Early Complications in Direct Transgluteal Anterolateral Total Hip Arthroplasty: A Comparative Study

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ABSTRACT

Introduction: In recent years, the advent of new procedures, surgical instruments, and surgeon skills has contributed to a reduction in the number of early complications that can arise after hip arthroplasty. Among the most frequent are femoral loosening, deep vein thrombosis, and dislocation. **Objective:** To evaluate the rate of intraoperative complications and complications within the first 12 months after a hip arthroplasty performed utilizing the direct anterolateral approach; and to compare the results to a series published in 2007. **Materials and Methods:** Retrospective cohort study, which included patients who underwent surgery for primary hip osteoarthritis at two institutions, divided into: group I (468 patients who were operated between June 1999 and June 2003) and group II (344 patients who were operated between January 2018 and January 2020). **Results:** The global rate of complications in group II was 4.7%. Deep vein thrombosis was the most frequent event, and there were no episodes of dislocation. The use of 22 mm diameter heads was associated with a higher risk of dislocation compared to surgeries in which larger heads were used (OR= 6.7 – 95% CI 1.2 – 78.2). **Conclusions:** Total hip replacement through a direct transgluteal anterolateral approach had a low global rate of complications within the first postoperative year. Complications were reduced by almost half in surgeries performed between 2018 and 2020, compared to the previous series, mainly in regards to dislocation.

Keywords: Total hip arthroplasty; anterolateral approach; hip replacement; complications; direct anterolateral approach.
Level of Evidence: IV

Complicaciones tempranas de la artroplastia total de cadera por vía anterolateral transglútea directa: estudio comparativo

RESUMEN

Introducción: En los últimos años, la introducción de diversas técnicas, el instrumental quirúrgico y las competencias del cirujano han contribuido a disminuir las complicaciones tempranas que pueden sobrevenir luego de una artroplastia de cadera. Las complicaciones más frecuentes son: el aflojamiento femoral, la trombosis venosa profunda y la luxación. **Objetivos:** Evaluar la tasa de complicaciones intraoperatorias y durante los primeros 12 meses luego de una artroplastia de cadera por vía anterolateral directa; y comparar los resultados con la serie publicada en 2006. **Materiales y Métodos:** Estudio de cohorte retrospectivo que incluyó a pacientes operados por artrosis primaria de cadera en 2 instituciones, divididos en: grupo I (468 pacientes operados entre junio de 1999 y junio de 2003) y grupo II (344 pacientes operados entre enero de 2018 y enero de 2020). **Resultados:** La tasa global de complicaciones en la nueva serie fue del 4,7%. La trombosis venosa profunda fue la complicación que más se repitió, no hubo episodios de luxación. El empleo de cabezas de 22 mm de diámetro se asoció con un riesgo de luxación más alto que con cabezas más grandes (OR = 6,7; IC95% 1,2-78,2). **Conclusiones:** La artroplastia total de cadera con abordaje anterolateral transglúteo directo causó una baja tasa global de complicaciones dentro del primer año de la cirugía. Las complicaciones se redujeron casi a la mitad en las cirugías realizadas entre 2018 y 2020, con respecto a la serie anterior, fundamentalmente a expensas de la luxación.

Palabras clave: Artroplastia total de cadera; abordaje anterolateral; reemplazo de cadera; complicaciones; abordaje anterolateral directo.
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INTRODUCTION

In recent decades, the number of primary hip arthroplasties has increased[1] and, in many studies, successful outcomes have been obtained in terms of clinical, functional and survival evaluations.[2-4] However, there are numerous potential complications that the orthopedic surgeon must face during the initial stage after primary arthroplasty, some of them are: loosening, infection, fractures (including protrusion), neurovascular injuries and dislocation.[5-7]

In 2007, the author of this article took part in a study in which a series of 468 hip arthroplasties were analyzed. The overall complication rate was 8.5% during the first year after surgery, and the three most frequent complications were: femoral loosening, deep vein thrombosis, and dislocation.[8]

Since then, in the last 20 years, improved designs of femoral stems and cementless prostheses and cementing techniques, as well as the advent of tranexamic acid, the introduction of highly cross-linked polyethylene together with the use of larger diameter femoral heads, and the experience gained in the approach, have contributed to a decrease in complications.[9-12]

The aim of this study was to evaluate the rate of complications intraoperatively and during the first 12 months after direct anterolateral hip arthroplasty, and to compare the results with those of the series published in 2007.

The hypothesis was that the number of overall complications had decreased between the two periods.

MATERIALS AND METHODS

A retrospective cohort study was conducted involving patients operated on for primary hip osteoarthritis at two institutions. Patients were divided into: group I (468 operated between June 1999 and June 2003)[8] and group II (344 operated between January 2018 and January 2020). All surgeries were performed by the same surgeon and the rate of complications during surgery and the first 12 months after surgery was recorded in both groups.

The following data were extracted from the medical records of the institutions: age, sex, diagnosis, follow-up, femoral or acetabular loosening, deep vein thrombosis, dislocation, heterotopic calcifications, and neurovascular injuries.

The radiographic evaluation was performed on anteroposterior radiographs of both hips with 10° of internal and lateral rotation of the operated hip using Synapse® software (Fujifilm, USA). Patients were routinely monitored in the immediate postoperative period, and 30 days, 3 months, 6 months, and 1 year after surgery (Figure). The Trendelenburg test and the ability to perform abduction against gravity in lateral decubitus were used to measure gluteal insufficiency in the clinical control.

A fellow trained in hip arthroplasty surgery documented all data.

Patients undergoing primary hip arthroplasty for osteoarthritis or avascular necrosis were included. Patients undergoing hip arthroplasty for fracture or fracture sequelae, septic arthritis sequelae, osteotomy sequelae, or high congenital hip dislocation were excluded.

Surgical technique

All patients were operated on in dorsal decubitus, under hypotensive spinal anesthesia. Antibiotic prophylaxis included 1 g of cefazolin (2 g if the patient weighed >80 kg) administered 30 minutes before the skin incision. All were given an initial dose of tranexamic acid during anesthetic induction.

The surgery was performed through a direct transgluteal anterolateral approach and, unlike the operations from 1999 to 2003 in which 22 mm diameter heads were used with conventional polyethylene (high-molecular weight polyethylene, HMWPE), since 2018, 28, 32 and 36 mm diameter heads were used depending on the prosthetic acetabular size, with ultra-high-molecular weight polyethylene (UHMWPE).

Prophylaxis for venous thrombosis included low molecular weight heparin administered subcutaneously for 21 days after surgery. In May 2019, patients without risk of thrombosis began receiving 325 mg of aspirin daily.[13]

Figure. Anteroposterior control radiographs of the hip one year after surgery. **A.** Patient in group I, where cemented prostheses with a 22 mm head predominated. **B.** Patient in group II, where cementless prostheses with a 32 mm head prevailed.

Rehabilitation protocol

All patients followed the same rehabilitation protocol. They were allowed to sit on the edge of the bed with their knees flexed up to 90º and to stand upright during the first day. They began walking with the assistance of a walker on the second day, followed by two Canadian crutches for a period of 3 to 6 weeks, depending on tolerance.

Statistical Analysis

Qualitative variables are described as frequency or percentages, and numerical variables as mean and standard deviation. Categorical and continuous variables were compared between the two groups with chi-squared (or Fischer exact method, if necessary) and Student's t-tests. A univariate analysis was performed to determine the association between dislocation and femoral head diameter. Similarly, the relationship between the use of cemented stems and femoral loosening was evaluated. A p value <0.05 was considered significant.

All data were entered into an Excel® spreadsheet (Redmond, USA) and the GraphPad Prism® 8.0 program (LaJoya, CA, USA) was used for statistical calculations.

RESULTS

The first series covered the period from June 1999 to June 2003. In this case, 478 primary total hip arthroplasties with direct anterolateral Charnley prosthesis were analyzed in 409 patients, with a minimum follow-up of one year. Eleven patients were lost to follow-up, one of whom died six weeks after surgery. Therefore, the analysis was performed on 468 hips corresponding to 398 patients, of which 79 were bilateral and non-simultaneous.

Subsequently, between January 2018 and January 2020 (group II), the second series of 356 primary hip arthroplasties was evaluated; 12 patients were excluded because they did not have complete records. The series of this group finally consisted of 344 patients, 50.6% were men and the mean age was 70.8 ± 11.5 years.

The prostheses used in this series were: 271 (78.8%) Trident-Accolade II (Stryker Inc. Mahwah, NJ, USA), 52 (15.1%) Trident-Exeter (Stryker Inc, Mahwah, NJ, USA), 10 (2.9%) UII Motion- UTF Stem (United Orthopaedic Corporation, Taiwan) and 11 (3.2%) Trilogy-ML Taper (Zimmer, Warsaw, IN, USA).

All of the uncemented stems had metaphyseal fixation. The 52 cemented stems were highly-polished, double-tapered Exeter stems (Stryker Inc, Mahwah, NJ, USA). The rest of the population characteristics are described in Table 1.

Table 1. Characteristics of patients operated on between January 2018 and January 2020.

Variables	n = 344
Age, mean, SD	70.8 ± 11.5
Sex, n (%)	
Male	174 (50.6)
Female	170 (49.4)
Femoral head diameter, n (%)	
28 mm	46 (13.4)
32 mm	223 (64.8)
36 mm	75 (21.8)
Femoral stems, n (%)	
Cemented	52 (15.1)
Uncemented	292 (84.9)
Complications, n (%)	
Deep vein thrombosis	6 (1.7)
Trochanteric fracture	3 (0.9)
Periprosthetic infection	3 (0.9)
Protrusion	1 (0.3)
Gluteal insufficiency	1 (0.3)
Neurovascular injury	1 (0.3)
Acetabular loosening	1 (0.3)
Femoral loosening	0 (0)
Dislocation	0 (0)
Heterotopic calcification	0 (0)

The overall complication rate was 4.7%. The highest percentage was represented by six patients who developed deep vein thrombosis in the lower limb ipsilateral to the operated hip. Five of them evolved favorably and one suffered a pulmonary thromboembolism for which he was admitted to the Intensive Care Unit where he received specific treatment and anticoagulant therapy, and had no other complications.

Secondly, there were three patients with fractures of the greater trochanter produced during surgery, which were treated with high-strength suture. None had pain or gait disturbances at the end of the study.

Three periprosthetic infections were also detected: two women, 22 and 30 days after surgery, respectively, came to the office with pain and signs of phlogosis and persistent serohemorrhagic discharge through the wound. Both were treated with surgical lavage, debridement, and polyethylene replacement. In the samples taken during surgery, the following microorganisms were isolated: Methicillin-sensitive *Staphylococcus aureus* and *Staphylococcus epidermidis*. Both evolved satisfactorily with specific antibiotic therapy.

The remaining case was a man with chronic infection four months after arthroplasty. Initially, an arthrocentesis was performed and methicillin-resistant *S. epidermidis* was isolated, so a two-stage revision with an antibiotic-loaded cement spacer and adjusted antibiotic therapy was performed. Eleven weeks later, reconversion to distal fixation prosthesis was performed, with no recurrences at the end of the study.

In addition, in one case, a femoral protrusion was observed in the immediate postoperative radiographic control, so the stem was repositioned that same day. Furthermore, radiographic acetabular loosening was detected in one woman in the sixth month control, which did not progress in subsequent controls. The patient never reported symptoms; therefore, conservative treatment was chosen.

In addition, one man had gluteal insufficiency that healed 11 weeks after surgery.

Finally, one patient evolved with steppage gait during the postoperative period, was treated with electrostimulation and orthoses, and partial recovery was achieved.

There were no cases of dislocation, femoral loosening, or heterotopic calcification.

When comparing variables between group I and group II, there was a statistically significant decrease with respect to the rate of femoral loosening ($p = 0.01$) and dislocation ($p = 0.02$). The rest of the variables compared are detailed in Table 2.

In the univariate analysis, it was observed that, when heads with a diameter of 22 mm were used, the risk of dislocation was 6.7 times higher than with larger heads (odds ratio= 6.7; 95%CI 1.2-78.2). On the other hand, no significant association was found between femoral loosening and the use of cemented stems (odds ratio = 0.91; 95%CI 0.15-10.07).

Table 2. Comparison of the variables between group I and group II

Variables	Group I (n = 468)	Group II (n = 344)	p
Age	69.0	70.8 ± 11.5	0.89
Sex			
Male	183 (46.0)	174 (50.6)	0.21
Female	215 (54.0%)	170 (49.4%)	
Femoral head diameter			
22 mm	468 (100%)	0 (0%)	
28 mm	0 (0%)	46 (13.4%)	
32 mm	0 (0%)	223 (64.8%)	
36 mm	0 (0%)	75 (21.8%)	
Stems			
Cemented	468 (100%)	52 (15.1%)	<0.01
Uncemented	(0%)	292 (84.9%)	
Complicaciones, n (%)			
Acetabular loosening	1 (0.2%)	1 (0.3%)	0.99
Femoral loosening	10 (2.1%)	0 (0%)	0.01
Deep vein thrombosis	9 (1.9%)	6 (1.7%)	0.99
Periprosthetic infection	3 (0.6%)	3 (0.9%)	0.46
Dislocation	8 (1.7%)	0 (0%)	0.02
Heterotopic calcification	4 (0.8%)	0 (0%)	0.14
Trochanteric fracture	4 (0.8%)	3 (0.9%)	0.99
Protrusion	1 (0.2%)	1 (0.3%)	0.99
Gluteal insufficiency	0 (0%)	1 (0.3%)	0.42
Neurovascular injury	0 (0%)	1 (0.3%)	0.42

DISCUSSION

One of the most important findings of our study was the overall low rate of early complications during the first year after arthroplasty compared to that published in 2007 (4.7% vs. 8.5%).[8]

In a prospective randomized study by Martin et al.,[14] the complication rate was 5.1% at 12 months after anterolateral hip arthroplasty. The main complications described were: psoas tendinopathy and deep vein thrombosis.

We believe that the decreased complication rate in our study may be due, in part, to improved femoral stem designs, increased use of cementless components, and the use of larger diameter femoral heads (32 and 36 mm). The latter was directly related to a significant decrease in dislocation rates with respect to the series published by Lopreite et al. in 2007 (0% vs. 1.7%; p = 0.02).[8]

All patients were operated by the same surgeon and with the same surgical technique, but, in group I, 22 mm diameter femoral heads were used.

When comparing both groups, the risk of dislocation decreased 6.7-fold (odds ratio = 6.7; 95%CI 1.2-78.2) in favor of group II.

In 1970, the use of 22 mm diameter heads decreased and the use of 28 and 32 mm diameter heads steadily increased, due to multiple reports that this resulted in lower dislocation rates.[15,16] The placement of uncemented cups generated controversy, because some authors published higher wear rates of polyethylene with larger diameter heads.[17] It was also established that the minimum thickness of conventional polyethylene (HMWPE) in uncemented cups should not be less than 8 mm, since a thickness <8 mm was associated with early wear and breakage. This led to the more frequent use of 22 mm diameter heads for cups of 50 mm or less, and 28 mm heads for cups of a larger diameter.

With the advent of highly cross-linked inserts (UHMWPE), it was shown that wear does not vary significantly with 32 and 36 mm heads.[18,19] Since a minimum polyethylene thickness of 6 mm can be used, 32 mm heads can used for uncemented cup diameters of 48 mm and up. The use of larger diameter heads and the improved design of the femoral necks allow an increase in the femoral head/neck ratio with a greater range of motion and a lower risk of impingement, thus decreasing the risk of instability. In this study, all the inserts included in the analysis were made of highly cross-linked polyethylene.

Another major cause of failure after hip arthroplasty is the loosening of the femoral stems.[20] Bozic et al.[21] conducted an epidemiological study in the United States, and observed that loosening represented the second leading cause of revision. Decades ago, loosening rates with cemented stems were high;[22,23] however, with advances in cementing designs and techniques, more promising series were published with better results in terms of loosening and survival rates.[24]

In the group of patients operated on between January 2018 and January 2020, there were no cases of femoral loosening during the first year after surgery, which represented a statistically significant difference from the 2007 series (0% vs. 2.13%). We consider that this could be due to a correct cementation technique and to the lower proportion of cemented stems in group II (10.8%), due to the improved designs of the cementless femoral stems with respect to their fixation surfaces that allow better osseointegration.

In the first published series, the femoral stems were cemented. In that study, it was clarified that the technique of cementing a femoral stem, as well as the difficulties of neutral orientation while avoiding varus placement, could predispose to early loosening.[8] However, in a different study by the same author on the coronal orientation of uncemented stems, it was shown that varus orientation did not alter osseointegration and long-term survival.[25]

This study has some limitations, such as its retrospective design and the variability of the prosthetic components placed. Likewise, we believe that the period established as a cut-off point to study some of the complications listed is insufficient, particularly for loosening, periprosthetic infection, and late dislocation.

It should also be noted that these are two non-consecutive cohorts of patients, operated on at different time periods and that the variables analyzed, both dislocation and loosening, are influenced not only by the approach used, but also by other technical details, such as the number of the head used and the type of femoral stem fixation.

As strengths, all patients were operated by the same surgeon and with the same surgical technique.

CONCLUSIONS

Total hip arthroplasty by a direct transgluteal anterolateral approach resulted in a low overall complication rate within the first postoperative year. Complications were nearly halved in surgeries performed between 2018 and 2020 compared to those in the previous publication, at the expense of a lower rate of early femoral loosening and a significant decrease in the dislocation rate.

The use of cementless metaphyseal fixation stems decreased the rate of early loosening when compared to cemented stems in the direct transgluteal anterolateral approach. The risk of dislocation was 6.7 times lower with the larger diameter heads than with the 22 mm heads for this approach.

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