

Treatment of Femoroacetabular Impingement with a Mini-open Direct Anterior Approach

Abstract

Background: The opinion about best methods of femoroacetabular impingement (FAI) treatment are not consistent. Operative treatment of this condition may be arthroscopic, but open procedures with osteotomy of the greater trochanter and hip dislocation has been used. The present study evaluates the benefits of the mini-open direct anterior approach (DAA) in treating patients with FAI, with is a procedure available for most orthopedic surgeons. **Materials and Methods:** 39 patients treated for FAI (25 men and 14 women) at an average age of 29.3 years (range 18–46 years) were reviewed in this retrospective study. The mean followup was 45 months, (range 24–55 months). The hip impingement test was positive in all patients. The diagnosis of FAI was confirmed on anteroposterior and lateral hip view radiographs. All patients were operated with mini-open DAA. The outcomes were assessed with the Harris Hip Score, Short-Form 36 Health Survey and VAS score. Preoperative osteoarthritis was assessed according to Tönnis score. **Results:** At the final followup, improvement was noted compared to preoperative status in Harris Hip Score ($P < 0.00001$), visual analog scale score ($P < 0.001$), and Short-Form-36 score ($P < 0.001$). Nineteen patients returned to their previous sports activities. No major complications occurred. One patient developed heterotopic ossification and three patients developed temporary postoperative meralgia paresthetica. Five patients from the treatment group required total hip arthroplasty for severe osteoarthritis. **Conclusions:** Mini-open DAA is a safe and effective procedure for the treatment of FAI that gives good relief of symptoms and allows a successful return to preoperative activity levels. Further research with a longer followup period is needed to evaluate the influence of surgery on natural history of FAI.

Keywords: Femoroacetabular impingement, cartilage lesion, labrum tear, cam type, pincer type, direct anterior approach

MeSH terms: Acetabulum, minimal access surgical procedures, arthroscopic surgical procedures, cartilage

Introduction

Femoroacetabular impingement (FAI) is an increasingly widely recognized and understood condition mostly in active younger patients which often leads to degenerative changes of the hip joints.¹⁻⁴ Damage to the acetabular labrum, the presence of pain, and increased restriction of movement are the most frequent qualifications for surgical intervention. Arthroscopy of the hip joint is the most common method of treatment; however, it is a technically demanding procedure and reserved for orthopedic surgeons with a great degree of experience in the area. Significant long term traction is commonly required, and the procedure itself is often relatively long.⁵⁻⁸ Alternatively, surgical procedures such as the Ganz *et al.* approach with osteotomy of the greater

trochanter and dislocation of the femoral head can be performed.⁹ Such an extensive approach, and the need for dislocation represents excessive surgical intervention, and iatrogenic avascular necrosis of the femoral head is a potential complication.^{10,11} However, the Ganz procedure offers the clear advantages of visibility, access around the entire circumference of the femoral head, and a clear view of the acetabular labrum.¹⁰⁻¹³ Procedures of the acetabulum together with resection of osteophytes on the femoral head by mini-open direct anterior approach (DAA) offer the possibility for effective reduction of pain and greater range of motion of the hip joint.⁸

Three different types of impingement can be distinguished: cam type, which is associated with changes in the shape and of the osteophytes of the femoral head; pincer

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type; and finally, mixed type, which is the most common one. In cam impingement the anatomy of the proximal femur is abnormal, such as a nonspherical femoral head or decreased head-neck offset. Pincer impingement is present when there is abnormal anatomy of the acetabulum such as acetabular rim overgrowth, acetabular retroversion, or coxa profunda. Both of these conditions lead to abnormal, repetitive abutment of the acetabulum and the femoral neck.¹

The present study evaluates the results of treating patients with FAI with mini-open DAA.

Materials and Methods

39 consecutive patients treated for FAI, secondary hip pain, and restricted range of hip motion were reviewed by the first author between January 2009 and December 2013 in this retrospective study. The study group comprised 25 men and 14 women, with an average age of 29.3 years (range 18–46 years). The diagnosis of FAI was performed on the basis of clinical examination and radiographic evaluation. The impingement test, i.e., pain in flexion, adduction, and internal rotation, was found to be positive in all patients. The diagnosis of FAI was confirmed on the basis of radiographs performed in anteroposterior and lateral hip view. An additional magnetic resonance imaging was performed in nine patients to diagnose labrum tears. The presence of prior hip surgery constituted exclusion criterion. Five examined patients (not included in the group of 39 patients) were excluded from the study: two who had undergone previous hip surgery and another three who were lost to followup. The mean followup was 45 months, (range 24–55 months).

Operative procedure

All procedures were performed by the first author, with the patient in the supine position. A standard DAA was used, incisions were made over the tensor fasciae latae (TFL) muscle. A proximal starting point of skin incision was made 3–4 cm distal from the anterior superior iliac spine (ASIS) along the line between the ASIS and the top of the greater trochanter. A 7–8 cm slightly curved cut was then made toward the femoral head. The superficial fascia of the thigh was opened along the TFL muscle which is partially detached from its aponeurosis and then retracted laterally. The proximal part of the innominate aponeurosis was cut, and the rectus femoris muscle was retracted medially. The gluteus minimus or the iliopsoas muscles were not detached from the capsule. The articular capsule was found in the intermuscular space between the TFL and the rectus femoris. The anterosuperior capsule was dissected free with a finger. Two retractors were used to expose the joint capsule. A Z-shaped incision of the capsule was made. The first incision of the capsule was along the acetabular rim from 10 o'clock to 2 o'clock, the second along the medial edge of the iliofemoral ligament, and the third along the

basis of femoral neck. The labrum was exposed. In the case of pincer impingement, partial cutting of the labrum with mini chisels was performed. High-speed burrs were used to remove the osteophytes from the anterior and superior acetabulum. An additional, similar technique was used to remove the osteophytes from the femoral head. The labrum was reinserted to the bone using 2.9 mm bone anchors. The range of motion of the joint was checked, as well as the stability of the labrum. The joint capsule was then closed. The procedure was completed by fascial, subcutaneous, and skin stitches. A drain was left for 24 h. X-ray images were taken to evaluate the degree of resection of osteophytes.

All patients demonstrated a cam lesion on the femoral head, which was excised with a burr and small chisel. Labrum tears were found in 20 out of 39 patients. The labrum was refixed using two or three 2.9 mm bone anchors in 5 cases, partially excised in 9 cases, completely excised in 5 cases, and left intact in the remaining case.

Postoperative rehabilitation

The patients were advised to walk with two crutches with weightbearing, as tolerated on the 1st postoperative day. They were allowed to gradually increase weightbearing and walking without support according to the tolerance. For the first 2 postoperative weeks, flexion of the hip joint was restricted to 90°, with restricted internal and external rotation. Exercises on a stationary bike were recommended for the week following the operation. After the removal of the stitches, the range of flexion increased to 110°, as did the standing rotational exercises. The patients were discharged on the 4th postoperative day. The patients were followed up at 4, 8, and 12 weeks after surgery.

In all patients, the range of motion of the hip joint was examined before the operation and during followup visits. The clinical functional outcomes were assessed with the Harris Hip Score (HHS)¹⁴ and Short-Form 36 Health Survey (SF-36).¹⁵ Assessment of pain was performed on the basis of a 10-point visual analog scale (VAS). Preoperative osteoarthritis was assessed according to Tönnis score.¹⁶

Statistical analysis

Shapiro–Wilk test was used to test the distributions of the HHS, VAS, and SF-36 scores for normality. The Student's *t*-test was used to compare preoperative and postoperative statuses for normally distributed variables, whereas Mann–Whitney U-test was used to compare nonnormally distributed variables. *P* < 0.05 was considered statistically significant.

Results

At the final followup, the mean HHS score was 27.7 points higher than baseline (56.4 ± 12 before operation versus 84.1 ± 16 points at last followup) (*P* < 0.00001). The mean VAS score had decreased from 4.9 (ranging from 2 to 7) to 1.5 (from 0 to 5) (*P* < 0.001). Mean SF-36 scores improved

from 61 (range from 49 to 71) before the operation to 86 (range from 70 to 100) postoperatively ($P < 0.001$). Nineteen patients returned to their previous sports activities. No complications, such as deep infections, femoral neck fractures, or avascular necrosis, were found in the cohort. One patient developed heterotopic ossification (Brooker Type 2), but this did not affect the final outcome. Three patients developed postoperative meralgia paresthetica, which resolved within 10 months.

Osteoarthritis developed in four hips. Those patients underwent total hip arthroplasty (THA) at a mean followup of 32 ± 6.9 months (range 5–44 months). All demonstrated at least Grade II changes on preoperative radiographs.

Discussion

The mini-open DAA provides a good visualization of the hip joint and most of the circumference of the femoral head and allows for procedures on the joint labrum. With this approach, iatrogenic damage of the muscle and vessels surrounding the hip joint can be avoided. This degree of access allows good exposure of the head and labrum of the joint, allowing the following procedures to be performed: osteochondroplasty, bone bump removal or fixation, partial removal, and debridement of the labrum. Visualization is similar to that described in studies based on dislocation surgery.^{17,18} Although posterior femoral lesions may be more difficult to visualize and to treat entirely, this type of lesion is rare.¹⁷ Another advantage of this procedure is the fact that patients may walk with weightbearing as tolerated on the limb immediately after the operation. Furthermore, both the cost incurred by the procedure and the rate of complications are lower than for other approaches.^{17,18} Mini-open DAA may also be employed for THA in the case of subsequent intensification of degenerative changes.

One unfortunate effect may be lesion of the lateral cutaneous nerve of the thigh (meralgia paresthetica), which usually is temporary. This complication was observed in three patients of the study group (7.7%). Such complications were also noted by Cohen *et al.* in 20% of cases.¹⁹ In addition, while one patient in the present study demonstrated heterotopic ossification, which had a minor influence on the results of healing, no cases were observed of avascular necrosis, femoral neck fracture, or trochanteric complications.

Functional scores were observed to have improved by the end of the study, which is consistent with the literature.^{8,17-19} However, it is difficult to compare our outcomes with those in the literature as different assessment criteria were used. Furthermore, most studies, including the present one, report results of a heterogeneous group of patients: it is difficult to compare scores achieved by athletes and average people. Laude *et al.* analyze over 100 cases of the modified anterior approach in treating FAI. In some cases,

the anterior approach was combined with arthroscopy. The best results were noted in patients under 40 without evident hip osteoarthritis.⁸ Malagelada *et al.* noted not only reduction in pain but also improvement in the gait analysis and functional capacity of patients treated for FAI with mini-open DAA.²⁰

The literature gives many examples of treating FAI using arthroscopy⁵⁻⁸ with satisfactory results. However, these procedures are often performed in orthopedic departments focused on arthroscopic treatment. Arthroscopy of the hip is technically difficult and only available for surgeons with experience in the specific procedure.²¹ When considering the technical difficulties, the possibility of iatrogenic damage to the pudendal and lateral femoral cutaneous nerves (due to intraoperative traction), as well as the rare occurrence of hip joint arthroscopy in some hospitals, the DAA appears to be an effective alternative for the treatment of FAI.

Extensive access to the dislocation of the femoral head proposed by Ganz is reserved only for specific indications.¹⁰⁻¹³ Apart from the unwillingness of many surgeons to use such an intrusive access, it may result in trochanter nonunion, trochanteric bursitis, the development of degenerative changes of the joint, and avascular necrosis of the femoral head.²² The true long term positive impact of these surgeries on the development of degenerative changes has not been proven, which further questions the performance of extensive and invasive procedures such as “debridement” of the hip joint.^{23,24}

Diaz-Ledezma and Parvizi compared the mini-open approach, hip arthroscopy, and surgical hip dislocation for the treatment of FAI. They found that considering the benefits, opportunities, costs, and risks, the mini-open approach is the best surgical option, followed by hip arthroscopy and surgical hip dislocation.¹⁷ Therefore, the method of treating FAI with mini-open DAA described above appears to be a valid alternative to a range of other procedures and can be employed by many other orthopedic surgeons.

Currently, only short- and midterm results of FAI treatment are known,^{8,17-19} and we are not aware of any long term results that could indicate not only an improvement of functional results but also prevention of osteoarthritis. Further research with a longer followup period is needed to evaluate the influence of surgery on the natural history of FAI.

Conclusions

Mini-open DAA is a safe and effective procedure for the treatment of FAI that gives good relief of symptoms and allows a successful return to preoperative activity levels. Further research with longer followup periods is needed to evaluate the influence of surgery on the natural history of FAI.

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Conflicts of interest

There are no conflicts of interest.

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