

Mini-invasive anterior approach in total hip arthroplasty: short-term follow-up

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Abstract. *Purpose:* To evaluate short-term follow-up of patients treated with total hip arthroplasty through minimally invasive anterior approach. *Methods:* Twenty-four patients, surgically treated with this approach from January 2010 to December 2010. We measured the blood loss, the number of transfusions, the time of surgery, the length of hospital stay and intra and postoperative complications. All patients were clinically evaluated by Womac and Harris Hip Score 12 months after surgery. Radiographic views were performed postoperatively and at 1, 3 and 12 months after surgery in order to evaluate component positioning. *Results:* The mean value of total blood loss was 1050 ml, the number of transfusions after surgery was on average 0.85. The mean time of surgery was 111 minutes. The mean hospital stay was 6.5 days. The radiographic views showed a correct component placement. We didn't encounter any complication and the mean score of Womac and Harris Hip Score was satisfactory in all cases. *Conclusions:* Minimally invasive anterior approach provides good short-term results. However, long-term studies are needed to confirm this evaluation. (www.actabiomedica.it)

Key words: hip, arthroplasty, mini-invasive approach, anterior surgical approach

Introduction

Total hip replacement is one of the most frequently performed and most successful surgical procedures in orthopedic and traumatology. In Italy about 100,000 hip replacements (20,000 in patients less than 60 years) are performed every year (1-2) with an increase of 5% of cases each year.

Over the years the improvements in prosthetic designs and materials, as well as in surgical techniques and instrumentations, have ensured a long-term survival of the implants in more than 98% of cases (3-4).

In contrast, surgical approaches remained substantially unchanged (anterior, lateral, posterolateral and anterolateral); each of them has advantages and disadvantages.

Among these, the anterior approach is less "traumatic", because it does not interrupt the muscular

structures and uses the anatomical interval between the tensor fascia latae and the gluteus laterally, and between the sartorius and the rectus medially.

Recently it has been developed the concept of less aggressive surgery that utilizes minimally invasive approaches performed with the help of dedicated instrumentations in order to reduce the invasiveness preserving as much as possible the bones, the skin and the peri-articular neurovascular and soft tissues.

In this context minimally invasive (MI) anterior hip approach has been proposed; in addition to the specific benefits of the classic anterior Smith-Petersen (5), it is characterized by a smaller incision and minimal damages to peri-articular soft tissues with the benefit of less postoperative pain and a faster recovery.

The authors report the results of 24 patients in which total hip arthroplasty (THA) was implanted through an anterior MI approach.

Materials and methods

In this study, 24 patients operated on at the University Hospital of Parma in the period between January 2010 and December 2010 were evaluated.

The anterior MI approach derives from the classic Smith-Petersen one (5). It has been modified with the concepts of minimally invasiveness and is performed utilizing dedicated instrumentations and operating bed (Figure 1), with the possibility of placing the limb to be operated in traction (Figure 1), a maneuver which facilitates the movement of the hip during operation (6-7).

The incision, that is of variable length between 5 and 8 centimeters, originates a centimeter laterally to the anterior-superior iliac spine and is directed towards the apex of the greater trochanter (Figure 2 A-B). The underlying superficial fascia is then sectioned in line with the skin incision above the muscle fibers of the tensor fasciae latae. At this level it is easy to recognize the intermuscular septum between the tensor fasciae latae and the sartorius and particular care should be taken to protect the lateral femoral cutaneous nerve. After the incision of the deep fascia, the tensor fasciae latae is retracted laterally and the sartorius and rectus femoris superiorly and medially. Afterwards, the fibers of the rectum which originates from the anterior part of the joint capsule are detached and the ascending branches of the lateral circumflex artery are isolated and legated. At this point, a retractor is placed medial to the femoral neck and another on the external side of

the greater trochanter, thus making visible the capsular plane (Fig. 2C) that is sectioned. This passage is followed by dislocation of the femoral head (Fig. 2D) and joint replacement is completed.

In all 24 cases blood losses, number of post-operative transfusions, operative time and hospitalization and intra- and postoperative complications were measured.

The operative time was calculated from the time of the skin incision to wound closure. The total blood losses were calculated using the mathematical formula developed by Rosencher et al. (8) that takes into account height and weight of the patient, pre- and post-operative hematocrit and intra- and postoperative blood transfusions. The patients were clinically evaluated with the Womac (Western Ontario McMaster) (9) and Harris Hip Score (HHS) (10) before and 12 months after surgery. Radiographic controls were also performed immediately after operation and after 1, 3 and 12 months, in order to assess the correct positioning of the prosthetic components. The positioning of the acetabular component was evaluated in the anterior-posterior radiographic projection of the pelvis, measuring the angle of inclination of the acetabulum which is calculated between the bisischiatric line and a line tangent to the edge of the prosthetic cup. The presence of a varus or valgus alignment of the femoral stem was evaluated in the same radiographic view assuming the neutral position as the coincidence of the axis of the stem with the anatomical axis of the femur (11).



Figure 1. Operating table and positioning of the patient in traction before surgery

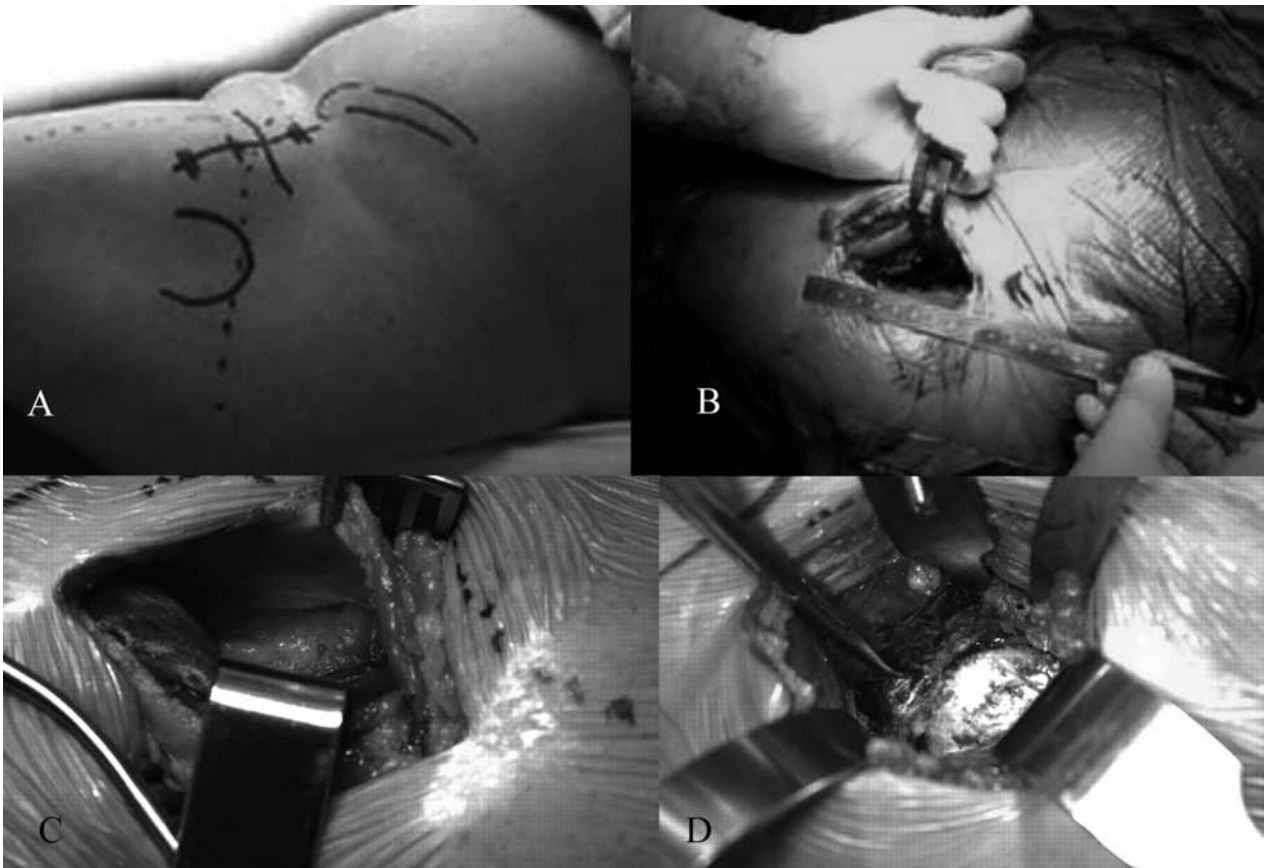


Figure 2. Anterior MI approach. A and B: skin incision; C: joint capsule; D: femoral head

Results

The average age of the patients (15 males and 9 females) at the time of surgery was 67.7 years (range: 59-78).

The mean follow-up was 17 months (range: 12-22). The preoperative diagnosis was osteoarthritis in 21 cases and idiopathic osteonecrosis of the femoral head in 3.

In all cases the patient was positioned on the operating table with the leg in traction, and a M2a-Magnum cup (Biomet®) and an uncemented Taperloc Microplasty stem (Biomet®) was implanted (Figure 3).

All patients were operated under spinal anesthesia and underwent to antibiotic prophylaxis with second-generation cephalosporins and antithrombotic prophylaxis with low molecular weight heparin. The average

blood loss was 1050 ml (range 727-2077). The average number of intra-and postoperative blood transfusion was 0.85 (range: 0-2).

The mean operative time was 111 minutes (range: 70-130) and the average hospitalization was 6.5 days (range: 5-8).

In all 24 cases there were no complications related to the surgical technique.

The average Womac score increased from a pre-operative value of 66 (range 56-77) to a postoperative of 93.18 (range: 89-98) thus suggesting a return to an excellent quality of life.

The average HHS was 63 (range, 48-77) preoperatively and 91 (range: 73.5 to 94.64) at follow-up (Table 1). The immediate postoperative x-ray and at 1, 3, 12 months after surgery showed good positioning of the acetabular and femoral components, with no signs of mobilization.



Figure 3. Bilateral hip osteoarthritis; preoperative (A) and postoperative x-ray (B) after positioning of uncemented total hip arthroplasty

Table 1. Functional results according to HHS. Preoperative vs. postoperative.

N° of patients		Functional Results
Pre-operative	Post-operative	
12	0	Poor
12	3	Fair
0	12	Good
0	9	Excellent

Discussion

Despite the improvements in THA and the evolution of materials and instrumentations, there is no doubt that the introduction of minimally invasive techniques has further improved the prognosis of such surgery. In spite of this, the literature is debating and conflicting results between traditional vs. less invasiveness techniques are reported (12-14). Very often this is the result of the fact that it is not completely known the difference between surgical techniques performed through mini-incisions and the real mini-invasive surgery and, therefore, the first reported comparative studies have not shown significant differences in the clinical and radiographic outcomes between these 2 procedures (12-14). In the latter, by definition, in addition to the reduction in the size of the skin incision, the hip is approached preserving as much as possible the peri-articular soft tissues and muscles. More recent studies have shown better results for mini-invasive techniques (15-18) and has

been reported that the postoperative bleeding is minor, such as the need to perform intra- and postoperative transfusions (12-18); in this study the results about these parameters reflect these advantages and blood loss were on average of 1050 ml, and the number of transfusions required were on average of 0.85 per person. We believe that these positive data depend on the type of anterior approach, which has the characteristics of minor surgical invasiveness compared to other classical and mini-invasive approaches. It is also important to emphasize that a critical step of this access is the isolation and ligation of the branches of the lateral femoral circumflex artery, in order to avoid substantial intra- and postoperative bleeding and hematoma (7-19). Some authors have reported a high rate of surgical wound complication (20-21) that were never observed; if necessary, the authors prefer to enlarge the incision a few centimeters rather than overstretch or manipulate the skin flaps and soft tissues in order to avoid these problems.

The mean operative time in this study was 111 minutes (range 70-130), a result which shows that this surgical technique have longer execution times than standard. This finding has been observed especially in the early cases performed and confirms that the learning curve is probably greater than the classical techniques. In the initial cases of patients operated on with minimally invasive technique, more difficulties in the positioning of the prosthetic components and visualization of the femoral canal and acetabulum

have been described (21-23). Some authors (22-23) use a second skin incision and place prosthetic components under fluoroscopy in order to avoid these difficulties. On the other hand Rachbauer (11) sustains that the second incision is not necessary as long as a proper joint capsule release from the femur and of the tendon of the internal obturator muscle is performed. Radiographic analysis of the 24 patients of this case series never showed a malposition of the prosthetic components; the authors believe, as proposed by Siguier (24) and Bombelli (25), that the use of traction bed facilitates surgical exposure and positioning of the components and avoids the need for additional incisions, and the use of the fluoroscope. Furthermore, the positioning of a short femoral stem undoubtedly facilitated the introduction and a more precise positioning of the femoral component, even if the authors recommend to perform in all cases an intraoperative radiograph of the pelvis with a trial stem in order to check and eventually modify the limb length and femoral offset. Some surgeons use minimally invasive approaches and techniques under computer assistance (26-28) thus facilitating the positioning of the components even if they require a learning curve and operative times more higher. The results observed in this study at follow-up showed in all cases an improvement of Womac and HHS compared to preoperative. All patients were satisfied with the intervention and defined as "simple" the postoperative pain management. This datum, even in the absence of a numerical evaluation of the objective parameter pain, is particularly important for the postoperative recovery of each patient, which is rapid and may involve a shorter time of hospitalization.

Conclusions

The anterior MI approach to the hip is considered the most physiological among those available. This less invasiveness access, despite initial longer surgical times and learning curve, allows a rapid functional recovery with low postoperative pain and short hospitalization. The satisfactory results observed in this study, as well as the satisfaction of the patients, confirm the validity of this therapeutic option.

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