Update to femoroacetabular impingement arthroscopic management

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KEYWORDS
Hip; Arthroscopy; Femoroacetabular impingement; Traction

Summary
Introduction: Arthroscopic treatment of femoroacetabular impingement (FAI) is recommended since it is a minimally invasive procedure allowing full access to the hip joint.
Hypothesis: Arthroscopic treatment can alleviate FAI without use of a perineal support.
Goals of the study: To describe an early experience of hip arthroscopy in the treatment of FAI using two types of hip distraction without perineal support; to assess morbidity of FAI release under arthroscopic control and its early clinical and radiological outcome.
Patients and methods: In the first 32 cases, the procedure used an invasive distractor and started with the central compartment. In the last six cases, it started with the peripheral compartment using a dedicated traction table with a contralateral buttock support. Inclusion criteria were: positive impingement test and radiological evidence of FAI. Thirty-eight consecutive patients with mean age 36 years (range 24—64) underwent arthroscopic treatment for FAI. Clinical outcome used WOMAC and Postel Merle d’Aubigné (PMA) scores. Radiological development of osteoarthritis (OA) was graded according to Tönnis score.
Results: At mean final follow-up of 1.3 years (range 0.5—3), there were no complications of either type of traction technique used. Mean WOMAC score increased from 55 to 75 points and PMA from 14.6 to 16.7 points. The subjective overall satisfaction rate was 79%. Radiological OA changes appeared in two hips, were unchanged in 33, and deteriorated in three.
Discussion: Invasive distraction device has been effective but appeared complex and costly. The procedure is now performed without it and begins at the peripheral compartment by the capsulotomy, which allows secondary distraction using a contralateral buttock. Preoperative OA seems to be a negative prognostic factor for clinical outcome.

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Conclusions: Arthroscopic treatment of FAI is a safe technique which can be achieved without perineal complications. Limited anterior—superior capsulectomy and cephalic bone resection represent the first operative step, allowing acetabular trimming, labral reattachment and FAI relief. It is effective in terms of early clinical results.

Level of evidence: Level IV: retrospective study.

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Introduction

Femoroacetabular impingement (FAI) is advocated as a cause of early hip pain and secondary osteoarthritis (OA) [1–3]. Anatomical abnormalities [2,4,5] that lead to impingement can be alleviated by reshaping the aspherical femoral head and the anterior acetabular rim. Open surgery requires hip dislocation [6–9] which is not needed for less invasive procedures, such as mini-open [10,11] or arthroscopic techniques [9,12–16]. Nevertheless, even if the most conservative, arthroscopy is technically demanding. The aims of this study were:

- to describe the operative procedure with particular regard to two consecutive techniques of hip distraction without perineal support;
- to assess their morbidity;
- to evaluate early clinical and radiological results.

Patients and methods

Patients

Inclusion criteria were hip pain in the groin or peritrochanteric regions for at least six months associated with positive impingement test and radiological evidence of FAI [2]. The patient was placed in a lateral position. Based on the experience of the surgeon (first author), the technique of hip distraction and the sequence of capsulotomy, and articular exploration have been modified over time.

Operative technique

The first 32 procedures began by positioning a specific distractor (Da Rold Medical™, Solothurn, Switzerland) (Fig. 1) which allowed traction between two osseous anchorages (proximal femoral metaphysis and acetabular tectum). Screw positioning, tool placement and bone resection were performed under fluoroscopic control (Fig. 2). The duration of distractor positioning was recorded. Exploration started with the central compartment and treatment of acetabular abnormalities and/or lesions. The anterolateral portal was created first, using expanded canulas, followed by a posterolateral portal performed under direct vision of the 70° scope. Capsulotomy was created using a radio-thermal device or a beaver blade, and was completed by creation of the third portal placed anteriorly. At this time, femoral osteoplasty represented the second step after release of the distraction.

For the last six cases, the patient was placed in lateral position on a traction table (Maquet™, Rastatt, Germany) without the use of the distractor. The perineal support was replaced by a contralateral buttock support and the hip was flexed (20°) in order to loosen the anterior capsule (Fig. 3). The procedure began by exploration of the peripheral compartment. Two portals (anterolateral and anterior) were consecutively created. The femoral neck was first reshaped and the capsulotomy was then performed from inside to outside without traction, using a hooked high-frequency electrode, through anterolateral and anterior portals. This capsulotomy, realized at first, allowed the acetabular treatment then performed under distraction.

At time of exploration, femoral head and acetabular cartilage damage was graded using the Outerbridge classification system [17]. Delamination was classified as stage 4 if the subchondral bone was exposed after debridement. The labrum was inspected and stability, size, ossification, partial or complete tearing and degenerative abnormalities recorded.

With both techniques of hip distraction, acetabular and femoral osteoplasties were performed with a barrel burr. Exposed subchondral bone was treated with microfractures and labral lesions were treated. The effectiveness of the procedure was controlled by two peroperative criteria: a dynamic test was performed to assess impingement clearance and the amount of resected bone from the femoral neck in order to restore cephalic sphericity was recorded using intra-operative fluoroscopy (Fig. 2).

Figure 1 Arthroscopic procedure using an external hip distractor (Da Rold Medical™, Solothurn, Switzerland).
Rehabilitation program

Postoperative weight-bearing was limited with use of crutches for four to six weeks depending on the extent of femoral resection and subchondral bone treatment. During this period, flexion exercises without rotation were encouraged. Rehabilitation began after six weeks with sports, such as swimming and stationary cycling. Jogging was allowed after three months for pain-free patients. In cases treated by labral repair, pivot sports were not allowed before six months.

Methods of assessment

Clinical assessment used the Postel Merle d'Aubigné score (PMA) (pain, ambulatory status and range of motion) [18] and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC score) [19]. Patients were also questioned whether they were subjectively very satisfied, satisfied or disappointed with their treatment and if they experienced any perineal complications or discomfort. Pre- and postoperative radiographic assessment was based on standard X-ray A-P radiographs of the pelvis and lateral, and oblique views of the hip [20,21]. Impingements were classified as «cam FAI» in case of aspherical femoral head, "pincer FAI" in case of acetabular abnormalities (excessive depth or malorientation), or combined [2,6]. Acetabular angular dysplasia was measured (anterior and lateral acetabular coverage) and OA was graded according to the Tönnis classification [22]. All patients underwent preoperative computed tomography (CT) or magnetic resonance (MR) arthrograms.

Statistical methods

Quantitative values have been described as mean, standard deviation and range. Statistical analysis was performed using the t-test and non-parametric Wilcoxon test for the comparisons of paired groups. Significance was determined as alpha ≤ 0.05.

Results

Between April 2005 and June 2007, 38 consecutive patients (33 men and five women), with mean age 36 years (range 24–64), underwent arthroscopic treatment for FAI. Symptoms duration before arthroscopy ranged from six months to ten years and did not correlate to the level of OA. Thirty
hips had no radiological OA and eight were graded 1. All hips had radiographic FAI morphologic abnormalities: 17 "cam FAI", four "pincer" FAI and 17 "combined". Six patients had acetabular angles borderline for dysplasia (ranging from 20° to 25° of anterior and lateral coverage) [23]. With arthro-CT or MR-arthrography, 35 hips demonstrated evidence of cartilage or labral damages. Only three hips had no lesions despite clinical evidence of FAI but, at time of surgery, all three had cartilage delamination without any labral lesion.

The mean duration for distractor positioning was 15 minutes (10—21). There has been no screw loosening or breakage. One patient developed a thigh hematoma which disappeared within three weeks. The 17 "cam FAI" had isolated femoral osteoplasty, the four "pincer FAI" had acetabuloplasty and the 17 "combined" had the two techniques.

There have been no neurological or perineal complications and no patient complaint of instability for both techniques. The amount of resected bone from the femoral neck with restoration of cephalic sphericity was achieved in all the cases whatever the technique of hip distraction. A torn and stable labrum were repaired in four cases and detached but intact labrums were reattached after acetabuloplasty in three cases. Degenerative and non-reparable labrums were debrided in the other cases.

Two patients have not been re-examined but were questioned by telephone. Data including last X-rays were available at the latest follow-up. One experienced temporary pain relief during the following one year. This patient underwent an arthroscopic revision at another centre. The second patient had still a painful hip after one year of follow-up. The remaining 36 patients were physically re-examined at mean final follow-up of 1.3 years (range 0.5—3). There was a significant improvement in the WOMAC and PMA scores (Table 1). Pain, ambulation and mobility statistically improved (Table 2). In this group, despite no statistical significance difference, hips without preoperative OA (29 patients) appeared to improve to a greater extent than in those with degenerative changes (seven patients) (grade 1). Thirty were very satisfied or satisfied and six were disappointed. Among them, two had acetabuli with angular coverage borderline to dysplasia. The others had extensive cartilage damage at time of arthroscopic evaluation (Outerbridge grade 4) and two patients underwent early hip resurfacing by the author. The first one had no pain relief and was re-operated one year after the arthroscopy. The second one remained totally pain-free during one year, before recurrence of pain necessitated further surgery 22 months post-arthroscopy.

In summary, the overall satisfaction rate was 79% (30/38). Eight patients (21%) were dissatisfied. Radiographically OA appeared in two hips (grade 0 to 1), and deteriorated in three hips (grade 1 to 2) (Fig. 4). Thirty-three hips (87%) had OA that remained stable: 28 grade 0 and five grade 1.

The six patients with preoperative limited lateral coverage of the acetabulum were associated with combined aspherical femoral heads and acetabular retroversion. In those cases, both anatomical abnormalities were treated by limited bone resection. Among these patients, four have had a poor subjective result independent of their OA status. The seven patients who had been treated with a suture or a reattachment of the labrum experienced good final clinical

**Table 1** Early clinical results of femoroacetabular impingement arthroscopic treatment: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)/100 points.

<table>
<thead>
<tr>
<th>Overall results</th>
<th>n</th>
<th>Mean preoperative WOMAC</th>
<th>Mean WOMAC at follow-up</th>
<th>p value</th>
<th>Mean preoperative PMA</th>
<th>Mean PMA at follow-up</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No preoperative OA</td>
<td>29</td>
<td>57 (17, 21—88)</td>
<td>76 (19, 35—100)</td>
<td>&lt; 0.001</td>
<td>14.6 (1.8, 11—18)</td>
<td>16.8 (1.9, 12—18)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Grade 1 osteoarthritis</td>
<td>7</td>
<td>50 (14, 8—71)</td>
<td>55 (17, 14—88)</td>
<td>&lt; 0.001</td>
<td>14.8 (1.8, 11—18)</td>
<td>17.2 (1.6, 12—18)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>(standard deviation, range).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.34</td>
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</tbody>
</table>

Postel Merle d'Aubigné (PMA)/18 points.

<table>
<thead>
<tr>
<th>Overall results</th>
<th>n</th>
<th>Mean preoperative PMA</th>
<th>Mean PMA at follow-up</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No preoperative OA</td>
<td>29</td>
<td>14.8 (1.8, 11—18)</td>
<td>16.8 (1.9, 12—18)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Grade 1 osteoarthritis</td>
<td>7</td>
<td>13.7 (1.5, 11—15)</td>
<td>15 (1.9, 13—18)</td>
<td>0.13</td>
</tr>
</tbody>
</table>

*Functional results were assessed on 36 hips, two patients not examined at follow-up by the current authors, were excluded for functional results.*
Table 2  Detailed pre- and postoperative Postel Merle d’Aubigné (PMA) score after arthroscopic treatment of femoroacetabular impingement.

<table>
<thead>
<tr>
<th></th>
<th>Preoperative</th>
<th>At follow-up</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain/6 points</td>
<td>3.9 (0.9, 2−6)</td>
<td>5.2 (1.1, 2−6)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Range of motion/6 points</td>
<td>5.7 (0.7, 3−6)</td>
<td>5.9 (0.5, 4−6)</td>
<td>0.03</td>
</tr>
<tr>
<td>Stability/6 points</td>
<td>5 (0.8, 3−6)</td>
<td>5.6 (0.5, 3−6)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

(standard deviation, range).

a Functional results were assessed on 36 hips, two patients not examined at follow-up by the current authors, were excluded for functional results.

Discussion

The first aim of this retrospective study was to report our technical early experience of arthroscopic FAI treatment with a particular regard to hip distraction techniques. The goal was to get rid of perineal support in order to prevent neurological complications reported in other series using traction table [24−27]. The limit is that the series in non comparative but depicts our technical evolution during the learning curve phase. The second aim was to report the clinical results on the FAI clinical test. This is allowed by a follow-up of 1.3 years which is, on the contrary, too short to draw conclusions on late radiological evolution of the hip.

In this series, no perineal complications and no specific morbidity of the distractor has been noted. Nevertheless, our technique of capsulotomy and femoroplasty improved with time and surgeon experience, and the use of invasive distraction appeared progressively as a complex and costly technique. Enlightened by the six last cases, the procedure now begins with the peripheral compartment [28,29], carrying an anterosuperior capsulectomy in order to perform the cephalic osteoplasty. This reduces strain across the hip and allows no need for the invasive distractor. The dedicated traction table, with a contralateral buttock support, appears to be sufficient. Even if some authors use a submuscular extracapsular approach [12,14], the inside−outside capsulotomy limited to the osteoplasty area is now preferred in order to reduce muscular traumatism. In our series, no hip instability appeared as a consequence of this procedure. This low morbidity provides confidence in the use of arthroscopy as the routine treatment for FAI and the preservation of hip anatomy makes further procedures easier as it has been verified by the authors for two patients.

This series only allows early conclusions for clinical and radiological results. In the literature, pain relief seems to be achieved whatever surgical technique is used [7−9,11,15,16]. Sadri [9] showed the relevance of arthroscopy in a prospective randomized study which compared this technique with open surgical dislocation: both options had an 80% rate of success at two-year follow-up. However, and as in other series, preoperative OA seems to be a negative prognostic factor for clinical results [7,8,11,16,30] and led to hip replacement in three cases. On the other hand, some patients of this series experienced durable pain relief despite preoperative OA (four cases), or postoperative progression of hip OA (two cases).

Another negative prognostic factor could be the association of FAI with a borderline lateral coverage of the acetabulum. In these cases, traditional surgery has not been used because none of these hips demonstrated a lateral coverage of less than 20°, and because CT/MRI arthrographic analysis demonstrated no hyperplasia of the labrum. The association between retroversion and acetabular dysplasia is not rare [31]. We hypothesise that acetabuloplasty could destabilise those hips. In such cases, acetabular rim trimming should probably be limited. In cases of labral tear, sutures seem to provide good results but the limited number of patients does not allow us to draw statistically significant conclusions. The current literature is encouraging for the use of labral suture [16] or reattachment each time its quality allows the procedure.

Conclusion

Arthroscopic treatment is a safe and effective technique of treating this particular hip deformity which causes FAI. With the experience of the surgeon, the invasive distractor has been replaced by the use of a traction table without perineal support, with the same efficiency for the clearance of the impingement. If early pain relief is confirmed, this technique has still to demonstrate benefits for late clinical and radiological results.

Conflict of interest statement

None.

References


