



Descriptive Epidemiology of Symptomatic Femoroacetabular Impingement in Young Athlete: Single Center Study

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Purpose: The purpose of this study was to determine the prevalence of symptomatic femoroacetabular impingement (FAI) in athletic patients.

Materials and Methods: From July 2003 to May 2013, 388 patients (422 hips) who underwent arthroscopic surgery for FAI were evaluated demographic characteristics. The patients' age, gender, diagnosis, and type of sports were analyzed using medical records and radiography.

Results: Among 422 hips in 388 patients, 156 hips were involved with sports. Among the 156 hips, 86, 43, and 27 hips were categorized as cam, pincer, and mixed type, respectively. Types of sports were soccer, baseball and taekwondo which showed 44, 36 and 35 hips, respectively. Also, cases related to sports according to age were 63 hips for twenties and 12 hips for teenagers in which the two showed highest association to FAI. The kinds of sports that showed high association were 28 hips of soccer and 20 cases of martial arts such as taekwondo and judo for twenties and 9 hips of martial arts for teenagers which was the highest.

Conclusion: FAI usually occurs in young adults and is highly related to sports activity. Most of the FAI type related to sports activity was cam type, and soccer and martial arts such as taekwondo were the most common cause of it.

Key Words: Hip, Femoroacetabular impingement, Prevalence, Sports, Arthroscopy

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INTRODUCTION

Many studies have been reported that femoroacetabular impingement (FAI) can be the cause of cartilage or acetabular labral lesion ultimately resulting in degenerative arthritis¹⁻³. Two types of FAI have been described: cam and pincer. In cam-type impingement, the abnormally shaped femoral head-neck junction abuts the anterosuperior acetabulum¹. In pincer-type impingement, the deep or cranially retroverted acetabulum provides excessive coverage to the femoral head and thereby restricts movement¹. The two types are commonly combined¹.

The advancement in the diagnostic methods and hip arthroscopy has allowed FAI that are caused by sports injuries to be diagnosed at an increasing rate and this has promoted discussion concerning the treatment. The prevalence of FAI as a clinical diagnosis is estimated to be 10-15% in a general adult population². Particularly, athletes have been more often associated with FAI than ordinary patients⁴⁻⁷.

There have been studies introducing cases showing high correlation of martial arts movements including kicks with FAI^{8,9}. Also, there was study which reported prevalence of FAI in Asian patients with osteoarthritis of the hip¹⁰. However, to the best of our knowledge, there has not been any official paper evaluating the relationship between sports activity and the prevalence of FAI. The purpose of this study was to determine the prevalence of symptomatic FAI in athletic patients.

MATERIALS AND METHODS

1. Patient Selection

From July 2003 to May 2013, 388 patients (422 hips) who underwent arthroscopic surgery for FAI were evaluated demographic characteristics. The patients who complained of hip pain underwent history taking, physical examinations including anterior impingement test¹¹ and Patrick test¹², and simple radiography (the pelvis anteroposterior view, the frog-leg lateral view, the false

profile view and cross-table lateral view) at the time of the visit (Fig. 1). Three-dimensional computed tomographic scan (3D CT) was taken preoperatively in patient who was scheduled to undergo arthroscopic surgery for identifying the precise site of the bump and osteophyte and postoperatively for checking state of femoro-and/or acetabuloplasty (Fig. 2). We included patients associated sports as we defined who underwent arthroscopic surgery due to FAI (cam, pincer, or mixed type). We excluded patients with the following: (1) patients with insufficient radiographs or records; (2) history of high-energy hip trauma (i.e., fracture or dislocation); (3) history of surgery involving the femur or pelvis; (4) Tönnis Grade 2 or above¹³; (5) idiopathic inflammatory arthritis (i.e.,



Fig. 1. A plain hip radiograph of a 35-year-old male with chronic right hip pain, who was a master of taekwondo, shows decreased femoral offset and femoral flattening (arrow).

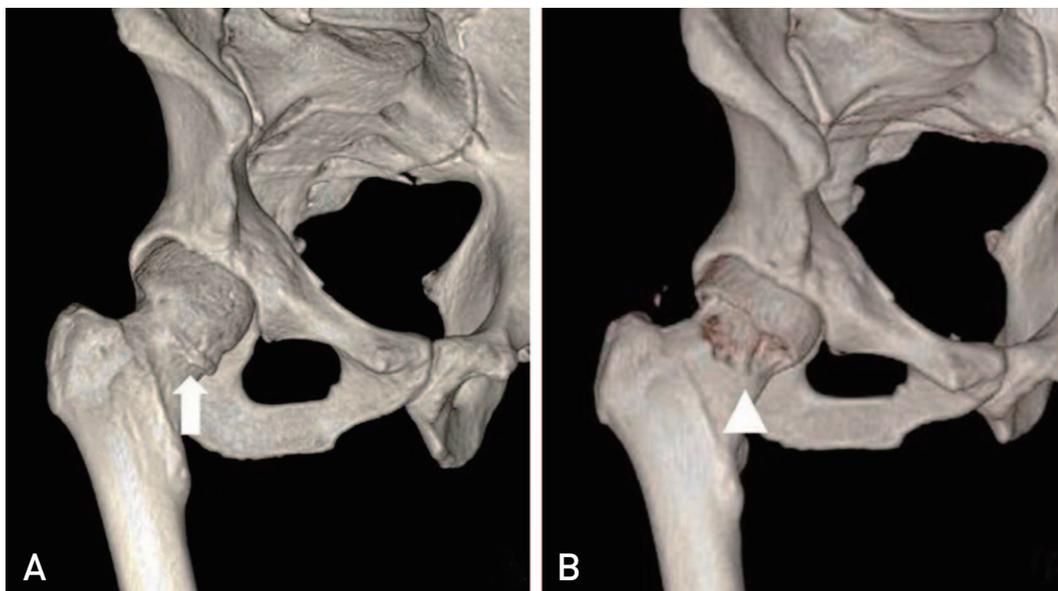


Fig. 2. Three-dimensional computed tomographic (3D CT) scan images. **(A)** Preoperative 3D CT image shows spur on femoral head neck junction (arrow). **(B)** Postoperative 3D CT image shows state underwent arthroscopic femoroplasty (arrowhead).

rheumatoid arthritis or seronegative spondyloarthropathy); (6) proliferative disease of the hip (i.e., synovial chondromatosis, pigmented villonodular synovitis); (7) Legg-Calvé-Perthes deformity; or (8) developmental dysplasia of the hip.

In this study, the athletic patient was defined as one who participated in sports or exercise more than 2 hours a day and 3 days per week for more than 1 year until hip pain developed. And alpha angle was considered to have been increased if more than 50° and anterior femur offset was considered to have been decreased if less than 8 mm and these were classified as cam type^{14,15}. Acetabular retroversion is a hip dysplasia in which the alignment of the acetabulum does not face the normal anterolateral direction, but inclined more posterolaterally¹⁶. In the simple radiography, crossover of the anterior wall of acetabulum over the posterior wall (focal cross over sign, figure of 8 sign) was defined as acetabular retroversion, and the adjoining of acetabular fossa and ilioischial line to be coxa profunda and the femur head passing the ilioischial as acetabular protrusio¹⁷. These were classified as the pincer type. Cam types and pincer types were classified under such radiological standards

and coexistence of both as mixed types¹⁸. 3D CT was taken for geography of bump on femur and alpha angle measurement. Under suspicion of labral tear or soft tissue lesion such as injury of hip joint cartilage or ligamentum teres, magnetic resonance image was taken.

2. Surgical Technique and Postoperative Care

All arthroscopic procedures were performed by a single senior surgeon. The intra-articular pathologies were identified after appropriate anterolateral capsulotomy, loose fragments were removed using a grasper via the anterior or posterolateral portal, and labral tears were debrided using an arthroscopic shaver or repaired using a 2.9 mm BIORAPTOR suture anchor (Smith & Nephew, London, UK) (Fig. 3). Pathologies of the peripheral compartment, such as a femoral head neck bump or bony spur, were treated by femoroplasty (Fig. 3).

All cases underwent 3D CT on the second day postoperatively to check the postoperative state of the acetabulo- and femoroplasty and removal of loose bodies. All patients were discharged on the third day after the procedure.

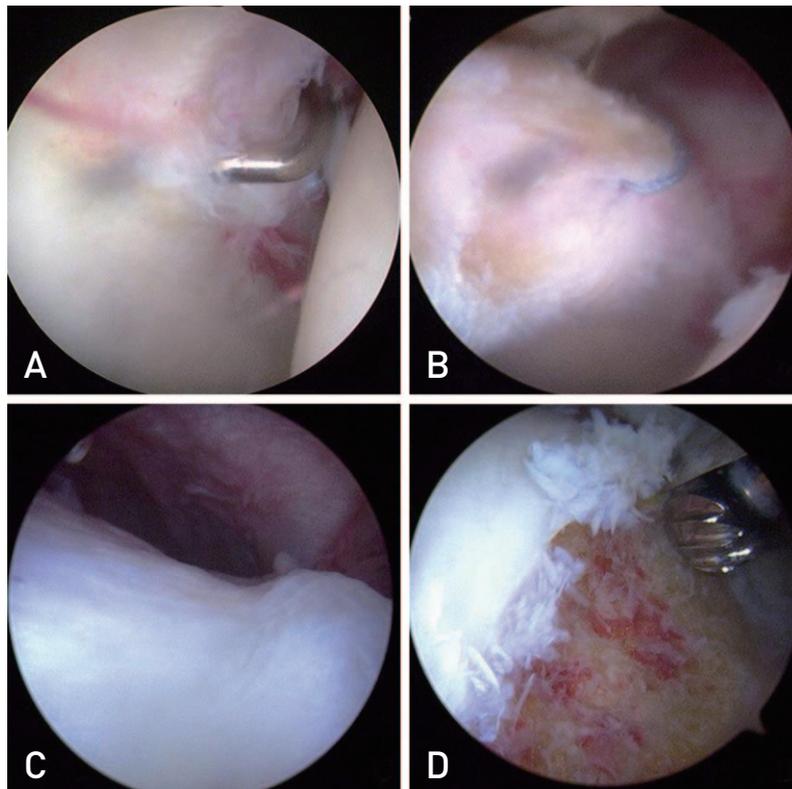


Fig. 3. Arthroscopic view images. (A) Arthroscopic view shows partial labral tear. (B) It shows the repair of labral tear. (C) It shows bump on femoral head-neck junction. (D) It shows state underwent arthroscopic femoroplasty.

3. Analysis of Epidemiology and Research Approval

The patients' age, gender, diagnosis, and type of sports were analyzed using medical records and radiography. This study was approved by the Institutional Review Board of our institution and informed consent was waived from all patients.

RESULTS

Among 422 hips in 388 patients, 60 hips in 50 patients were excluded because 5 hips with insufficient radiographs or records, 12 hips with history of high-energy hip trauma, 5 hips with history of surgery involving the femur or pelvis, 5 hips with Tönnis Grade 2 or above, 18 hips with idiopathic inflammatory arthritis, 10 hips with proliferative disease of the hip, 3 hips with Legg-Calvé-Perthes deformity, 2 hips with developmental dysplasia of the hip. The remaining study population consisted of 362 hips in 338 consecutive patients (229 male and 109 female). Epidemiology of patients with FAI according to ages was shown on Table 1.

One hundred fifty-six hips (43.1%) were involved with sports in which male (122 hips, 78.2%) outnumbered female (34 hips, 21.8%). Among the 156 hips assessed in the present study, 86 hips (55.1%), 43 hips (27.6%), and 27 hips (17.3%) were categorized as cam, pincer, and mixed type, respectively. Type of sports were soccer, baseball and taekwondo which showed 44 (28.2%), 36 (23.1%) and 35 (22.4%) hips, respectively (Table 2, Fig. 4). Also, cases related to sports according to age were 63 hips (61.8%) for twenties and 12 hips (54.5%) for teenagers in which the two showed highest association to FAI. The kinds of sports that showed high association were 28 hips (44.4%) of soccer and 20 hips (31.7%) of martial arts such as taekwondo and judo for twenties and 9 hips (75.0%) of martial arts for teenagers which was the

highest. Specific relationship was not able to be examined for the forties which showed diverse distribution of hiking (5 hips, 14.7%), taekwondo (4 hips, 11.8%) and other activities (Table 3).

DISCUSSION

FAI induces cartilage or acetabular labrum lesion, and ultimately could result in degenerative arthritis¹⁻³. Up to now, there has been no study reporting long term results, but Ganz et al.¹⁾ reported that early diagnosis and treatments of FAI can prevent progression of hip joint arthritis. Particularly, athletes could be exposed to micro-injury constantly to intra-articular or structures around the joint due to the repetitive movement of a certain joint, and risk of hip joint injury due to excess movement range could be high, therefore chronic hip pain resulting from FAI could decrease the athletic ability¹⁹. And the close relationship between the FAI and sports have been verified in numerous studies^{5,6,20,21}.

FAI is classified as cam type, pincer type, and mixed type which cam and pincer coexists¹⁸. Cam type is induced by powerful movements, particularly by abnormal impingement of acetabulum and femoral head-neck junction (deformation of femur characterized by findings of decreased offset of lateral femoral head-neck junction, anterolateral bony bump of femoral neck, coronoid deformation of femoral head-neck junction and bipartite line of femoral neck not crossing the femur midline) while flexing and internally rotating, and pincer type is induced by linear contact of abnormal acetabulum boundary (retroversion of acetabulum, coxa profunda and acetabular protrusion) and femur head-neck region.

As for the FAI relating to sports, Siebenrock et al.^{22,23} reported in the study on aggressive athletes playing baseball and ice-hockey that intense sports activity induces FAI, in particular the cam type which was dominant. In the present study, cam type was verified in

Table 1. Categorization of Femoroacetabular Impingement (FAI) according to Ages

Variable	10s	20s	30s	40s	50s	60s	70s	Total
Sex (male:female)	15:7	86:16	41:32	62:39	27:20	9:6	1:1	247:115
Hip (right:left)	22 (15:7)	102 (62:40)	73 (45:28)	101 (63:38)	47 (33:14)	15 (9:6)	2 (2:0)	362 (229:133)
Type of FAI								
Cam	15	57	37	57	21	4	0	191
Pincer	4	33	19	24	15	3	0	98
Mixed	3	12	17	20	11	8	2	73

Values are presented as number.

Table 2. Prevalence of Femoroacetabular Impingement (FAI) in Athletic Patients

Variable	FAI in athletic patients
Sex (male:female)	122 (78.2):34 (21.8)
Hips	156
Type of FAI	
Cam	86 (55.1)
Pincer	43 (27.6)
Mixed	27 (17.3)
Type of sports	
Soccer	44 (28.2)
Baseball	36 (23.1)
Taekwondo	35 (22.4)
Weightlifting	15 (9.6)
Others	26 (16.7)

Values are presented number [%].

86 cases (55.1%) and sports had close relationship with FAI. Also, aggressive sports activity at an early age could result in FAI and chronic hip pain²⁴⁾, thus deciding the starting time and the kind of sports at an early age should be carefully made in case of findings of FAI after precise screening test and explanation on the risk of disorders.

Philippon et al.²⁰⁾ reported about the 93% of returning rate of 45 professional athletes after treatments with arthroscopic surgery on hip joint lesion including osteoplasty. Also, McCarthy et al.²¹⁾ reported outstanding results of 80% of elite athletes and Byrd and Jones²⁴⁾ reported that modified Harris hip joint scores of 42 high school and university recreation athletes after arthroscopic treatment improve in all cases. Also, the present study showed most of patients returning to the prior level or

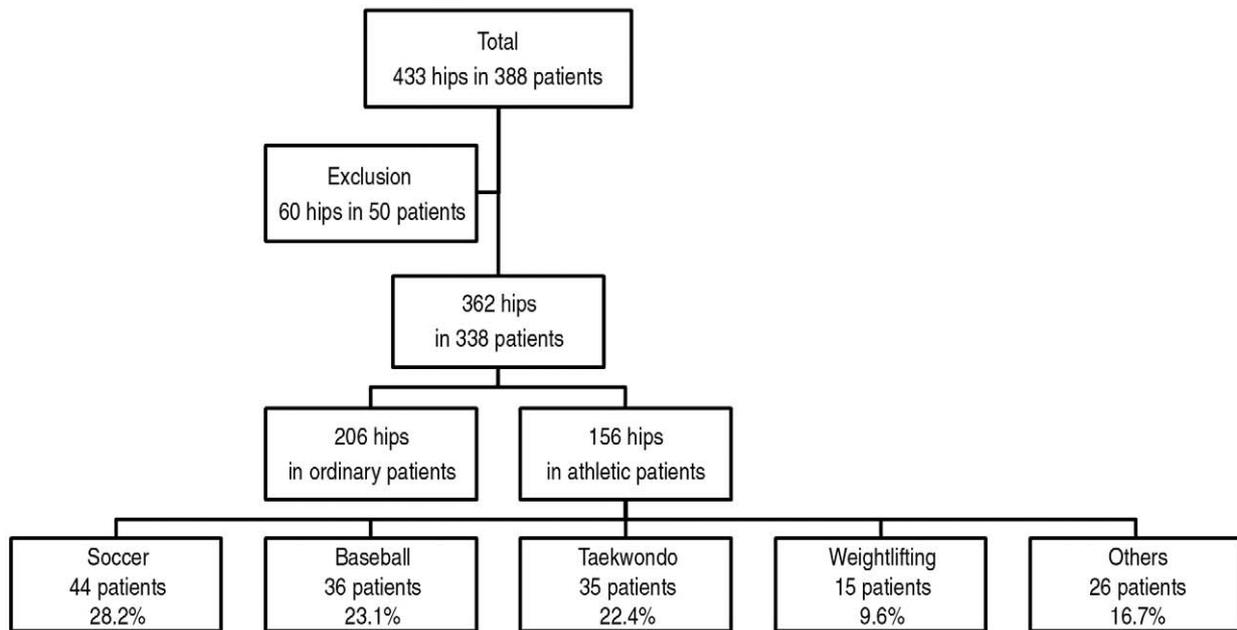


Fig. 4. A flowchart shows the process for selection of symptomatic femoroacetabular impingement in athletic patients among the patients who underwent arthroscopic surgery for femoroacetabular impingement.

Table 3. Categorization of Sports according to Ages

Variable	10s	20s	30s	40s
Hips with FAI	22	102	73	101
Hips related to sports	12 (54.5)	63 (61.8)	33 (45.2)	34 (33.7)
Sports				
Soccer	0	28 (44.4)	13 (39.9)	3 (8.8)
Martial arts	9 (75.0)	20 (31.7)	7 (21.2)	4 (11.8)
Hiking	0	0	3 (9.1)	5 (14.7)
Others	3 (25.0)	15 (23.8)	10 (30.3)	22 (64.7)

Values are presented number [%].

FAI: femoroacetabular impingement.

close level of sports activity after surgery and at least 2 years of follow-up.

There were limitations to this study. First, the study has a patient bias due to geographical or institutional predominance. Thus, our results may be influenced by these errors. Second, we could not evaluate rate of return to sports. We determined only epidemiology of symptomatic FAI in athletes. Third, criteria of the athletic patients who were enrolled were not official. We defined the criteria through the consensus of all authors considering the general thought, because there was no reference about criteria of duration or frequency for definition of athlete. However, to our knowledge, there has not been any official paper regarding the relationship between sports activity and the prevalence of FAI.

CONCLUSION

FAI usually occurs in young adults and is highly related to sports activity. Most of the FAI type related to sports activity was cam type, and soccer and martial arts such as taekwondo were the most common cause of it.

CONFLICT OF INTEREST

The authors declare that there is no potential conflict of interest relevant to this article.

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