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Research Article

Total Hip Arthroplasty by Direct Anterior Approach (Hueter)

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Abstract

Introduction: Hip arthroplasty is a successful treatment in orthopedics. The direct anterior approach, through the Hueter interval, avoids dissection of muscle attachments to the bone and causes less disruption of the soft tissues around the hip.

Purpose: To show the results of primary total hip arthroplasties, performed by direct anterior approach.

Methods: Descriptive-prospective study, case series type, with patients operated on for hip osteoarthritis, who underwent primary uncemented total hip arthroplasty through a direct anterior approach between September 2019 and March 2021 and one-year follow-up.

Results: Predominance of the female sex in a ratio of 2 to 1, age groups between 45 and 60 years with no difference in the location of the operated hip. Low body mass index and low anesthetic risk. Surgical time greater than two hours, with little surgical bleeding, the placement of the acetabular and femoral component was adequate and allowed walking in less than three postoperative days with such hospitalization time. Incidence of low and infrequent complications, resolved with adequate treatment. The pain went from a mean of 9 in the preoperative period to a 2 in the postoperative period, the "Harris hip score" varied from a mean of 60 (bad) to one of 87 (good close to excellent).

Conclusions: The use of the direct anterior approach for primary total hip arthroplasties offers very satisfactory results valued as good.

Keywords: total hip arthroplasty; direct anterior approach

Introduction

In today's society, with the prolongation of life expectancy, and the aging of the population, the increase in the incidence of accidents that cause avascular necrosis of the femoral head, primary osteoarthritis of the hip joint or fracture of the upper end of the femur, constitute health problems worldwide.

Total hip arthroplasty (TCA), as the main treatment method to eliminate hip pain and restore hip function, is becoming increasingly accepted for patients with hip joint disease. Its successful application brings great benefits to many patients, as it alleviates the pain of the disease, improves the quality of life and recovers the ability to work, achieving excellent effects and thereby reducing the burden on the family and society [1].

Driven by the aging population in the United States, the demand for hip arthroplasties is expected to grow exponentially over the next two decades. Kurtz et al. noted a 50% increase in the prevalence of these arthroplasties from 1990 to 2002 and projected a 174% increase, from a total of 208,600 in 2005 to 572,000 in 2030 [2].

Hip arthroplasty is one of the most successful surgical treatments in orthopedic surgery. Although the surgical procedure has a high satisfaction rate, it does present some complications or adverse events, some of which are related to the surgeon's experience and the approach used to perform it. Among these adverse events are: prosthetic dislocation, residual weakness of the abductor muscles, decreased joint range of motion, and postoperative Trendelenburg claudication.

Depending on the implant fixation method, arthroplasty can be divided into two different types: cemented and non-cemented arthroplasty [3].

There are multiple approaches described to perform a hip arthroplasty, each one of them has its advantages and disadvantages, but most provide access to the joint without excessive risk and allow the components to be implanted in the proper position, an essential requirement for the correct function of the patient and adequate implant survival [4].

A basic principle that should be part of the mentality of every orthopedic surgeon with respect to any surgical approach should be that it be as anatomical as possible, which means that it is performed in the internervous and intermuscular spaces to minimize tissue damage. soft. In the hip, the only approaches that meet the requirements for accessing the joint through anatomical spaces are the anterior (Hueter) and the anterolateral (Watson-Jones) [4,5].

The direct anterior approach ("Direct anterior approach, DAA") was first described by Carl Hueter in 1881 and later popularized by Smith-Peterson when he published his first description in 1917. This approach is performed through the Hueter interval between the tensor fascia lata muscle and the superficial rectus femoris muscle and the sartorius muscle in depth, thus avoiding dissection of muscle attachments to the bone and causing less disruption of the soft tissues around the hip [4,5].

Currently, there has been increased interest in the orthopedic community in using the anterior approach to perform hip arthroplasty due to the belief that the anterior intermuscular approach can result in decreased pain, faster recovery, better stability of the hip and a lower risk of dislocation after surgery compared to the most commonly used, the posterior, where disinsertion of the rotator muscles, muscle laceration and opening of the posterior joint capsule are performed. In addition, since the patient is placed supine on the operating table, the anterior approach allows the use of fluoroscopic image intensification that favors intraoperative evaluation and proper positioning of components, allowing for a more precise final position. Preliminary series of patients who have undergone hip arthroplasty using the anterior approach have suggested decreased narcotic consumption, decreased hospital stay time, earlier independent mobilization, better positioning of components on radiographic images and a higher percentage of medical discharge in less time. However, others suggest that it is not the surgical approach, but factors such as patient selection, patient and family education, accelerated rehabilitation, and improved analgesia protocols that play a critical role in influencing the results of hip arthroplasties [5].

Due to the absence of muscle injury in the direct anterior approach, Bergin et al. report a decrease in the elevation of inflammatory markers, which indicates less muscle damage [6]. Bremer et al. also report a lower lesion observed in the resonance image compared with other approaches [7].

Surgery through the direct anterior (Hueter) approach minimizes muscle damage by using an interneural and intermuscular plane, which may reduce hip pain early in the postoperative period [8-10]. Zhao et al report less pain between on the first and third postoperative day with the use of the Hueter approach compared to the posterolateral approach ("Posterolateral standard approach, PLAe"), which requires more soft tissue dissection and thus more muscle damage [11].

The purpose of this work is to show the results obtained in primary total hip arthroplasties, where the approach used is the direct anterior or Hueter approach.

Materials and Methods

Methodological design

A descriptive-prospective study, case series type, was carried out with patients treated and operated on for the diagnosis of hip osteoarthritis, who underwent primary uncemented total hip arthroplasty through a direct anterior approach (Hueter) between September 2019 and March 2021 with a one-year follow-up.

The universe consisted of all patients diagnosed with hip osteoarthritis, treated at the Beijing Jishuitang Hospital in the aforementioned period of time.

The sample was made up of patients who met the established criteria:

Inclusion

- Patients who gave their written informed consent to the proposed treatment.

- Patients older than 18 years.

- Diagnosis of primary or secondary coxarthrosis.

Exclusion

- History of previous hip surgery.

- History of epilepsy, mental retardation, hemiplegia or movement disorder.

- Previous infections in the hip to intervene.

Exit

- Patients who decided to abandon the study.

The following variables were collected for the study: Age, sex, affected hip, body mass index, anesthetic risk index (ASA), acetabular anteversion angle, acetabular abduction angle, walking start time, hospital stay, and complications.

The evaluation of the result was carried out through the "Harris Hip Score" and the Visual Analog Pain Scale, determined before surgery and one year after surgery in each patient.

Results

In accordance with what was declared, the sample of this work consisted of 100 patients with a mean age of 51 ± 15 years, with a predominance of females in a ratio close to 2 to 1; 61 women for 39 men. The relationship in terms of the location of the affected hip was very equal with 48 left hips for 52 right hips.

The average found regarding the body mass index was 19.7 Kgs/mt2 ± 3.1, very favorable according to what was found in the bibliography to perform an anterior approach to the hip. Regarding the location in the anesthetic risk classification (ASA), we found 62 patients classified as ASA I risk, 36 at ASA II risk and only two patients with ASA III. All of the above is visible in Table 1 referring to demographic and clinical variables of the patients.

Table 1: Demographic and clinical data

Sample data	
Total patients	100
Age*	51 ± 15 años
Sex	

Male	39
Female	61
Localización	
Right	52
Left	48
Body mass index*	19,7 ± 3,1 Kgs/mt^2
Anesthetic risk	
ASA I	62
ASA II	36
ASA III	2

* Average values are shown.

The variables related to the surgical act, surgical time, intraoperative bleeding, size of the acetabular component, of the head of the femoral stem and the position angles of the acetabular cup (abduction and anteversion) in an abbreviated manner are located in Table 2. Surgical time with 86.9 ± 30.3 was very long in our opinion and may be related to the experience in performing this direct anterior approach, where reaming for the placement of the femoral component is the greatest difficulty when performing a total arthroplasty.

Hip; however, the intraoperative bleeding volume (145.3 ± 71.1) is closely related to an anatomical approach through intermuscular planes, where tissue damage is minimal.

In Table 2 itself, it is significant that the implantation angles of the acetabular cup are within Lewinnek's safe zone: abduction of 40.1° (range between 37.2°-43.3°) and anteversion of 17, 3°(range 14.9°-21.9°).

Table 2: Surgical and imaging variables

Surgical and imaging parameters	
Surgical time (in minutes)*	86,9 ± 30,3
Operative bleeding (ml)*	145,3 ± 71,1
Acetabular component size (mm)*	52,4 ± 3,2
Femoral head component size (mm)*	34,7 ± 2,2
Acetabular cup*	
Abduction angle (degrees)	40,1 (37,2-43,3)
Anteversion angle (degrees)	17,3 (14,9-21,9)

* Average values are shown.

In relation to the complications that occurred in our sample of 100 patients who underwent total hip arthroplasty by direct anterior approach, two cases were detected that showed symptoms of numbness along the anterolateral aspect of the thigh, with a diagnosis of neuropraxia of the thigh lateral femoral cutaneous nerve, both were controlled by conservative treatments, based on B complex vitamins. One patient had a complete resolution of symptoms at six months, another noted a resolution at one year, three infections classified as superficial, the that resolved with antibiotic treatment, one case also suffered hip bursitis and was controlled by conservative treatment. The time to start ambulation was very short, as established for this anatomical surgical approach. The mean hospitalization time of our patients was barely three days, which is visible in Table 3.

Table 3: Postoperative clinical variables

Clinical variables	
Walking time (days)*	2,7 ± 1,9
Hospitalization time (days)*	3,2 ± 0,5
Complications	
Nerve injury	2
Hip bursitis	1
Superficial infection	3

* Average values are shown.

To determine the results obtained in the patients that make up our sample, who underwent primary total hip arthroplasty by direct anterior or Hueter approach, two gauges were used that constitute the "gold standard" in the assessment of most of the results found. in the bibliography related to hip arthroplasty: The analog scale of pain and the “Harris hip score”.

The importance of determining the variation achieved between what was marked by each patient in the preoperative and postoperative period was considered. In this way, Table 4 shows this change expressed by our patients, who significantly varied from a mean of pain in the pre of 9 to a mean of 2 in the post. It is also important what is reflected in the responses in relation to function, with a change from 60 on average in the pre to 85 on average in the postoperative period. This is displayed in Table 4, which reflects the results obtained.

Table 4: Results according to the applied functional tests (“Harris hip score” and VAS)

Functional results	
Visual analog pain scale*	
Preoperative	9 ± 1
Postoperative	2 ± 1
Harris hip score*	

Preoperative	60 ± 12
Postoperative	87 ± 9

* Average values are shown.

Discussion

A good exposure of the hip favors the implantation of the prosthesis; however, as exposure of the bony structures of the joint increases, damage to the soft tissues around the hip is also aggravated, resulting in excessive intraoperative bleeding, muscle weakness around the joint, increased postoperative complications and decreased prosthetic stability.

The direct anterior approach exposes the hip through the space between the tensor fascia latae and the sartorius muscle, without sacrificing the musculatures around the hip, with little damage to the soft tissues; the structural integrity of the hip abductor muscles is preserved, which improves the stability of the prosthesis and allows the patient to be mobilized early, therefore, it is beneficial for early recovery [12,13]. In addition, the recumbent position supine intraoperative favors the precision of the prosthesis placement, and the incidence of postoperative dislocation of the prosthesis is low, which constitutes a safe, effective and reliable surgical approach [14,15].

Regarding postoperative bleeding, Fransen et al. [16], in their study reported an increase in perioperative bleeding in their group with the direct anterior approach when compared to the standard posterolateral approach group. Chay collaborators[17] carry out a meta-analysis, which also concludes that blood loss using the direct anterior approach was the highest. However, Yang et al. [18], conducted a study to compare the results afterwards in patients who underwent simultaneous bilateral total hip arthroplasties on the same day with identical prostheses by the same surgeon, with an anterior approach on one side and a posterolateral approach on the other hand, and does not observe a significant difference in the amount of perioperative bleeding. The author of this investigation considers that an important cause of this result could be the steep learning curve required for the direct anterior approach, which could lead to increased blood loss. Preoperative and intraoperative hemostatic methods are also very important. Administration of 1.0 g tranexamic acid intravenously prior to total hip arthroplasty can reduce blood loss by 20% [19]. Periarticular injection of tranexamic acid can further reduce bleeding and reduce transfusion rates of blood without increasing the risk of thrombosis [20,21].

Chen et al perform a meta-analysis which includes ten studies (5670 participants) reporting a comparison of the operative time between the posterolateral approach and the direct anterior approach, and the result obtained shows that the operative time of the posterolateral approach is less than that of the anterior approach. direct.[22] We consider this phenomenon to be because femoral preparation is a very significant challenge using the anterior approach. This approach requires sufficient release of deep structures such as the posterior capsule and pisiform fossa, especially during femoral elevation.[23] With insufficient release of deep structures, the anterior approach runs the risk of complicating a greater trochanteric fracture, albeit with the help of specifically designed tables and retractors [24].

The study by Xu et al. also reported a longer surgical time and a similar amount of bleeding in the group with an anterior approach when compared with the minimally invasive posterolateral approach group; our study coincides with this result [25].

Regarding the position of the prosthesis, several studies show that when comparing the position of the prosthesis between groups operated on using the direct anterior approach and the standard posterolateral approach, no differences are observed in the degree of anteversion of the acetabular and femoral components [11, 25-27].

According to the rate of complications between the direct anterior and standard posterolateral approaches, Aggarwal et al., Woolson et al., and Sun et al. report in their studies a higher complication rate with the use of the direct anterior approach [24,28,29]. Without However, Woolson et al. [29], find a decrease in the complication rate after performing more than 30-50 interventions using this previous approach. This phenomenon is also noted by Moskal et al. [30], and Alexandrov et al. [31], where the complication rates correlate with the surgeon's experience and decrease significantly after the first 40 to 100 cases. Moerenhout et al. [32], report in their study a similar complication rate between both groups. Among all surgical complications, femorocutaneous nerve damage is the most common nerve injury after using the direct anterior approach, with an incidence of neuropraxia ranging from 3.4% to 81.0% [32-36]

Perhaps familiarity with the branching pattern of the femorocutaneous nerve may help reduce such nerve damage. Bartlett et al describe the main branching patterns (classic, late, primary femoral, and trifurcated) and find that the late branch variants present the highest risk of injury due to the perpendicular orientation of the nerve to the incision line. This nerve lesion is treated conservatively and symptomatically, and most are alleviated or recovered without leaving sequelae [26, 37, 38]

There are several studies on the comparison between the anterior approach and the posterolateral approach. Yang et al perform bilateral arthroplasties on the same day with two different approaches, find that the VAS score is significantly lower when the direct anterior approach is used compared to when the posterolateral approach is used on the first, third, and seventh postoperative days. ($p < 0.05$). There is no clinical difference between the anterior approach and the posterolateral approach in terms of VAS or HSS at 6 weeks and 3, 6, and 12 months postoperatively [18].

Barrett et al conclude that patients operated on with the direct anterior approach have less pain at baseline and better function six weeks postoperatively, but all measurable differences between the two groups disappear by six months. In a meta-analysis carried out by Xuedong et al., they also obtain similar results, they show that compared to the posterolateral approach group, the anterior approach group achieves a better "Harry hip score" within six months after the operation, but they do not show significant differences between the two groups after six months. Chen et al. publish in their study that the pain is lighter and relieves faster in the group with direct anterior approach in 24 or 48 h after the operation [22-24].

Bergin et al. [4], analyze the biochemical markers of muscle damage and inflammation in patients undergoing total hip arthroplasty using the direct posterolateral and anterior approach to provide objective evidence of local soft tissue injury at the time of arthroplasty. They report that the levels of inflammation markers are slightly reduced in the direct anterior approach group compared to those in the standard posterior approach group. Therefore, as this result is assessed at 12 months, the results of the "Harry hip score" and VAS do not show significant differences ($p > 0.05$). This evidence may also explain the result that walking time and hospitalization time were significantly shorter in the group with the anterior approach.

In the comprehensive assessment of the "Harry hip score", especially in the sock wear and sitting scores, we consider that because the direct anterior approach penetrates through an anterior intermuscular space and causes less damage to the soft tissues of the hip, especially to the soft tissue of the back, patients may score better on sitting and wearing

socks after surgery. In the study carried out by Xu et al, no statistically significant differences were found at six months, in addition, when assessing the sitting function and the use of footwear, a better result was also observed in the group with the direct anterior approach, they conclude that the advantages of total hip arthroplasty through the direct anterior approach lie in less positional limitation in the early postoperative period, as well as faster recovery of hip function [39].

Conclusion

- Our series showed a predominance of female patients in a ratio close to 2 to 1 in relation to males, with age groups between 45 and 60 years with no significant difference in location of the operated hip. The patients had a low body mass index and low anesthetic risk.

The use of the direct anterior approach required a surgical time greater than two hours, although with little operative bleeding, which allowed adequate placement of both the acetabular and femoral components and allowed ambulation in less than three postoperative days with such length of hospitalization. The incidence of complications was very low and not very serious, which were resolved with adequate treatment.

- The scales used to determine the results achieved showed an important change towards the clinical improvement of the patients; the pain went from a high 9 on average in the preoperative period to a 2 on average afterward, the "Harris hip score" also varied from an average of 60 (bad) to one of 87 (good close to excellent). The use of the direct anterior approach to perform primary total hip arthroplasties offers very satisfactory results that can be considered good.

Conflict of interest:

The authors declare that they have no conflicts.

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DrC. Horacio Tabares Neyra- He planned the research and wrote the paper.

Dr. Tiemur Wu- He carried out the research and data collection.

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