MINIMALLY INVASIVE ANTEROLATERAL ACCESS ROUTE FOR TOTAL HIP ARTHROPLASTY

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ABSTRACT

Objective: The aim of this study was to present a minimally invasive anterolateral access route and to ascertain whether this enables total hip replacement without compromising the quality of the implant positioning, while maintaining the integrity of the gluteus muscles. Method: A retrospective study was conducted on 260 patients (186 females and 74 males) with an average age of 62 years. There were 18 bilateral cases, totaling 278 hips. All the patients had osteoarthritis and had undergone non-cemented total hip arthroplasty (metal-metal or metal-polyethylene) between October 2004 and December 2007. A minimally invasive anterolateral access route was used, measuring 7 to 10 cm in length, according to body weight and the size of the femoral head. The patients were assessed clinically regarding age, sex and presence of the Trendelenburg sign, and radiologically regarding acetabular and femoral positioning. Results: The acetabular inclination was between 30° and 40° in 78 patients, between 41° and 50° in 189 patients, and 51° or over in 11 patients. On anteroposterior radiographs to study femoral positioning, the positioning was central in 209 cases, 41 presented valgus deviation and 28 presented varus deviation. On lateral views, 173 were central, 67 anterior and 38 posterior. The mean duration of the procedure was 63 minutes. Regarding complications, there were five cases of infection, three of deep vein thrombosis, two of hip dislocation, 80 of lengthening of the lower limbs and five of shortening of the operated limb. The Trendelenburg sign was present in four cases, of which one showed superior gluteal nerve injury. Conclusion: The minimally invasive anterolateral access route made it possible to perform total hip arthroplasty without compromising the positioning of the implants, thereby maintaining the integrity of the gluteus muscles.

Keywords – Osteoarthritis/surgery; Arthroplasty, Hip; Surgical Procedures, Minimally Invasive

INTRODUCTION

Total hip arthroplasty became popular in the 1960s, thanks to Charnley⁴. Since then, it has been further perfected through improvements in implants, the development of new materials, and more accurate instruments, as well as improvements in cementing techniques, making arthroplasty one of the most efficient surgeries in orthopedics, with high levels of satisfaction⁵. However, the search for better implant materials has not led to a significant decrease of the aggression suffered by patients submitted to this type of procedure.

There is currently a growing concern, among surgeons, to decrease the risks associated with surgery, in the search for a technique that produces less tissue aggression and less bleeding, decreases surgery and hospitalization times, avoids blood transfusion, and enables the patient to be rehabilitated as quickly as possible. © 2011 Sociedade Brasileira de Ortopedia e Traumatologia. Open access under CC BY-NC-ND license.
possible. Analyzing the most commonly used access routes nowadays, like the anterolateral approach of Watson Jones\textsuperscript{(3)}, the lateral approach of Hardinge\textsuperscript{(4)} and the posterior approach, it is observed that these incisions are around 20cm in length. There is currently a tendency to carry out total hip arthroplasties through minimally invasive incisions of around 8cm, using a single access route\textsuperscript{(5)}.

The objective of this study is to present a minimally invasive anterolateral access route, and to determine whether this route enables total hip arthroplasty to be carried out without compromising the quality of positioning of the implants, maintaining the integrity of the gluteal musculature.

**MATERIAL AND METHOD**

A retrospective study was carried out with 288 patients who underwent surgery at Hospital Samaritano (São Paulo) and Hospital Municipal Antonio Giglio (Osasco-SP) during the period of October 2004 to December 2007. Of these, 260 patients were selected, with a total of 278 osteoarthritic hips submitted to total uncemented hip arthroplasty. As criteria for inclusion, records were selected of patients submitted to total uncemented hip arthroplasty for whom there were pre- and post-operative radiographs and full records of outpatient follow-up for at least one year after surgery.

The following were excluded: incomplete records, patients submitted to hybrid and cemented arthroplasties, those who did not maintain adequate follow-up, those with acetabular dysplasias, bone tumors, fractures, positive preoperative Trendelenburg sign, and a body mass index higher than 40, calculated according to the World Health Organization criteria\textsuperscript{(6,7)}.

The patients were clinically evaluated in relation to age, sex, presence of Trendelenburg sign, and criteria of ASA, and radiographically, in relation to the position of the acetabular and femoral components.

All the patients were operated on by the same surgical team, using a minimally invasive technique, through an anterolateral incision.

**Description of the material**

All the patients were submitted to total hip arthroplasty with uncemented metal-metal or metal-polyethylene prostheses.

The conventional instruments of the basic prosthesis kit were used, together with Hohmann type curved retractors of different widths and angles, hip retractor, reamer and curved acetabular impactor (Figure 1).

![Curved acetabular reaming instrument](image)

1) Curved acetabular reamer  
2) Curved acetabular impactor  
3) 2 Narrow curved Hohmann type retractors with 30° and 45° angles  
4) 1 Wide curved Hohmann type retractor with 20° angle  
5) 1 Right-angle retractor with hooks of 3/4/5 cm in depth

**Figure 1 – Curved deep retractors.**

**SURGICAL TECHNIQUE**

The patient is positioned in lateral decubitus, held in place by two cushions, at 0° lateral and sagittal inclination (neutral position).

The access route starts at 3cm posterior and 1cm superior to the prominence of the greater trochanter, moving in an anterior and distal direction at a 45° angle to the femoral diaphysis, and extending approximately 7 to 10cm (Figure 2), the length varying according to body mass and size of the femoral head.

After dissection of the subcutaneous tissue and fascia lata, tenotomy of 4cm of the gluteus medius is performed in its myotendinous transition, initiating from medial to lateral. Tenotomy of the gluteus minimus is also performed, and both are retracted upwards, without dissecting the two muscles. The anterior portion of the joint capsule is resected, enabling luxation of the femur head.
The access route 3cm posterior and 1cm superior to the prominence of the greater trochanter, in the anterior direction at a 45° angle to the femoral diaphysis, measuring approximately 7 to 10cm.

Femoral osteotomy is performed 1 to 2cm from the lesser trochanter, according to the preoperative plan.

The modified Hohmann retractors are placed anterior and posterior to the acetabular edge, and the posterior retractor pulls back the greater trochanter to expose the acetabular cavity.

The acetabulum is then reamed using the curved reamer. The acetabular cup is then placed in position (Figure 3).

The preparation of the femur begins by positioning the lower limb at 90° of hip and knee flexion, with maximum possible external rotation and abduction. The trochanter retractor is positioned on the posterior surface of the trochanteric region, giving a full view of the proximal third of the femur. Femoral reaming is then performed, and the femoral implant is inserted. Next, a stability test is carried out with the provisional head, and only then is the final component inserted. Finally, the wound is closed in layers, and suction drainage inserted. In the postoperative phase, the patient begins motor physiotherapy on the first day and walking training on the second day. The drainage is removed 24 hours after surgery.

EVALUATION OF PATIENTS

The patients were submitted to pre- and postoperative evaluations. In the pre-operative evaluation, they were evaluated by the ASA(8) criteria to define the clinical condition. The patients were also evaluated in relation to sex and age, and the Trendelenburg test was performed. For this, the examiner stands behind the patient, asking him or her to flex the knees, keeping the hip extended (to eliminate the action of the psoas muscle). If there is insufficiency of the gluteus medius, a drop in the iliac crest is observed on the same side, due to inability of the contralateral gluteal musculature to contract and lift the pelvis(9).

In the postoperative evaluation, the surgery time was measured from the moment of the initial incision through to complete suture of the skin. The hospitalization period was calculated from admission through to discharge. All the patients were followed-up as outpatients, at 15/30/60/90/180/360 days, in order to evaluate scarring, gait, integration of the implant and Trendelenburg sign. The following postoperative radiograph images were evaluated: anteroposterior pelvis, anteroposterior and profile hip.

The position of the acetabulum was measured on the anteroposterior radiograph of the pelvis based on straight lines drawn from the ischia and acetabular edge. The point where these lines crossed was the angle of positioning of the acetabulum. The femoral positioning was calculated based on a line drawn on the longitudinal axis of the femur, both in the anteroposterior and profile radiographs, and a line in the center of the prosthesis, obtaining an angle between the lines that thus define the position of the implant as central, or with varus or valgus deviation.
RESULTS

A total of 260 patients (278 hips) with initial diagnosis of osteoarthritis were submitted to uncemented total hip arthroplasty, 186 female and 74 male, with a minimum age of 52 years, maximum age of 82 years, and a mean age of 62 years (Table 1). A positive Trendelenburg sign was found in four cases, which were submitted to electroneuromyography. Only one patient presented positive electroneuromyography, confirming lesion of the superior gluteal nerve. In this patient, there was lengthening of the lower limb of 3.5 cm. In relation to acetabular inclination, 78 patients had between 30° and 40°, 189 had between 41° and 50° and 11 cases had 51° or more (Table 2). In relation to femoral positioning in the anteroposterior radiograph, a central positioning was observed in 209 cases, with valgus deviation in 41 and varus deviation in 28. In the profile radiograph, there were 173 central, 67 anterior and 38 posterior (Figure 4).

Table 1 – Total hips by sex and age.

| Total patients | 260 |
|----------------|-----|
| Total hips     | 278 |
| Male           | 74  |
| Female         | 186 |
| Mean age       | 62  |

Table 2 – Total patients by acetabular angle.

| Total patients | Acetabular inclination |
|----------------|------------------------|
| 78             | 30° to 40°              |
| 189            | 41° to 50°              |
| 11             | > 51°                   |

In terms of complications, five cases of infection were observed. Of these, two were submitted to surgical cleaning resulting in total improvement, and three had to be submitted to surgical cleaning with insertion of the retractor and performing the total hip prosthesis in a second surgery. There were three cases of deep vein thrombosis, confirmed by vein contrast echo Doppler, and two cases of hip luxation. 80 cases were found with lengthening of the lower limbs, with values less than 0.5 cm, and only seven had lengthening greater than 2 cm. Five cases were also observed with shortening of the operated limb, but all with less than 1 cm, which corroborates the results found in the literature\(^\text{(10-12)}\).

DISCUSSION

From 2002\(^\text{(13)}\), minimally invasive techniques for total hip arthroplasty began to increase in popularity, publicized by the non-medical media in articles on the Internet and newspapers, as well as in specialist magazines, which saw a huge increase of articles on these new techniques. This led to a demand, by both surgeons and patients, for mini-incision, which promised a less aggressive surgery, with little pain and faster recovery time. With information gathered from the internet, candidate patients for hip arthroplasty practically forced surgeons to make smaller incisions, and the competition between surgeons for the smallest incision became common\(^\text{(14)}\).

Obviously, like all new techniques, complications arose during the learning curve, such as failures in the positioning of the implants, necrosis of the surgical border with an increase in levels of infection, luxations, occult bleeding, and a dis-
parity between the limbs\textsuperscript{(15,16)} and at the start of
the learning curve, it was common for surgeons
to start with a small skin incision and end with a
bigger one, leading to greater tissue lesion due to
the difficulties associated with the smaller access
route. The literature corroborates these facts, en-
ding the euphoria, leading surgeons to rethink this
technique which brought out complications that had
already been overcome by the conventional techni-
ques. Analyzing these facts in detail, the learning
curve was the first main hurdle. Naturally, any new
technique requires a phase of initial training, when
the level of errors is higher, due to the difficulty in
visualizing the points of reference, which were pre-
viously easy to find using the traditional methods,
but which were now obscured with the minimally
invasive routes, even in the hands of surgeons who
were highly skilled, but who were still accustomed
to the 20cm access route.

Another important point is to the instruments
used to perform the prosthesis, not specifically the
implants, but the actual instruments used. Due to
the small incision size, the instruments also had
to be adjusted to facilitate the minimally invasive
 technique for the surgeon. In this series, retractors
with curvature and various angles were used to fa-
cilitate the surgical approach, as well as acetabular
reamers and impactors to assist in the preparation
of the bone and positioning of the implant. Without
these instruments, the acetabulum would frequently
be positioned with a vertical inclination.

The use of this anterolateral route together with
the specialized material enabled the incision to be
taken full advantage of, both in the acetabular and
femoral preparations, as the latter is at a 45° angle
to the femoral diaphysis, making the entire length
of the route available and enabling the adequate
preparation of bone adequately for the implants.

A constant criticism in relation to the anterior
and lateral access is the need to deinsert the ab-
ductor musculature, particularly the gluteus medius
muscle, and the probability of lesion of the superior
gluteal nerve, which can lead to gluteal insuffi-
ciency, which is clinically evidenced by claudica-
tion on walking and Trendelenburg sign. Analyzing
the results in this series, the Trendelenburg sign
was present in four cases (2%). All these cases were
submitted to electroneuromyography, and lesion
of the superior gluteal nerve was observed in only
one. There are works that cite a positive Trende-
enburg percentage of up to 20% after two years
of follow-up\textsuperscript{(17)}.

In relation to the positioning of the implants, an
average acetabular angle of 41°-50° was observed,
which shows a level that is within the ideal mean
value cited in the literature\textsuperscript{(18)}, both for traditional
direct lateral access, and for anterior access\textsuperscript{(19)} and
this value is also similar to the results obtained
using the navigation system\textsuperscript{(20)}. With regard to the
femoral positioning, it was observed that 75% of
the shafts were positioned in the ideal manner. In
other minimally invasive accesses, a varus posi-
tioning was found in up to 12%\textsuperscript{(21,22)}.

For surgery time, a maximum time of 90 minu-
tes was observed, and a minimum of 35 minutes,
with a mean time of 63 minutes. The literature cites
an increase in surgical time using traditional access
in relation to the minimally invasive posterior rou-
te, which would be due to the time spending open-
ing and closing the surgical layers\textsuperscript{(23-26)}. Anterior
accesses with mean times of 60.4 minutes 60.4
\textsuperscript{(27)} and 75 minutes\textsuperscript{(18)} are also cited. Extremely low
means were also found, such as 37.5 minutes\textsuperscript{(24)} and
57 minutes\textsuperscript{(28)}, in which the author benefited from
preoperative planning to define the osteotomy of
the femoral neck. With practice, the mini-incision
inevitably minimizes the surgery time, since its
smaller size reduces the time it takes to open and
close the soft tissues\textsuperscript{(26)}. The reduced surgery time
clearly brings advantages, reducing the anesthesia
time and the amount of drugs administered to the
patient, decreasing the exposure time, and conse-
quently, lowering the risk of infection. The surgery
time should not be prolonged, but it should not be
the main focus in surgery of total hip arthroplasty.
It is understood that the procedure time decreases
with the improvement and practice of the surgeon
and the team, over the learning curve. The main
objective of arthroplasty is to perform surgery to
re-establish the center of rotation and good posi-
tioning of the implants. The choice of a minimally
invasive access route should not compromise the
success of the procedure.
Some factors of great importance that were not studied here should also be taken into consideration when discussing mini-incision in total hip arthroplasty. The decrease in bleeding, pain and rehabilitation time are great advantages of this surgical approach over other traditional approaches. The importance of protocols is emphasized in the preparation of the patient, both prior to surgery and in the rehabilitation and control of pain, which has brought proven benefits for patients submitted to this type of surgery.

CONCLUSIONS

1. The minimally invasive anterolateral access route enables consecrated hip joint replacement surgery to be carried out safely.
2. It does not affect the quality of the positioning of the implants, and it preserves the gluteal musculature intact.
3. It is extremely important to have appropriate instruments and a surgical team that is trained to carry out the minimally invasive technique.

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