Original Article

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Evaluation of Results of Hip Arthroscopic Surgery for Femoroacetabular Impingement

Prasanta Kumar Saha

Associate Professor, Department of Orthopaedics, Calcutta National Medical College Hospital, Kolkata, West Bengal, India

Abstract

Background: Femoroacetabular impingement (FAI) is an increasingly recognized disorder. FAI is the result of abnormal contact between the proximal femur and acetabulum and can result in intra-articular pathology and eventual osteoarthritis. Open surgical hip dislocation procedure described by Ganz is gold standard. Recently, arthroscopic-based treatment has been developed. Our study aims to present clinical outcome in a single-center cohort of patients treated arthroscopically for hip-related pain due to FAI.

Materials and Methods: A total of 55 patients from 2013 to 2016 were included in this prospective case series (50 male; mean age 35 years; [range: 15-50]). The indication for arthroscopic treatment of hip-related pain was mechanical hip symptoms and radiological findings of FAI. To evaluate hip function and pain level at 1-year follow-up by modified Harris Hip Score (mHHS), hip outcome score (HOS), and a numeric rating scale (NRS) pain score.

Results: Radiologically, 45 patients had both cam and pincer lesion. After 1 year, the impingement test was negative or mildly positive in 91% cases. mHHS, HOS, and NRS pain score significantly improved from previous status ($P < 0.001$). There was a significant reduction of the alpha angle from the pre-operative value ($P < 0.001$). Total hip replacement was done in three patients, and two patients were scheduled for replacement after the follow-up period.

Conclusions: Although our study has several limitations such as lack of control group, small sample. We have found there was a significant statistical improvement by arthroscopic treatment of FAI. Further studies are needed to determine failure rates and risk factors.

Key words: Arthroscopy, Femoroacetabular impingement, Hip, Labral tear

INTRODUCTION

Femoroacetabular impingement (FAI) is an increasingly recognized disorder. FAI is described as the abnormal contact between the anterior acetabular rim and femoral neck. There are two primary mechanisms of FAI: Cam and pincer impingement. Cam impingement defined as an abnormally shaped femoral head-neck junction converging into the acetabular rim. Pincer impingement described as acetabular over coverage of the femur. FAI has been identified as a common cause of hip pain in young, active patients with non-dysplastic hips. It is considered as a major factor in the development of osteoarthritis.[1]

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The aim of surgical treatment is to reshape cam deformities that cause bony contact during normal hip motion and repair of associated labral and acetabular cartilage pathology.[2,3] Ganz *et al.*[4] described surgical hip dislocation technique. It has the advantage of complete visualization of the proximal femur and acetabulum without compromising the femoral head vasculature. Several investigators who have used this open technique have reported good early and midterm clinical success with minimal complications.[5-11] However, this is a major surgery, which necessitates the use of a trochanteric osteotomy and hip-joint dislocation with a high chance of injury to vascular supply of femoral head.

With the advancement of arthroscopy technique and a better understanding of hip pathology, hip arthroscopy is a new modality in treating FAI. This is a minimally

Corresponding Author: Dr. Prasanta Kumar Saha, Golden View Apartment, 2nd Floor, Room No - 305, T. N. Mukherjee Road, Monoharpur, (Near HDFC Bank), Dankuni, Hooghly - 712 311, West Bengal, India. Phone: +91-9903151908. E-mail: prasantakumarsahaortho@gmail.com

invasive technique which has the advantages of early and faster rehabilitation. Early outcomes in the arthroscopic treatment of FAI are equivalent to the open technique.[12-16] The superiority of the open surgical dislocation technique originally considered the gold standard for FAI treatment, has been questioned in several meta-analyses.[17-19]

In this prospective study, we evaluate clinical results of arthroscopic treatment of FAI performed by a single experienced surgeon. According to our hypothesis, the arthroscopic approach will yield faster initial recovery, with statistically significant outcomes at longer follow-up.

MATERIALS AND METHODS

This is a prospective study. The study was conducted in our institution after getting ethical permission. All the patients were counseled about the advantages, disadvantages, and complications of the procedure. After getting written consent from patients, we performed the arthroscopic procedure. The study period was from January 2013 to January 2016. The inclusion criteria were younger patients (50 years of age or younger), mechanical symptoms (hip pain, restricted hip motion), at least 6 months of failed conservative treatment, a positive impingement test, and radiographic criteria for FAI. We excluded patients who had previous hip surgery, Legg-Calve-Perthes disease, slipped capital femoral epiphysis, hip dysplasia, trauma, and osteonecrosis. A positive anterior impingement test was defined as forced internal rotation/adduction in 90° of flexion was painful, and for posterior impingement with painful forced external rotation in full extension.

Radiographical definition of cam deformity on anteroposterior radiographs was Pistol-grip deformity, caput-collum-diaphyseal angle <125°, horizontal growth plate sign and on cross-table radiographs alpha angle >50°, femoral head-neck offset <8 mm, offset ratio <0.18 femoral retrotorsion. Radiographical definition of pincer deformity on anteroposterior radiographs was focal acetabular retroversion (Figure of 8 configuration due to overlapping of anterior and posterior wall of acetabulam), lateral center edge angle >39° reduced extrusion index, acetabular index ≤0°, posterior wall sign. Radiographic signs on cross-table radiograph were linear indentation sign. Magnetic resonance arthrogram was not performed routinely in all patients due to high cost. If there was any ambiguity about the source of pain, diagnostic injection of local anesthetic under fluoroscope guidance was performed to clarify the intra-articular source of pain.

Intra-articular cartilage status of the femoral head and acetabular joint surface was described using the International Cartilage Repair Society (ICRS) grading.[19] All surgical treatments were performed by one experienced surgeons.

In general, two portals, the anterior and the anterior paratrochanteric were used. 70° optics was used in all cases. First, the central compartment was viewed and operated. The acetabular labrum was debrided or repaired (Figure 1). Afterward, the peripheral compartment was operated by releasing traction and viewing the peripheral region of the femoral head-neck junction. Once the region of the cam-type impingement was defined by local morphological changes or dynamic examination of the joint, osteochondroplasty was performed (Figure 2). The procedure was considered finished when rubbing of the neck against the acetabular rim was no longer seen in 90° flexion, adduction, and internal hip rotation of 30° was performed. 1-year post-operative data collection was performed at average 16 months after surgery

Figure 1: Repair of pincer lesion

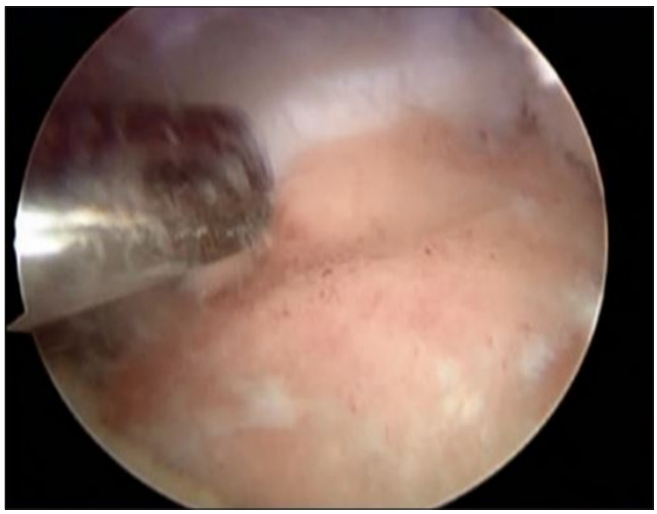

Figure 2: Repair of cam lesion

(range: 12-22). The difference between pre-operative and post-operative values was analyzed using the Student's *t*-test. *P* values below 0.05 were considered to be statistically significant.

RESULTS

A total of 55 patients were treated by hip arthroscopy procedure. Among them, 50 patients were male and 5 were female. The average age of patients was 35 years. Most of them were associated with sports activity. Only one patient had radiologically cam deformity and nine patients had isolated pincer deformity. The remaining 45 patients have both cam and pincer lesion (Table 1). On arthroscopic examination, 91% cases labral lesion was found. According to ICRS classification, the cartilage status of acetabulum, Grade 0: 8%; Grade 1: 20%; Grade 2: 43%; Grade 3: 19%; Grade 4: 10% were found. On 78% cases, labral reattachment was done. CAM and pincer deformity resection were done in 96% and 92% cases, respectively.

Al patients were treated arthroscopically. We had found significant improvement from their previous status. All the patients had positive impingement test before surgery. In a follow-up at least 1 year after, 91% cases impingement test was negative or mildly positive and only in 9% cases it was positive($P < 0.001$). Modified Harris Hip Score (mHHS), hip outcome score (HOS), numeric rating scale (NRS) pain score significantly improved from previous status (Table 2). According to mHHS at minimum 1 year follow-up, excellent result (>90) was found in 29 patients (52.72%) good result (80-89) found in 9 patients (16.36%), fair result (70-79) found in 12 patients (21.81%), and poor (<70) found in 5 patients (9.11%). There was a significant reduction of the alpha angle from the pre-operative value ($P < 0.001$) (Figure 3). We observe during analysis of mHHS, HOS, NRS pain score that significant improvement occurred during first three months postoperatively (Figures 4-6). No significant difference in 1-year follow-up between labral fixation and labral resection was found. The average traction time during surgery was 52.3 ± 14.5 min (median = 45).

One patient had partial sciatic nerve neuropraxia which was improved completely. There was no post-operative femoral neck fracture, infection, or osteonecrosis.

Table 1: Radiological parameters of hip joint

Parameters	Mean±SD
Alpha angle	74.9±8.7
CE angle (center edge angle)	31.6±6.3
JSW (mm)	3.4±0.3

JSW: Joint space width

Table 2: Patient reported outcome scores

Parameters	Mean±SD		*P* value
	Preoperatively	Postoperatively	
mHHS	69.34±16.8	85.3±17.1	<0.001
HOS	68.27±17.0	86.1±17.4	<0.001
NRS	6.74±2.7	2.5±1.2	<0.001

mHHS: Modified hip score, HOS: Hip outcome score, NRS: Numeric rating scale

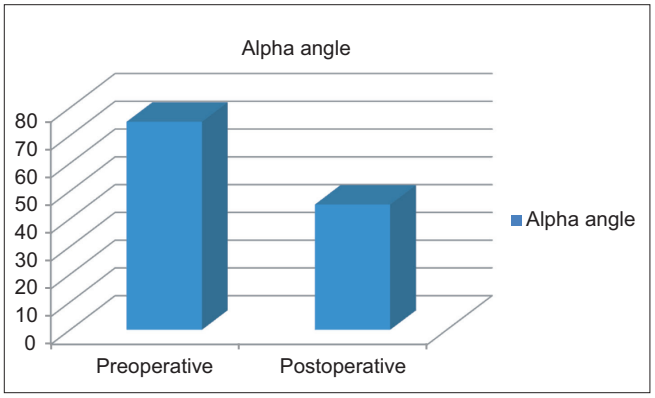

Figure 3: Preoperative and postoperative angles as measured on cross-table lateral radiographs for hips with cam impingement revealed significant improvements

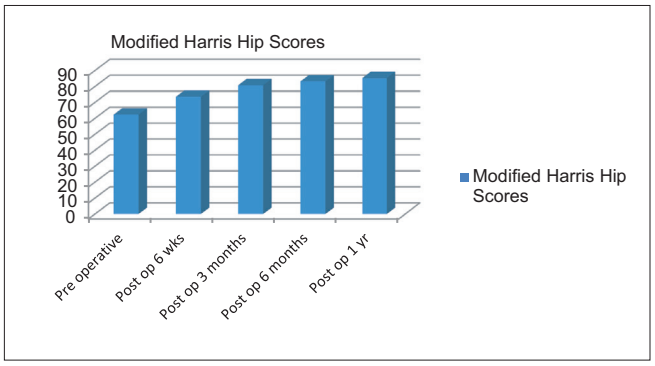

Figure 4: Progressive analysis of modified Harris hip score revealed statistically significant improvement postoperatively without further significant improvement after 3 months

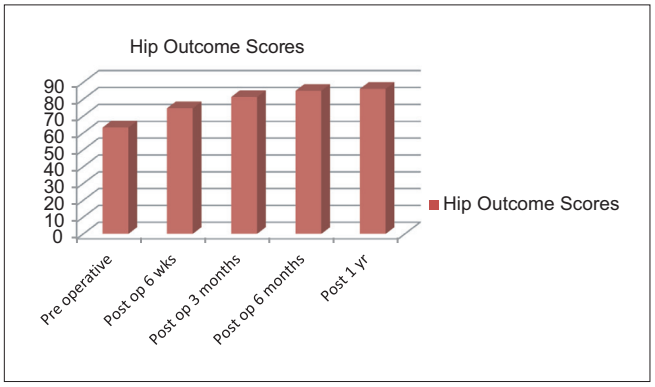

Figure 5: Progressive analysis of hip outcome score revealed statistically significant improvement postoperatively without further significant improvement after 3 months

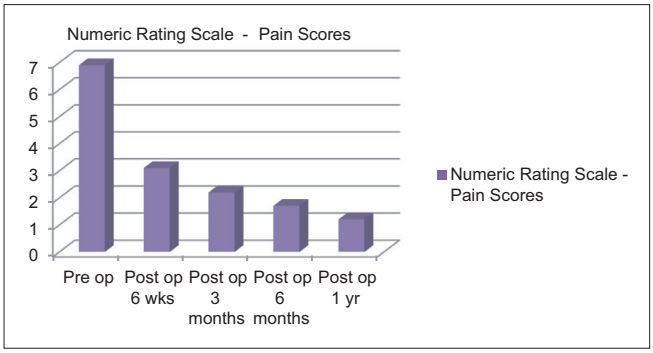

Figure 6: Progressive analysis of numeric rating scale - pain score revealed statistically significant improvement postoperatively without further significant improvement after 3 months

The failure case was defined as 10 point drop in mHHS and HOS, respectively, from pre-operative to follow-up. According to this, 9.5% cases were failure. Total hip replacement (THR) was done in three patients. Two patients were operated for THR after the follow-up period. All these patients mean age was 47 years, and they had cartilage injury ICRS Grade 4 at the acetabular rim and ICRS Grade 3 on the femoral head.

DISCUSSION

The goal of surgical management of FAI is removal or reorientation of acetabular over coverage by labral repair/refixation or labral debridement and is reshaping of the proximal femur. This concept has been pioneered by Ganz. The procedure has been traditionally done with surgical hip dislocation doing a trochanteric osteotomy. Beck *et al.*[10] published that excellent results were found in 13 patients among 19 patients on 4.7 years follow-up. Peters and Erickson[5] reviewed 30 hips undergoing open reconstruction. Their observation that significant improvement of mHHS from a mean of 70 preoperatively to 87. Four hips required total hip arthroplasty because of progressive osteoarthritis and pain. Espinosa *et al.*[2] compared the effect of labral debridement versus repair/refixation and found better outcomes at 2 years' follow-up in the labral repair group with respect to pain and progression of osteoarthritis. Overall, the results of open management have been promising in the absence of significant chondral damage at the time of surgery.

Although there is increasing interest in arthroscopic management of FAI.[20-28] A systemic review of 45 elite athletes with FAI treated arthroscopically, concluded that all patients had symptomatic relief and returned to their sport.[20,25] In another review of over 320 patients treated arthroscopically, 90% had the elimination of the impingement sign and were reportedly satisfied with their results.[28] Our study showed significant improvement of patients in respect of the impingement test, mHHS, HOS score, and NRS pain score at early follow-up. With up to 3 years' follow-up, the scores have remained relatively stable. Total hip arthroplasty had been required and performed in 3 patients and scheduled in 2 patients.

Several studies have found a correlation between chondral damage in FAI patients and subjective outcome. Haviv *et al.*[29] examined the impact of cartilage injury on clinical outcome of cartilage damage in FAI patients. They found no difference in improvement of mHHS improvement between different degrees of cartilage injury. Philippon *et al.*[16] found that poor cartilage status leads to a poor subjective outcome. The present study did not find any difference in mHHS outcome between cartilage injuries ICRS Grades 1-2 (16 patients) and Grades 3-4 (35 patients). The mHHS was 82.5 and 85.0, respectively. However, all failures that had THR reoperation had severe cartilage injuries Grade 4.

A total of 78% of the patients had a labral refixation after removal of acetabular bone tissue. The patients with labral refixation did not have poorer subjective outcome than patients without this procedure. Larson and Giveans[30] demonstrated that labrum refixation led to improved subjective outcome compared to labral resection in two patient cohorts with labral damage. Another prospective randomized study by Krych *et al.*[31] showed the same improvement of outcome scores.

The THR reoperation rate in the present study is similar to other published studies. In 96 patients, Larson and Giveans found a 3% THR reoperation rate.[15] All had Grade 4 acetabular chondral lesions with delamination of cartilage from the subchondral bone. Overall higher age, higher degree of cartilage injury and/or osteoarthritis is predictors for THR reoperations.[16,29]

The present study has several limitations. One of the most important is the lack of control group consisting of non-operated/conservatively treated FAI patients. There are several strengths in this present study. This study is a consecutive, prospective case series including a relatively large cohort of 55 patients. The study had excellent completeness with 100% and 75% at 1 year and longtime follow-up, respectively.

CONCLUSION

Arthroscopic management of patients with pain related to mechanical hip symptoms and radiological findings of FAI will benefit from hip arthroscopy with resection of

cam and pincer bony deformities. Significant improvement in outcomes measures, with good to excellent results, is being observed in 75% of hips at a minimum follow-up of 1 year. Alteration in the natural progression to osteoarthritis and sustained pain relief as a result of arthroscopic management of FAI remain to be seen. In conclusion patients with their functional level will increase and their pain level will decrease significantly. Further studies are needed to determine failure rates and outcome risk factors.

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