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Original article

Does Prior Surgery for Femoroacetabular Impingement Compromise Hip Arthroplasty Outcomes?

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ABSTRACT

Background: Open and arthroscopic approaches have been described to address femoroacetabular impingement (FAI). Despite good outcomes, there is a subset of patients who subsequently require total hip arthroplasty (THA). However, there is a paucity of data on the outcomes of THA after surgery for FAI. The purpose of this study was to determine whether clinical outcomes of THA are affected by prior open or arthroscopic treatment of FAI.

Methods: This case-matched retrospective review included 23 patients (24 hips) that underwent THA after previous surgery for FAI (14 arthroscopic and 10 open) and compared them to 24 matched controls with no history of prior surgery on the operative hip. The controls were matched for age, sex, surgical approach, implants used, and preoperative modified Harris hip score (mHHS) did not differ between groups. The primary outcome measure was the mHHS. Operative time, blood loss, and the presence of heterotopic ossification after THA were also compared between groups.

Results: There was no significant difference in mean mHHS between the FAI treatment group 92.9 ± 12.7 and controls 95.2 ± 6.6 ($P = .43$) at a mean follow-up after THA of 33 (24-70) months. Increased operative times were noted for THA after surgical hip dislocation (SHD; mean 109.3 ± 29.8) compared to controls (mean 88.0 ± 24.2; $P < .05$). There was no significant difference in blood loss between groups. The occurrence of heterotopic ossification was significantly higher after SHD compared to controls ($P < .05$).

Conclusions: Clinical outcomes after THA are not affected by prior open or arthroscopic procedures for FAI. However, increased operative times and an increased risk of heterotopic ossification were noted after SHD.

Femoroacetabular impingement (FAI) results from structural abnormalities of the hip and leads to pain, disability, and early osteoarthritis in the young adult hip [1,2]. The relationship between these structural changes, symptoms at a young age, and early osteoarthritis led to the advancement of surgical techniques designed to correct these abnormalities. The goal of these procedures is to improve pain and to preserve the native hip joint and prevent, or at least delay, the need for future arthroplasty. Surgical hip dislocation (SHD) was established to provide access to the hip while preserving blood flow to the femoral head [3]. Outcomes of open treatment of FAI with SHD have been reported with good clinical outcomes and minimal risk of avascular necrosis of the femoral head [4,5]. Arthroscopic techniques to address FAI have also been developed with good clinical outcomes reported, comparable to open techniques [6–12]. However, the outcome of surgical treatment for FAI is correlated with the amount of preoperative radiographic arthritis [13]. Despite the promising short-term and midterm data, there is little known regarding the long-term success of surgical treatment of FAI to preserve the hip joint. Furthermore, despite appropriate surgical treatment, there is a subset of patients who continue to have pain or become symptomatic from degenerative changes and progress to total hip arthroplasty (THA). Yet, to the authors' knowledge, there are no studies comparing THA outcomes after open or arthroscopic treatment of FAI. The purpose of this study was (1) to determine if a difference exists in clinical outcomes of THA after open or arthroscopic treatment of FAI when compared to matched controls and (2) to evaluate the effect of prior surgery on THA operative times,

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blood loss, and the development of heterotopic ossification (HO). The hypothesis is that no difference exists in outcomes of THA after surgery for FAI compared with controls with no prior hip surgery.

Material and Methods

This retrospective review of prospectively collected data included all patients aged 18 years or older at the time of THA with a history of either SHD or hip arthroscopy (HA), a diagnosis of FAI by radiographs, magnetic resonance imaging and clinical examination, and subsequent ipsilateral THA at our institution. A minimum of 24 months of clinical and radiographic follow-up was required for inclusion. Patients with FAI as sequelae of pediatric hip conditions such as Perthes disease, slipped capital femoral epiphysis, or any prior surgical procedures of the ipsilateral hip for reasons other than FAI were excluded from the review.

After institutional review board approval, data was retrieved over a 10-year period between 2004 and 2014, during which over 3900 THAs were performed. Institutional databases were used to identify 23 patients (24 hips) who had either SHD or HA performed for a diagnosis of FAI before THA. Twenty-four controls (24 hips) with no history of surgery on the ipsilateral hip before THA were matched for exact age, sex, surgical approach, and implants used by a nonautomated database search. Demographic and clinical data points were recorded using a combination of chart review and automated database searches. Preoperative body mass index and available modified Harris hip scores (mHHS) were compared to ensure that there were no baseline differences between groups. Anteroposterior and lateral hip radiographs were reviewed by a single author, and pre-THA Tönnis grade, evidence of femoral and acetabular component loosening (according to the criteria of Engh [14] and Moore [15], respectively), and the presence and severity of HO using the Brooker classification were recorded [16]. The primary outcome measure was the postoperative mHHS. Secondary outcomes including operative time, blood loss, and the presence of HO before and after THA were also examined.

A power analysis was conducted based on the HHS and data available from a previous study, where the response within each subject group was normally distributed with standard deviation (SD) of 13 [17]. With 24 hips identified in each of the 2 groups, there is 80% power at an alpha-level of 0.05 to detect a difference in the mean mHHS of 11 points or more. Previous reports of the minimal clinically important difference for the mHHS are population specific and ranges between 10 and 20 points in cohorts similar to this study [18,19]. Comparisons were made between subjects with prior surgery for FAI and controls. Subanalyses were conducted by separating the treatment group and comparing HA to controls and SHD to controls independently. For the purpose of subgroup analysis, group 1 included all patients with prior HA; group 2 included all patients with prior SHD; and group 3 included all controls. The Student's *t* test was used to compare means of outcome measures when normally distributed. The Wilcoxon rank-sum test was used to compare nonparametric data. Univariate analyses were also performed and statistically significant differences identified on univariate analysis were then investigated with regression models. The Fisher's exact test was used to analyze categorical data as dictated by sample sizes. The alpha-level was set at 0.05 for statistical significance.

Results

Between 2004 and 2014, 482 HAs and 216 SHDs were performed for FAI. Overall, 14 of 482 (2.9%) hips had subsequent THA after HA and 10 of 216 (4.6%) hips underwent THA after SHD. The mean interval between HA and THA and SHD and THA was 12 (3-25) months and 48 (8-87) months, respectively. There was no significant difference between treatment groups with respect to pre-THA Tönnis grade; however, there was a higher proportion of patients with Tönnis grade 1 changes in the FAI group (42%) compared with the controls (16%; $P = .15$). The mean follow-up after THA across all groups was 33 (24-70) months. Preoperative mHHSs were available for 16 of 24 patients in the treatment group and 13 of 24 patients in the control group. There was no significant difference between patient groups based on demographic and baseline data (Table 1). At final follow-up, there was no significant difference in mean and SD of the mHHS between the FAI treatment group 92.9 (12.7) and controls 95.2 (6.6; $P = .43$). Subanalysis of mHHS between groups demonstrated no significant differences: group 1 93.3 (9.1); group 2 91.4 (13.6); and group 3 95.2 (6.5; $P = .4$; Fig. 1).

Increased operative times were noted for group 2 (mean 109.3, SD 29.8) compared to group 3 (mean 88.0, SD 24.2; $P = .039$). This finding persisted after regression analysis controlling for body mass index ($P = .027$). However, when controlling for hardware removal at the time of THA (70% of patients in group 2), the relationship was no longer significant ($P = .763$). There was no significant difference in blood loss between the FAI treatment group (mean 395.8, SD 303.2) and controls (mean 304.2, SD 139.0; $P = .18$). Subanalysis of blood loss demonstrated a trend toward increased blood loss in group 2 (mean 535.0, SD 410.3) when compared with group 3 (mean 304.2, SD 139.0; $P = .11$), but no difference between groups 1 (mean 296.4 SD 143.4) and 3 (mean 304.2, SD 139.0; $P = .87$). Transfusion rates did not differ between groups with 2 patients requiring postoperative blood transfusions in the FAI group (1 patient in each subgroup) compared with 3 patients in the control group ($P = .78$). The occurrence of HO was significantly higher in group 2 (80%) compared to group 1 (29%) and group 3 (25%; $P < .05$, Fisher's exact test). Subanalysis of HO occurrence by Brooker grade demonstrated the presence of HO after the index procedure in group 1 (21.4%) and group 2 (70%). Progression of HO grade after THA occurred in both group 1 (14.3%) and group 2 (30%). One patient underwent excision of HO at the time of THA without change to the Brooker grade on final radiographic follow-up (Table 2). There was no correlation between HO presence or grade and mHHS ($P = .287$). There were no incidences of early loosening. One patient in group 1 had a single dislocation episode that was managed conservatively, without recurrence at final follow-up. One patient in group 2 required revision of the acetabular component with psoas tendon release 5 years after primary THA for continued pain due to psoas impingement.

Table 1
Demographic and Baseline Data.

Variable	FAI	Controls	*P* Value
Age at THA (y)	42.6 (20-68)	45.7 (25-68)	.32
Sex			
Female	11 (48%)	11 (45%)	.89
Male	12 (52%)	13 (55%)	
BMI	30.2 (22.5-28.8)	30.3 (23.9-45.4)	.94
Surgical approach			
Posterior	20 (83%)	20 (83%)	1.00
Anterolateral	1 (4%)	1 (4%)	
Direct anterior	3 (13%)	3 (13%)	
Preoperative mHHS	56.2 (SD 13.5)	60 (SD 22.6)	.55

Demographic and baseline data for treatment and control groups. Mean (range or standard deviation [SD]) is reported for continuous variables, with total count (percentages) for categorical data. There were no significant differences between groups.

BMI, body mass index; FAI, femoroacetabular impingement; mHHS, modified Harris hip score; THA, total hip arthroplasty.