



The Minimally Invasive Anterolateral Approach (MIS-AL)- 11-Year Results of Cementless Total Hip Arthroplasty

D Musil*, M Held, J Klouda, P Sadovský, T Trnka and J Stehlík

Department of Orthopedics, České Budějovice Hospital, Germany

***Corresponding author:** D Musil, Department of Orthopedics, České Budějovice Hospital, Boženy Němcové, České Budějovice, Czech Republic, Germany

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Abstract

The study prospectively assessed the eleven-year outcomes of cementless total hip arthroplasty using the minimally invasive anterolateral approach (MIS-AL). Enrolled into the study were a total of 104 patients who had had total hip arthroplasty using the MIS-AL approach in our center between 1/2005 and 3/2006. A combination of an Allofit cup and CLS stem was used in all patients (Zimmer Biomet). Patients were assessed using the Harris score, school-like performance rating, evaluation of satisfaction levels (in percent), and evaluation of X-ray scans obtained prior to, 1 year, and 11 years after the procedure. Overall, complete assessment was performed in 75 patients. The Harris score was 91.34 and 91.35 at 1 year and 11 years post-surgery, respectively. One patient required re-implantation for damage to the femoral head at 2 years after the primary implantation and another one replacement for stem loosening because of an inappropriately-sized component. There was no case of infection-related stem loosening. Our results showed that, in indicated cases, the MIS-AL approach can be an alternative to the conventional one; however, while the former has comparable mid-term outcomes, they are not superior to those obtained using standard approaches.

Introduction

Minimally invasive approaches in total hip arthroplasty continue to be a debated topic with a number of controversial views [1,2]. The present paper presents prospective results of cementless total hip arthroplasty over a period of 11 years post-procedure. Evaluation was performed using the Harris score, monitoring of the level of patient satisfaction, and X-ray scan assessment.

Materials and Methods

The study included a total of 105 patients who had had cementless hip arthroplasty (Allofit cup and CLS stem) using the mini-invasive anterolateral approach. The patients were followed up prospectively for a period of 11 years. Thorough examination prior to, 1 year and 11 years after surgery was performed in 75 evaluated patients. Our finally evaluated study group is made up of 43 men and 32 women with a mean age of 59.5 years at the time of surgery, and aged 70.5 at the time of evaluation. Mean BMI at the time of the joint prosthesis implant procedure was 26.7. Of the above 75 cases, the right and left hip joints were in 38 and 37 patients, respectively. One patient had re-do surgery 2 years after the primary procedure because of femoral head split fracture, with another patient having

re-do surgery for stem loosening. A total of 28 patients failed to respond to our invitation for a final comprehensive assessment and were thus excluded from the group. In our department, total hip arthroplasty using the MIS-AL approach is indicated for non-obese patients (with the main criterion being body fat distribution and not total body weight or BMI) with primary spherical hip joint arthritis. Contraindications include marked obesity, severe postdysplastic arthritis, severe joint deformities, previous hip joint surgery, and marked limb shortening [3]. The procedure is performed using the MIS-AL approach described in detail by Bertin and Rottinger [4], with the latter modifying the original technique proposed by Keggi [5,6], using a dedicated toolset manufactured by Zimmer Biomet for both cemented and cementless implants.

Technique

The procedure is performed under regional or general anesthesia with the patient in the recumbent position and fixed tightly in the pubic and sacral regions. The incision, measuring 5-8 cm in length, is localized slightly dorsally from the line between the spina iliaca anterior superior and the anterior superior facet of the greater trochanter. Upon fascial dissection, we proceed along

the space between the gluteal medius muscle and tensor fasciae latae. Next, we loosen as much as possible the joint capsule, which is-after placing femoral elevators-ventrally excised and medially dissected. Once the elevators have been placed in the joint above (one sharp elevator) and below the neck (two blunt elevators), subcapital transverse osteotomy of the femoral neck is performed. The oscillating blade is inclined transversally to prevent damage to the posterior acetabular rim. Osteotomy allows to change the position of the limb operated on to the antero-posterior position (A-P thereafter, 90° external rotation, 0° flexion and abduction). The lower leg (shank), hanging down with the knee flexed 90 degrees, is wrapped in a sterile plastic bag. This is followed by second, definitive, A-P femoral neck osteotomy at the usual site, the interfragment is extracted and search started for any residual fragments in the surroundings of the neck or acetabulum. Once the limb has been placed back to the lateral position, the femoral head is removed and incision of the medial capsule up to the acetabulum completed. Upon resection of the capsular residues and, also, from the surroundings of the acetabulum-worked with a dedicated reamer - we continuously monitor the status of both pillars and, after spongiosis application to the bottom cup, the acetabular component is implanted using the pressfit Allofit cup (Zimmer Biomet). As the next step, the limb is returned to the A-P position allowing for stem implantation. Upon bone marrow cavity trepanation, the femoral canal is worked using dedicated rasps and the original cementless CLS stem (Zimmer), checked for proper size, implanted. Throughout the procedure, all bleeding sites are immediately and thoroughly coagulated and the operating field repeatedly flushed. Two suction drains are inserted to the joint and subcutaneous tissue and left in place for 48 hours. An elastic spike is applied after suture of the fascia, subcutaneous tissue, and skin. Once the procedure is over, the patient is transferred to our intensive care unit with verticalization and mobilization started on postoperative day 2. The patient is allowed to immediately load the limb up to 50% of body weight; however, as a rule, based exclusively on subjective sensations. Beginning week 6, the patient is encouraged to progressively proceed to full load using three-points ambulation. Standard antibiotic prophylaxis is performed intraoperatively, with the patient secured with low-molecular weight heparin while continuing with pharmacological prevention of thromboembolic disease for a period of 6 weeks. The patients are followed up at intervals of 6 weeks, 4 and 12 months, and 2 years thereafter. All patients were followed up prospectively. Preoperative and postoperative evaluation at 1 and 11 years post-op was performed using the Harris score; also, patients were invited to provide their rating of satisfaction with their current status (in percent), school-like rating of the overall outcome, and asked whether or not they would be willing to have the same procedure on their contralateral joint if needed. Those patients who had had total hip arthroplasty from the standard anterolateral approach previously were asked whether they found

the mini-invasive procedure better than, worse than or equal to the standard technique. X-ray scans obtained in the A-P and axial projections were assessed at 1 and 11 years postoperatively. Both intraoperative and postoperative complications were recorded.

Results

Of the original 104 patients enrolled, 28 were lost to follow-up or failed to present for all examinations at the pre-defined time intervals. Two patients had re-do surgery which made them ineligible for analysis; in one, the problem was breakup of the femoral head, the other one involved loosening and shift of the stem due to inappropriately-sized component. Complete evaluation was made in 75 patients. There was no death. Our study group included 43 men and 32 women with a mean age of 59.5 (28-77) years at the time of surgery. In all cases, the indication was primary hip joint arthritis. The ratio of sides operated on was 38 to 37 in favor of the right hip joint. Mean BMI was 26.7 (19-36), with a mean height of patients being 1.72 m (1.56-1.92) and body weight of 79.3 kg (60-112). All patients received a combination of an Allofit cup and CLS stem (Zimmer). The procedures were performed by a total of 5 surgeons. In one case, the surgeon was forced to expand the approach to the standard anterolateral one because of femoral fissure and secure it with a Cable system (Zimmer Biomet). Average postoperative blood losses to the suction drains were 897 ml (170-1450). After surgery, the average cup inclination was 49° (42-55). In no case was the cup implanted in retroversion. One cup was evaluated as inadequately buried; however, became fully integrated without clinical complications. In nine patients, the stem was inserted off the optimal position. In five cases, mild varus deformity of up to 2° was noted, another two stems were in 5° and 7° varus deformity, two stems were inserted in 2° and 4° valgus deformity. None of the patients experienced endoprosthesis luxation, developed infectious complications, thrombosis or embolism. Two patients had postoperative wound revision for hematoma.

The average surgical time from transporting the patient to the operating theater to covering the wound was 94 minutes (57-124). Baseline evaluation was performed using the Harris score. Immediately prior to the procedure, its mean value was 48 (7.75-70.25) increasing, at 1 year post surgery, to 91.34 (48.5-100) and to 91.35 (53.5-100) at eleven years after the procedure (Table 1). However, the Harris score was not designed to assess the joint operated on but a patient's overall mobility. Our group included one patient after amputation of the contralateral lower limb and several patients with severe arthritis affecting other joints (6 cases), limiting their overall mobility. When asked if they would be willing to have the same procedure should identical problems occur, 74 patients answered "yes" at 1 and 7 years post-op while one would opt for another procedure. The patient complained of pain in the lower pole of the scar at the site of gluteal medius muscle insertion. Satisfaction with the outcome was reported, both at 1 and 7 years

post-op, by 74 out of the 75 patients. Patients were also asked to rate their level of satisfaction (in percent) with the outcome in relation to the joint operated on only. The rating at 1 year was an average 97.5% (range, 75-100) and at 11 years post-op 94.5% (range, 70-100). Next, the patients were asked to evaluate the outcome using school-like performance rating. Here, the outcome received average ratings of 1.16 at one year and 1.25 at 11 years. Twelve patients had previously total hip arthroplasty using the standard anterolateral

approach; of this number, 10 found the MIS-AL approach better, while two considered both approaches equal. None of the patients rated the MIS-AL approach inferior to the standard one. X-ray scan assessment at 1 year documented para-articular calcifications in 13 patients; of these, grade 1 and 2 calcifications were present in 11 cases, and grade 3 calcifications in two patients. One patient developed a soft rim around the cup, so far without progression and clinical problems.

Table 1: Rating of patient satisfaction with cementless TEP implanted from the MIS-AL approach using the Harris score, level of satisfaction (with 100% indicating maximum satisfaction) and school-like performance rating (1 best, 5 worst) at 1 and 11 years post-implant.

Harris score (range)	Before	1 year	11 years
Level of satisfaction %	48 (7.75- 70.25)	91.34 (48.5-100)	91.35 (53.5-100)
School-like performance rating		97.5% (75-100)	94.5% (70-100)
		1,16	1.25

Discussion

In fact, the mini-invasive approach in total hip arthroplasty is not a revolution in endoprosthetics, but an alternative for a well-defined selected subgroup of patients which should be more patient-friendly in the first postoperative days. Use of the mini-invasive approach with cementless implants does not significantly reduce postoperative blood losses. The Allofit cup (Zimmer) seems to be suitable for implantation using the approach evaluated in our study as its centering poses no problem. None of our patients experienced loosening of the acetabular component over the 11-year period. While Zenz [7] did not document a single case of Allofit cup loosening at 10 years, Howard [8] reported increased rates of cementless cup loosening not earlier than 10 years post-implant. Regarding implantation per se, a more challenging part of the procedure is the introduction of the femoral component associated with increased error rates; the femoral component was placed off the ideal position in 12% of cases. While malcentering of up to 2° is tolerable, the deviation was over 2° in three cases (4%); however, a change in femoral component orientation has no effect on the mid-term outcome. In this respect, some improvement could be expected from the use of navigation, conservative stems (Mayo, Fitmore) or design of new toolsets. A shift of a cementless, inappropriately-sized stem, which failed to engraft occurred in one patient requiring stem re-implantation. Total endoprosthesis luxation was not documented in any of our patients. In our view, the error rate is closely related to the learning curve and the fact the surgical technique is currently used by a greater number of surgeons. Our follow-up included all patients since the introduction of the surgical technique. We believe that mastering the technique requires implantation of at least 30 endoprostheses using the MIS-AL approach, and hence consider the above number consistent with the learning curve. As the number of implantation procedures increased, the error rate decreased. MIS-AL approach includes the higher incidence of para-articular calcifications in

our first patients. In our department, when using the conventional technique, the patient is in the supine position so that the bone fragments are washed away while flushing the wound. With the MIS-AL approach, the debris tends to stick to the surrounding tissue with the wound serving as sort of a "bowl". A detailed evaluation of the technique showed it is absolutely critical to pay utmost attention to detail with each procedure, carefully remove all spongy bone fragments and stop bleeding from any injured vessels. These measures helped reduce the incidence of the above errors. Another most important finding is that there was not a single case of an early infectious complication. We believe an advantage of the mini-invasive approach is the reduction of the surgical wound area, being 4 to 5 times smaller thus reducing the risk of surgical field contamination. The procedure is much more challenging in obese patients where body fat distribution is the critical factor. Jackson [9] reported that, while the Harris score in obese patients was lower, the level of patient satisfaction and total endoprosthesis durability was the same in the mid-term horizon. In our own prospective study [10] comparing the quality of life at 1 year post-procedure using the conventional and mini-invasive techniques and the SF-36 questionnaire, we documented identical outcomes in either group. Some items in the Harris score focus on patient overall mobility. Our patient set included those with spinal injury, arthritis affecting other joints, subtalar arthrodesis as well as a patient after contralateral lower limb above-the-knee amputation, who could not achieve complete assessment despite optimal outcome; another factor not to be neglected was the effect of aging at the time of individual assessment on the patients' overall status, which was why decided to ask our patients to rate their level of satisfaction with the outcome. The average Harris score at 11 years had virtually not changed since that of one-year follow-up. There was a slight worsening of the level of satisfaction in percent and school-like performance rating. An important finding was that 10 out of 12 patients who had undergone total hip arthroplasty

using (separately) both conventional and mini-invasive techniques considered the MIS-AL approach superior to the conventional one. None of the patients rated the former as a worse option.

While, in one of the first studies comparing 86 implant procedures using the posterolateral mini-invasive approach with 85 standard technique procedures, Goldstein et al. [11] did not report any difference in end points between the two groups; the authors continue to use the mini-invasive technique based on patients' preferences. Results of what is perhaps the largest retrospective follow-up study to date were published by Kennon. [5,6] who have been using the technique for two decades; in their series of 3,500 procedures, not compared with the conventional one, these authors reported only 0.6% of clinically relevant thromboembolic complications. In their comparison of a group of 50 posterior mini-incision approaches with 85 standard approaches, Woolson. [12] did not document any differences in blood losses, surgical time and length of hospital stay. While not identifying a single benefit supporting mini-invasive approach superiority over the standard technique, the MIS-AL approach can be reasonably considered a safe and comparable technique. Matta. [13] published a series of 494 anterior mini-invasive approaches with average cup inclination of 42° and anteversion of 19°. The authors documented 3 cases of dislocation, no case requiring revision, and 17 perioperative complications. The mean operating time was reported to be 75 minutes with blood losses of 350 ml. The conclusion was that the technique allows to achieve proper acetabular component centering with an increase in luxation rates. O'Brien [14] described their experience with a direct lateral mini-invasive approach in 87 primary implantations. There were no cases of dislocation, infection, neurological problem, no problems with healing or differences in the incidence of complications or numbers of blood transfusion; nonetheless, patients operated on using the mini-invasive approach were leaner. Teet [15] published the results of 73 mini-incision and 54 standard procedures with a follow-up of 4.5 years without a difference between the patient groups. The first to publish a prospective study assessing the posterior mini-invasive approach were Floren [16]. In their paper, the authors compared clinical versus X-ray scan outcomes of patients 10 to 13 years after endoprosthesis implantation using the posterior mini-invasive approach with data presented by authors using the conventional approach but the same implant type. The postoperative Harris score was 92.3, 57% of patients exhibited bone atrophy in the area surrounding the proximal part of the stem on the X-ray scan, with radiolucent zones in the areas of the stem and cup identified in 14% and 11% of cases, respectively. There was no case of aseptic loosening of the implant. These authors consider the mini-invasive approach comparable with standard approaches as reported in earlier papers. In their controlled study, Howell [17] compared data of 50 patients receiving implants from the mini-invasive anterolateral approach with data of 57 patients operated on using

the standard approach. As the former patient group showed shorter operating times, smaller blood losses, and shorter hospital stays, the authors consider the mini-invasive technique safe. In their well-documented prospective randomized study comparing 209 patients operated on using either the mini-invasive posterior or the standard 16-cm approach, Ogonda [18] did not document any benefits in any of the end points such as hemoglobin levels, X-ray scan assessment, length of hospital stay, level of pain, or any of the scoring systems employed (Harris hip score, McMaster University Osteoarthritis index, Short Form-12) favoring one of the two technique; importantly, all procedures were performed by a single surgeon. Evidence stemming from studies published to date has not clearly supported the use of popular mini-invasive techniques at the expense of conventional ones. In some well-indicated patients, mini-invasive techniques compare well with other procedures available in centers performing total hip arthroplasty. While, in the case of proper indication, the patient may benefit, in the first postoperative days, from a less invasive approach, short- and mid-term outcomes for conventional and mini-invasive techniques are identical. An advantage of the latter is the possibility to extend the procedure to the standard approach. The mini-invasive technique must never be used at the expense of proper component centering. The procedure should be undertaken by an erudite surgeon with sufficient experience based on a reasonable number of procedures. Another advantage is that the mini-invasive approach allows to use both, cementless or cemented, implants.

Given the short- and mid-term outcomes and spectrum of patients in our center, we continue to regard the conventional anterolateral approach as the golden standard for the majority of patients. Further studies are warranted to definitively establish the position of the MIS-AL approach within the range of procedures performed in our center.

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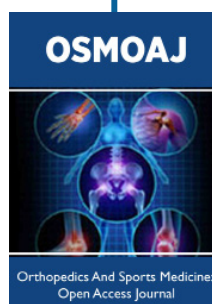


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