Prevalence of asymptomatic femoroacetabular impingement in Turkey; cross sectional study

Gökhan Polat, Koray Şahin*, Ufuk Arzu, Alper Şükrü Kendirci, Mehmet Aşık

Istanbul University, Istanbul Medical Faculty, Orthopedics and Traumatology Department, Istanbul, Turkey

ARTICLE INFO

Article history:
Received 22 January 2017
Received in revised form 10 September 2017
Accepted 1 October 2017
Available online 20 November 2017

Keywords:
Hip
Osteoarthritis
Femoroacetabular impingement
Pincher
CAM
Prevalence
Turkey

ABSTRACT

Objectives: Femoroacetabular impingement (FAI) is one of the causes of hip pain in young-adult patients. The purpose of our study is to determine the prevalence of radiological FAI findings in asymptomatic population in Turkey.

Methods: Trauma patients aged 18–65 years who applied to the emergency service between September 2015 and September 2016 were retrospectively evaluated for this study. After a preliminary study and power analysis, 2152 hips of the 1076 previously asymptomatic patients were evaluated radiologically with pelvis antero-posterior and frog-leg radiographs. On radiographs of these patients; alpha angle, lateral central edge angle (LCEA), Tönnis angle (TA) and collodiaphyseal angle were measured. Alpha angle values higher than 55° were noted as cam type FAI. TA values lower than 0° or LCEA values higher than 39° were noted as pincer type FAI. LCEA values lower than 25° or TA values higher than 10° were noted as acetabular dysplasia.

Results: Mean age of 1076 patients (602 female, 474 male) was 42.1 ± 15.6 years. The assessment showed that 15.9% of the patients had cam type, 10.6% had pincer type, 3.1% had combined type FAI and 9.3% had findings of acetabular dysplasia. The prevalence of asymptomatic FAI is significantly more in males (46%) in comparison to females (17%) in Turkey.

Conclusion: Even though FAI is considered to be a pathology associated with hip osteoarthritis; it is very common in asymptomatic population. In this respect, our study showed that prevalence of radiological FAI findings in asymptomatic adult population was 29.6% in Turkey.

© 2017 Turkish Association of Orthopaedics and Traumatology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

Femoroacetabular impingement (FAI) is considered as one of the most common causes of hip pain in young-adult population and is associated with development of osteoarthritis. In recent years, awareness of FAI have risen and FAI has become a popular pathology. Different treatment modalities including open or arthroscopic surgery have been described and large numbers of studies were published stating successful short and mid-term clinical results of FAI treatment.1–6

Abbreviations: FAI, Femoroacetabular impingement; LCEA, lateral central edge angle; TA, Tönnis angle; CDA, collodiaphyseal angle.

* Corresponding author. Turgut Ozal cad. No 118 FK 34093 Istanbul Tıp Fakültesi, Ortopedi ve Travmatoloji ABD, Çapa/Fatih/Istanbul, Turkey.
E-mail address: sahinkoray1089@gmail.com (K. Şahin).
Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

Radiological findings of FAI can be seen in high ratios, reaching up to 60% of the population, especially in asymptomatic athletes.7,8 Radiological findings of FAI can be encountered incidentally when investigating other conditions which may cause hip pain such as soft tissue injuries, other impingement syndromes around hip region, lumbar discopathy etc. The clinicians may misdiagnose some of these patients due to the high prevalence of radiological FAI.9,10 There are many etiological factors of FAI such as genetic factors, congenital anatomical disorders, pediatric diseases. However, developmental and acquired factors are considered to be the prominent etiological factors.11 Therefore, it has been stated that there may be some differences in FAI prevalence according to ethnicity and social habits like sports etc. For these reasons, there are some studies that evaluate the prevalence of asymptomatic FAI in different populations or ethnicities.12–14 However; to our knowledge, there is not any study which was performed in Turkey, evaluating the prevalence of FAI in asymptomatic population. The purpose of our study is to determine the prevalence of radiological findings of FAI.
FAL findings in asymptomatic adult population in Turkey. We hypothesized that ethnic properties and social habits may affect the prevalence of FAL in different populations and orthopedic surgeons should be aware of the prevalence of asymptomatic FAL in Turkey.

Materials and methods

Trauma patients aged 18–65 years who applied to the emergency service between September 2015 and September 2016 were retrospectively investigated for this study. Pelvis antero-posterior (AP) and pelvic frog-leg radiographs of these patients were evaluated in terms of radiological findings for FAL. Ideal radiographs in which both iliac crests and proximal femurs were seen, with symmetrical obturator foramen and centralized symphysis pubis were accepted as suitable for evaluation. Patients with proper radiographs were questioned by telephone that if they had any hip pain before trauma, and those who did not have any hip pain history or rheumatologic disease anamnesis were included in the study. Radiographs which were positioned improperly and patients who had fractures in the pelvic ring or lower extremity, ligamentous injuries in lower extremity and with radiological findings of coxarthrosis or previous surgeries around hip joint were excluded from the study. Our study was approved by the ethical committee of Istanbul University Istanbul Faculty of Medicine (IU2016/254).

Due to the lack of FAL prevalence data in Turkey and wide range of FAL prevalence in different populations in the literature; with a preliminary study over 562 patients, we observed radiological FAL prevalence of Istanbul cohort, a power analysis was assessed for this prevalence value with 5% error margin and a sample amount of 1076 patients (2152 hips) to include to the study. Our study was approved by the ethical committee of Istanbul University Istanbul Faculty of Medicine (IU2016/254). From the study. There were no statistical differences between right and left hips regarding alpha angle, TA, LCEA and CDA according to gender were resumed in Table 1. There were no statistical differences between right and left hips regarding alpha angle, TA, LCEA and CDA (n.s.).

The assessment of radiographs showed that 658 patients (61.2%) had morphologically normal hip joints. 171 (15.9%) of the patients had cam type FAL, 114 (10.6%) had pincer type FAL and 33 (3.1%) had combined type FAL. In addition to this, 100 patients (9.3%) had findings consisted with acetabular dysplasia. After the radiological evaluation of 474 male patients; 232 patients (48.9%) were seen to have normal hip morpholology. 146 patients (30.8%) had cam morphology, 44 patients (9.3%) had pincer type FAL and 26 patients (5.5%) had combined type FAL. Results of 602 female patients showed that 426 of them (70.8%) had normal morphology. 25 patients (4.2%) had cam morphology, 70 patients (11.6%) had pincer type FAL and 7 patients (1.2%) had combined type FAL. The radiological evaluation resulted that asymptomatic FAL prevalence in Turkey is 29.6%; 45.6% in male population and 16.9% in female population (Figs. 1 and 2).

The radiological assessment made in regard of acetabular dysplasia showed that 100 patients (9.3%) had radiological findings of acetabular dysplasia. The evaluation according to the gender resulted that acetabular dysplasia prevalence is 5.5% for male population and 12.3% for female population.

Discussion

Awareness of FAL continues to rise. Besides this, many orthopedic surgeons consider FAL in the first order among other pathologies when investigating hip pain. The high prevalence of this morphological disorder in asymptomatic population and extreme awareness to this pathology may cause overdiagnosis in some cases.10–18

| Table 1 | Mean and standard deviation values of radiological measurements (R: right hip, L: left hip). |
|---------|------------------------------------------------------------------------------|
|          | General population | Male | Female |
| Alpha Angle – R (AP) | 47.3 ± 7.1 | 51.4 ± 9.8 | 44.0 ± 7.1 |
| Alpha Angle – L (AP) | 46.7 ± 6.0 | 51.2 ± 10.0 | 43.2 ± 6.0 |
| Alpha Angle – R (Frog leg) | 50.5 ± 6.6 | 56.6 ± 8.8 | 45.7 ± 8.1 |
| Alpha Angle – L (Frog leg) | 49.2 ± 6.3 | 55.7 ± 2.3 | 44.1 ± 8.5 |
| LCE Angle – R | 31.0 ± 6.2 | 31.2 ± 5.7 | 30.8 ± 6.5 |
| LCE Angle – L | 32.1 ± 6.6 | 32.7 ± 6.1 | 31.8 ± 6.8 |
| Tonnis Angle – R | 6.6 ± 4.1 | 6.2 ± 3.8 | 6.9 ± 4.3 |
| Tonnis Angle – L | 6.1 ± 4.2 | 5.5 ± 4.1 | 6.5 ± 4.2 |
| Collodiaphysial Angle – R | 128.9 ± 6.6 | 129.5 ± 6.9 | 128.3 ± 6.3 |
| Collodiaphysial Angle – L | 129.1 ± 7.2 | 130.1 ± 6.4 | 128.5 ± 7.7 |

Statistical analysis

Qualitative variables were described as frequency and percentage. Quantitative ones were described as minimum, maximum, mean and standard deviation. Radiological measurements were performed by two resident physicians. After measurements, a definite analysis for morphological characteristics had done by senior author on digitally measured and recorded files with other authors and only cases which were considered positive by all observers were defined as true FAL-related morphologic features. An intraclass correlation coefficient (ICC) was found between the two sets of measurements. Interobserver agreements were almost perfect for the LCEA (ICC: 0.98), TA (ICC: 0.97) and alpha angle (ICC: 0.91) on all radiographs; substantial to almost perfect in rating cam-type and pincer type morphologic features. p-values of <0.05 were considered significant. All statistical tests were performed using SPSS software for Windows, version 12.0 (SPSS, Chicago, IL, USA).
There are many etiological factors associated with FAI such as; genetic factors, congenital anatomical disorders, sequelae of pediatric diseases, posttraumatic deformities etc. Within these etiological factors, developmental and acquired factors are the most prominent factors. There are etiological studies stating that FAI is more common in athletes due to increased physical activity during adolescence. Apart from that, it has been claimed that FAI prevalence may depend on ethnical properties and social
habitats and vary across different societies. In this respect, in a study made upon direct radiographies of 200 asymptomatic Asian volunteers; radiological cam type impingement findings were detected in 38% of the population. In the same study, prevalence of radiological pincer type impingement findings was 23%. In this study, the authors concluded that the prevalence of FAI-related morphologic features in asymptomatic Asian population was comparable to the prevalence in western populations. In another prevalence study, authors evaluated 202 hips of Japanese patients and they announced that radiological FAI prevalence was 29.7%. In another study in which 445 male soccer players were assessed in order to determine the effect of ethnic differences on FAI prevalence; it was told that FAI prevalence was significantly lower in east Asians compared to black and white population. Also, it was claimed that cam deformity was more common in black population. As a result, the authors noted that ethnic differences may affect hip joint morphology in athletes. In another study that investigated this subject, 103 pelvic CT of Belgian and Chinese patient was evaluated and it was announced that FAI prevalence was significantly lower in Chinese group. In our study, we found that in Turkey, 29.6% of the asymptomatic population had radiological FAI.

In females made upon asymptomatic volunteer athletes, radiological findings of FAI were found on 30–70% of the subjects. In the literature, there are limited number of studies evaluating FAI findings in asymptomatic normal population. In a systematic review evaluating 26 studies, asymptomatic cam incidence in normal population was reported as 37% and average alpha angle 54.1 ± 5.1. In addition to this, it was noted that FAI prevalence was 23.1% in normal population while 54.8% in athletes. In this respect, one of the most valuable studies about this subject belongs to Gosvig et al. In this study, authors evaluated morphological disorders of hip joints of 3620 individuals in sum (1332 males and 2288 females). The authors reported that the prevalence of acetabular dysplasia was 4.3% in males and 3.6% in females, the prevalence of cam type impingement was 19.6% in males and 5.2% in females, the prevalence of pincer type impingement was 15.2% in males and 19.4% in females, the prevalence of combined type impingement 2.9% in males and 0.9% in females. In our study, after radiological assessment of pelvic radiographs of 2152 hips of 1076 patients; the results showed that 658 patients (61.2%) had normal hip morphology, 171 patients (15.9%) had cam type impingement, 114 patients (10.6%) had pincer type impingement and 33 patients (3.1%) had combined type impingement. Similar to the reported literature, cam type impingement was more prevalent in males (31%) (Fig. 2).

It is known that combined type FAI is the most common among FAI types according to the classical knowledge. However, it was reported that pincer or cam type FAI could be seen more frequently in different studies. In this respect, in a cross-sectional study published by ANCHOR study group; 1130 hips of 1076 patients who underwent surgery were evaluated. And it was stated that 47.6% of the patients had cam type impingement, 44.5% had combined type impingement and 7.9% had pincer type impingement. In our study, cam type impingement had a higher prevalence over other types of FAI. Prevalence of radiological findings of FAI was 29.6% in general population.

There were some limitations in our study. We used conventional radiography in detection of bone morphologic abnormality in our asymptomatic volunteers. CT scan may be more effective in detection of radiological morphological abnormalities in FAI. However, because of the high dose radiation with CT scans; in order to reach a high number of asymptomatic hips to analyze the prevalence of FAI in our population, we used pelvis radiographs for these purposes. The other limitation of our study is female to male ratio (474 male, 602 female) of our study group. We analyzed a long period of time and nearly 10,000 trauma patients, however we found more female patients that were convenient with our study inclusion criteria. Our study is the first epidemiologic cross-sectional study performed in Turkey on this issue and guides surgeons in clinical decision making for patients with hip pain.

Conclusion

This study is the first cross-sectional study that gives the prevalence of radiological FAI in Turkey (29.6%). The prevalence of asymptomatic FAI is significantly more in males (45.6%) in comparison to females (16.9%). Turkish clinicians should know that FAI morphologic features are common in asymptomatic patients like other populations. Clinical decision making should involve careful analyze of the association of patient history and physical examination with radiographic imaging.

Acknowledgements

There is not any contribution of a person other than authors listed to this study.

No assistance of medical writing, language help or proof reading was taken.

No financial support was received by none of the authors related to this study.

The authors whose names are listed above certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

References

1. Ganz R, Parvisis J, Beck M, Leunig M, Notzli H, Siebenrock KA. Femoracetabular impingement: a cause for osteoarthritis of the hip. Clin Orthop Relat Res. 2003;417(12):112–120.
2. Leunig M, Beck M, Dora C, Ganz R. Femoracetabular impingement: trigger for the development of coxarthrosis. Orthopade. 2006 Jan;35(1):77–84 [Review. German].
3. Mardones RM, Gonzalez C, Chen Q, Zobitz M, Kaufman KR, Trousdale RT. Surgical treatment of femoracetabular impingement: evaluation of the effect of the size of the resection. J Bone Jt Surg Am. 2005 Feb;87(2):273–279.
4. Khan M, Habib A, de Sa D, et al. Arthroscopy up to date: hip femoroacetabular impingement. Arthroscopy. 2016 Jan;32(1):177–189. https://doi.org/10.1016/j.arthro.2015.10.010 [Review].
5. Keogh MJ, Batt ME. A review of femoracetabular impingement in athletes. Sports Med. 2008;38(10):863–878 [Review].
6. Nawabi DH, Bedi A, Tibor LM, Magennis E, Kelly BT. The demographic characteristics of high-level and recreational athletes undergoing hip arthroscopy for femoracetabular impingement: a sports-specific analysis. Arthroscopy. 2014 Mar;30(3):398–405. https://doi.org/10.1016/j.arthro.2013.12.010 [Review].
asymptomatic Chinese and white subjects. J Bone Jt Surg Am. 2015 Feb 18;97(4):310–317.

14. Fukushima K, Takahira N, Imai S, et al. Prevalence of radiological findings related to femoroacetabular impingement in professional baseball players in Japan. J Orthop Sci. 2016 Nov;21(6):821–825. https://doi.org/10.1007/j. Jos.2016.07.003 [Epub 2016 Jul 21].

15. Tannast M, Siebenrock KA. Conventional radiographs to assess femoroacetabular impingement. Instr Course Lect. 2009;58:203–212.

16. Yamauchi R, Inoue R, Chiba D, et al. Association of clinical and radiographic signs of femoroacetabular impingement in the general population. J Orthop Sci. 2016 Nov 4;22(1):94–98. https://doi.org/10.1007/j. Jos.2016.09.014. pii: S0949-2658(16)30183-X.

17. Tibor LM, Sekiya JK. Differential diagnosis of pain around the hip joint. Arthroscopy. 2008 Dec;24(12):1407–1421. https://doi.org/10.1016/j.arthro. 2008.06.019.

18. Canella RP, Adam GP, de Castillo RA, Codonho D, Ganev GG, de Vicenzi LF. Overdiagnosing of femoroacetabular impingement: a North American cohort of patients undergoing surgery. J Bone Jt Surg Am. 2016 May;98-B(5):1162–1169. https://doi.org/10.2106/JBJS.H.01674.

19. Gosvig KK, Jacobsen S, Sonne-Holm S, Palm H, Troelsen A. Prevalence of malformations of the hip joint and their relationship to sex, groin pain, and risk of osteoarthritis: a population-based survey. J Bone Jt Surg Am. 2010 May;92(5):1162–1169. https://doi.org/10.2106/JBJS.H.01674.

Canale ST, Beaty JH. Campbell’s Operative Orthopaedics. Vol. I. Elsevier; 2013:342.

20. Mineta K, Goto T, Wada K, et al. CT-based morphological assessment of the hip joint in Japanese patients: association with radiographic predictors of femoroacetabular impingement. Bone Jt J. 2016 Sep;98-B(9):1167–1174. https://doi.org/10.1302/0301-620X.98B9.37267.

21. Clohisy JC, Baca G, Beaulé PE, et al, ANCHOR Study Group. Descriptive epidemiology of femoroacetabular impingement: a North American cohort of patients undergoing surgery. Am J Sports Med. 2013 Jun;41(6):1348–1356. https://doi.org/10.1177/0361596613488861 [Epub 2013 May 13].