously verified through clinical information cross-referenced with procedure codes. This rigorous approach effectively mitigated the risk of coding errors, a common limitation in population-based studies.

This study highlights the significant diagnostic challenges in FAI, which may lead to repeated healthcare visits, prolonged patient suffering, and higher healthcare costs. Delayed diagnosis can contribute to joint damage progression and the need for invasive treatments such as total hip arthroplasty[28,29]. Although we did not perform a cost analysis, the observed median of 9 clinic visits and 2 MRIs per patient underscores the potential economic burden. Streamlining diagnostic pathways could improve patient outcomes and reduce unnecessary healthcare utilization. Future research should evaluate the cost-effectiveness of these strategies and their impact on clinical outcomes.

The study has several limitations that should be considered when interpreting its findings. The lack of investigation into MRI reports and operative findings means that the influence of specific diagnostic pathologies on hip-related hospital visits could not be determined. Moreover, the inability to report details of surgical procedures and conduct analyses on surgical techniques or dependent variables limits the depth of understanding regarding the effects of different interventions. Finally, the omission of analysis on physical therapy visits further restricts the comprehensive evaluation of patient outcomes and treatment pathways. Addressing these limitations in future studies could provide a more nuanced understanding of the factors influencing hip-related healthcare utilization and outcomes.

Conclusion

This study showed that patients with FAI required a mean of 9 physician visits and 2 MRI scans in the 2 years prior to arthroscopic FAI surgery. These results are suggestive of diagnostic challenges and difficulties in indicating surgery. Further strategies are needed to decrease the symptom-to-treatment time and the financial burden caused by delayed diagnosis by increasing awareness of FAI.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to restrictions to protect patient confidentiality. The Ministry of Health and the Turkish Hip Preserving Society were actively involved in the study, and the data, which is accurate, is stored within the Ministry's internal system. For any queries or requirements regarding the data, please contact Saygin KAMACI, M.D., Associate Professor, Hacettepe University, Department of Orthopedic Surgery, Ankara, Türkiye, email: sayginkamaci@gmail.com.

Received: 29 May 2024; Accepted: 24 February 2025
Published online: 01 July 2025

References

1. Friedrich, S., Reis, S., Meybohm, P. & Kranke, P. Preoperative anxiety. *Curr Opin Anaesthesiol* **35**, 674–678 (2022). https://doi.org/10.1097/ACO.0000000000001186
2. Thomas, G. E. *et al.* Diagnosis and management of femoroacetabular impingement. *Br J Gen Pract* **63**, e513-515 (2013). https://doi.org/10.3399/bjgp13X669392
3. Bouck, Z. *et al.* Measuring the frequency and variation of unnecessary care across Canada. *BMC Health Serv Res* **19**, 446 (2019). https://doi.org/10.1186/s12913-019-4277-9
4. Mygind-Klavsen, B. *et al.* Danish Hip Arthroscopy Registry: an epidemiologic and perioperative description of the first 2000 procedures. *J Hip Preserv Surg* **3**, 138–145 (2016). https://doi.org/10.1093/jhps/hnw004
5. Birinci, S. A Digital Opportunity for Patients to Manage Their Health: Turkey National Personal Health Record System (The e-Nabiz). *Balkan Med J* **40**, 215–221 (2023). https://doi.org/10.4274/balkanmedj.galenos.2023.2023-2-77
6. Poulsen, E., Lund, B. & Roos, E. M. The Danish Hip Arthroscopy Registry: Registration Completeness and Patient Characteristics Between Responders and Non-Responders. *Clin Epidemiol* **12**, 825–833 (2020). https://doi.org/10.2147/CLEP.S264683
7. Sansone, M. *et al.* A Swedish hip arthroscopy registry: demographics and development. *Knee Surg Sports Traumatol Arthrosc* **22**, 774–780 (2014). https://doi.org/10.1007/s00167-014-2840-9

8. Burnett, R. S. *et al.* Clinical presentation of patients with tears of the acetabular labrum. *J Bone Joint Surg Am* **88**, 1448–1457 (2006). https://doi.org/10.2106/JBJS.D.02806
9. Arastu, M. H., Grange, S. & Twyman, R. Prevalence and consequences of delayed diagnosis of anterior cruciate ligament ruptures. *Knee Surg Sports Traumatol Arthrosc* **23**, 1201–1205 (2015). https://doi.org/10.1007/s00167-014-2947-z
10. Kahlenberg, C. A., Han, B., Patel, R. M., Deshmane, P. P. & Terry, M. A. Time and Cost of Diagnosis for Symptomatic Femoroacetabular Impingement. *Orthop J Sports Med* **2**, 2325967114523916 (2014). https://doi.org/10.1177/2325967114523916
11. Holleyman, R. *et al.* Hip arthroscopy for femoroacetabular impingement is associated with significant improvement in early patient reported outcomes: analysis of 4963 cases from the UK non-arthroplasty registry (NAHR) dataset. *Knee Surg Sports Traumatol Arthrosc* **31**, 58–69 (2023). https://doi.org/10.1007/s00167-022-07042-y
12. Shankar, D. S. *et al.* Increased 90-Day Readmissions and Complications Following Hip Arthroscopy in Centers With Low Surgical Volume in New York State. *Arthroscopy* **39**, 2302–2309 (2023). https://doi.org/10.1016/j.arthro.2023.03.026
13. Sing, D. C., Feeley, B. T., Tay, B., Vail, T. P. & Zhang, A. L. Age-Related Trends in Hip Arthroscopy: A Large Cross-Sectional Analysis. *Arthroscopy* **31**, 2307–2313 e2302 (2015). https://doi.org/10.1016/j.arthro.2015.06.008
14. Montgomery, S. R. *et al.* Trends and demographics in hip arthroscopy in the United States. *Arthroscopy* **29**, 661–665 (2013). https://doi.org/10.1016/j.arthro.2012.11.005
15. Weigl, M. *et al.* Effects of a medical second opinion programme on patients' decision for or against knee arthroplasty and their satisfaction with the programme. *BMC Musculoskelet Disord* **22**, 595 (2021). https://doi.org/10.1186/s12891-021-04465-5
16. Weyerstrass, J., Prediger, B., Neugebauer, E. & Pieper, D. Results of a patient-oriented second opinion program in Germany shows a high discrepancy between initial therapy recommendation and second opinion. *BMC Health Serv Res* **20**, 237 (2020). https://doi.org/10.1186/s12913-020-5060-7
17. Mack, L., Vannatta, N., Rasmussen, C. & Borgert, A. Prevalence and Course of Treatment of Common Hip Diagnoses Presenting to a Sports Medicine Clinic. *WMJ* **118**, 65–70 (2019).
18. Palsson, A., Kostogiannis, I., Lindvall, H. & Ageberg, E. Hip-related groin pain, patient characteristics and patient-reported outcomes in patients referred to tertiary care due to longstanding hip and groin pain: a cross-sectional study. *BMC Musculoskelet Disord* **20**, 432 (2019). https://doi.org/10.1186/s12891-019-2794-7
19. Lynch, T. S. *et al.* Best Practice Guidelines for Hip Arthroscopy in Femoroacetabular Impingement: Results of a Delphi Process. *J Am Acad Orthop Surg* **28**, 81–89 (2020). https://doi.org/10.5435/JAAOS-D-18-00041
20. Schmaranzer, F., Kheterpal, A. B. & Bredella, M. A. Best Practices: Hip Femoroacetabular Impingement. *AJR Am J Roentgenol* **216**, 585–598 (2021). https://doi.org/10.2214/AJR.20.22783
21. Tresch, F., Dietrich, T. J., Pfirrmann, C. W. A. & Sutter, R. Hip MRI: Prevalence of articular cartilage defects and labral tears in asymptomatic volunteers. A comparison with a matched population of patients with femoroacetabular impingement. *J Magn Reson Imaging* **46**, 440–451 (2017). https://doi.org/10.1002/jmri.25565
22. Schaver, A. L., Khazi, Z. M., Paulson, A. C., Willey, M. C. & Westermann, R. W. Utilization of Physical Therapy Prior to Consultation for Hip Preservation Surgery. *Iowa Orthop J* **41**, 72–76 (2021).
23. Larson, C. M. Editorial Commentary: Routine Preoperative Magnetic Resonance Imaging for Hip Arthroscopy Is Wasting Health Care Dollars and Delaying Surgical Intervention: Decision Making Should Be at the Discretion of the Health Care Provider Not Mandated by Health Care Insurers. *Arthroscopy* **38**, 3020–3022 (2022). https://doi.org/10.1016/j.arthro.2022.04.009
24. Ramkumar, P. N. *et al.* Evaluating the Need for Preoperative MRI Before Primary Hip Arthroscopy in Patients 40 Years and Younger With Femoroacetabular Impingement Syndrome: A Multicenter Comparative Analysis. *Orthop J Sports Med* **11**, 23259671221144776 (2023). https://doi.org/10.1177/23259671221144776
25. Ramkumar, P. N. *et al.* Preoperative Magnetic Resonance Imaging Offers Questionable Clinical Utility, Delays Time to Hip Arthroscopy, and Lacks Cost-Effectiveness in Patients Aged </=40 Years With Femoroacetabular Impingement Syndrome: A Retrospective 5-Year Analysis. *Arthroscopy* **38**, 3013–3019 (2022). https://doi.org/10.1016/j.arthro.2022.03.025
26. Salari, H. *et al.* Evidence for Policy Making: Clinical Appropriateness Study of Lumbar Spine MRI Prescriptions Using RAND Appropriateness Method. *Int J Health Policy Manag* **1**, 17–21 (2013). https://doi.org/10.15171/ijhpm.2013.04
27. Manta, A., O'Grady, J., Bleakney, R. & Theodoropoulos, J. Determining the appropriateness of requests for outpatient magnetic resonance imaging of the hip. *Can J Surg* **62**, 224–226 (2019). https://doi.org/10.1503/cjs.003718
28. Ramkumar, P. N., Olsen, R. J., Shaikh, H. J. F., Nawabi, D. H. & Kelly, B. T. Modern Hip Arthroscopy for FAIS May Delay the Natural History of Osteoarthritis in 25% of Patients: A 12-Year Follow-up Analysis. *Am J Sports Med* **52**, 1137–1143 (2024). https://doi.org/10.1177/03635465241232154
29. Lee, M. S. *et al.* Patients Undergoing Primary Hip Arthroscopy Report Favorable Outcomes at Minimum 10 Year Follow-Up: A Systematic Review. *Arthroscopy* **39**, 459–475 (2023). https://doi.org/10.1016/j.arthro.2022.10.040

Acknowledgements
This study is conducted in coordination with the Turkish Society of Preventive Hip Surgery and the Turkish Ministry of Health. All authors made appropriate contributions to the conception and design of the study.

Author contributions
SK: Writing – Original Draft, Visualization. BG, IB, NEY: Writing – Review & Editing. ED: Formal Analysis. UCK: Software, Data Curation. NA, MMU, SB: Project Administration. TB, AK, BA, BK: Supervision, Writing – Review & Editing. All authors critically revised the manuscript, agreed to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

Funding
No funding has been received for this study. Guarantor : SK.

Declarations

Competing interests
The authors declare no competing interests.

Ethics approval
This study was conducted in accordance with the principles of the Declaration of Helsinki and received approval from the Turkish Ministry of Health with a waiver for informed consent for retrospective data analysis and the health information privacy law (ID: 95741342-020/27112019).

Additional information

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1038/s41598-025-91956-3.

Correspondence and requests for materials should be addressed to S.K. or B.K.

Reprints and permissions information is available at www.nature.com/reprints.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.