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Research Article

Functional Evaluation of Postoperative Total Hip Arthroplasty Using Modified Harris Hip Score: A Comparison Between Anterior, Lateral and Posterior Approaches

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Abstract

Background: Degenerative hip joint disease is one of the most common and disabling musculoskeletal disorders. Hip arthroplasty is used to replace the hip joint in advanced stages of disease, using the commonly surgical approaches: posterior, lateral and anterior. The Harris Hip score evaluate functional capacity and symptoms, including postoperative outcomes, and assess the patients' quality of life. This study aims to compare the clinical evolution and outcomes with these surgical approaches.

Material and Methods: We performed a cross-sectional study with 101 patients undergoing hip arthroplasty using anterior, posterior, and lateral approaches. Functional evolution was assessed at one year using the modified Harris Hip score from January 2017 to December 2023 using one-way ANOVA test to correlate quantitative versus qualitative variables. A p-value < 0.05 was considered significant.

Results: The study revealed a higher prevalence of hip arthropathy in females over 45 years old. Patients experienced a significant decrease in hemoglobin levels, reaching Grade I anemia, regardless of the surgical approach. While ambulation and hospital stay were generally short, the anterior approach showed a trend towards shorter times. Overall functional evolution favored the "good" category, with the anterior approach trending towards "good to excellent" compared to other approaches. The predominant general complication was joint instability.

Conclusions: Despite the need to consider additional factors affecting functional evolution to enhance study power, the direct anterior approach is recommended as a safer technique with superior functional outcomes. Patients undergoing this approach demonstrated quicker ambulation and discharge, alongside better functional progress, all with statistical significance.

Keywords: total hip arthroplasty; harris hip score; hip; osteoarthritis; anterior approach; lateral approach; posterior approach

Abbreviations:

THA: Total hip arthroplasty

HHS: Harris Hip Score

Introduction

The degenerative pathology of the hip joint is one of the most common and disabling of all musculoskeletal disorders. Currently, 28% of the population aged 45 years or older suffer from hip arthritis, a prevalence that is expected to increase in the coming decades. [1] In advanced stages of degenerative progression (III-IV of the Kellgren and Lawrence classification), surgical treatment is required. This typically results in excellent outcomes, with patient satisfaction rates ranging from 89% to 95%. [2] Total hip arthroplasty (THA) is a surgical technique to replace the hip joint. For traditional hip replacement, three surgical approaches have been described: anterior, anterolateral, and posterior, each with various modifications within these

groups. [3]In 1982, Kevin Hardinge popularized the direct lateral approach, previously described in 1954 by McFarland and Osborne for hip replacement procedures. [4-5] This approach has become a less invasive technique, causing minimal soft tissue damage, and providing good visibility, Allows the access between the fibers of the gluteus medius, while preserving the continuity between the anterior gluteus medius and the vastus lateralis of the quadriceps, without damaging the abductor mechanism. However, it carries the risk of damaging the superior gluteal nerve, causing Trendelenburg gait [6].The anatomical landmarks are the anterior superior iliac spine, greater trochanter, and femoral shaft as anatomical landmarks. A straight incision is distal to the greater trochanter along the anterior border of the femoral shaft, proximally. The vastus lateralis is incised, and a muscle flap is elevated. The incision curves over the trochanter and continues with blunt dissection. The gluteus minimus is incised to expose the capsule, which is then cut longitudinally [4]. modified the technique regarding the dissection of the gluteus medius, which is detached following its fibers and then reflected anteriorly to form a flap. It is separated from the gluteus minimus, which is subsequently detached and reflected anteriorly as well. This modification allows for better reconstruction of the abductor mechanism, thereby reducing postoperative limping. [7] The modifications to the classic approach aim to improve surgical time, reduce blood loss, and decrease the prevalence of complications. [4]

Smith-Petersen popularized the anterior approach, performed between the sartorius muscle and the tensor fasciae latae muscle, with the patient supine and hip hyperextended [8]. A primary risk of this approach is injury to the lateral femoral cutaneous nerve [9]. Preserving the femoral head often requires extending the approach by partially cutting the tensor fasciae latae or gluteal muscles, which increases the risk of injuring the lateral femoral cutaneous nerve. [10-11] It has been shown that the direct anterior approach is more "muscle-friendly" due to the use of an intermuscular interval. The direct anterior approach resulted in less damage to the gluteus minimus, with an average of 8% of muscle surface affected, compared to 18% with the posterior approach. [12] The posterolateral approach is the most widely used globally (55%) and the most common in the United States (73%). This approach is performed through the gluteus maximus muscle and posterior to the gluteus medius, preserving the abductor mechanism. The advantage of this approach is the excellent exposure of the femoral head without damaging the extensor mechanism, which facilitates a quicker recovery. [3] When comparing the posterolateral approach to the anterolateral approach, the second one has been observed to have a lower rate of prosthetic dislocation due to the preservation of the posterior capsule. Posterolateral approach is associated with greater weakness of the abductor muscles, leading to an increased incidence of postoperative limping during the first 6 months. [5] It has been demonstrated that repairing the short rotator muscles and the joint capsule is essential in all cases. [13]

The impact of different approaches on femoral head vascularization has been studied. Blood flow to the femoral head is superior with the direct lateral approach, which spares the medial femoral circumflex artery, compared to the posterior approach, which does not preserve this artery. [14] The prevalence of dislocation following primary total hip arthroplasty varies from less than 1% to over 15% (1). Meta-analyses report similar dislocation rates among the anterolateral, direct lateral, and posterior approaches when capsule and rotator repairs are performed, with dislocation rates being 0.70%, 0.43%, and 1.01%, respectively [15]. Aggarwal et al., 2019 reported postoperative statistics for 3,574 patients who underwent total hip replacement, with the following results: average surgical time for the lateral approach was 68-92 minutes, blood loss ranged from 270-345 cm^3, hospital stay averaged 2.3-3.4 days, and the complication rate was between 6.11% and 6.7%. Complications included superficial infections at 1.9%, deep infections at 1.9%, wound discharge at 2.3%, periprosthetic fractures at 2.7%, dislocation at 0%, aseptic loosening at 0.4%, and surgical reintervention for any reason at 8.3% [16].The direct anterior approach allows for more accurate measurement of pelvic limb length because the patient is positioned supine. Postoperative limping, often criticized in the anterolateral approach, shows no significant difference in clinical outcomes, ranging from 0-16% compared to 4-20% for the posterior approach [17]. Surgical approaches have important concerning complications. Postoperative satisfaction with hip joint replacement is high, ranging from 89% to 95% [21]. Hoskins et al. described early complications of hip joint replacement based on the approach used. They studied 1,413 hip replacements performed via the lateral approach and analyzed variables such as dislocation, instability, infection, and fractures. The study found no statistically significant difference when comparing the lateral approach to other approaches [22-23]. The Harris Hip Score (HHS) is one of the most widely used tools globally for assessing the functional capacity and symptoms of patients with hip conditions [18[. It evaluates the impact of hip joint symptoms on the patient's quality of life [1] through pain assessment and functional evaluation. The score ranges from 0 to 100 points [20], which can be categorized as follows: poor (< 70), acceptable (70-79), good (80-89), and excellent (90-100) [18,20]. There are few studies comparing long-term functional outcomes after hip joint replacement. Evaluating functional status according to the surgical procedure allows for the use of functional scales to identify the most appropriate and safe approach, promoting patients' social integration by assessing factors such as pain perception, ability to walk, sit, or use stairs, among others.

The main objective of this research was to evaluate the one-year functional outcomes using the Harris Hip Score in patients who underwent total hip replacement for coxarthrosis, comparing the different hip approaches (anterior, lateral, posterior).

Material and Methods

We realize a cross-sectional study. The study Included a population of 191 patients, through inferential calculations for finite populations, an auditable universe will be determined where N = 191 patients, e = 5% margin of error, desired confidence level of 90%, statistical power greater than 70%, resulting in a study sample of 101 patients. who underwent total hip replacement surgery for coxarthrosis. The surgeries were performed from January 2016 to December 2022. A sample of 101 patients using the following approaches: 27 anterior, 28 lateral, and 46 posterior. These patients were followed up for one year to assess their functional status using the Harris Hip Score from January 2016 to December 2023.

Inclusion and exclusion criteria

Inclusion criteria: The study includes male or female patients between 30-90 years old, candidates for total hip replacement surgery, who underwent total hip replacement surgery using conventional surgical approaches: anterior, lateral, and posterior. They could be contacted either in person or by phone for the Harris Hip Score survey one year after the surgical procedure, during the period from January 2017 to December 2023. The inclusion criteria were based in surgery indications to perform a THA [24]. The HHS score could be evaluated since immediate post-surgical and at periodic intervals, considering one-year postsurgical following an adequate parameter to evaluate this score [18-20].

Exclusion criteria: Patients under 30 years or over 90 years, who underwent a different surgical procedure than the anterior, lateral, and posterior approaches for total hip replacement. Patients who could not be contacted in person or by phone one year after the total hip replacement surgery. Patients with a history of previous hip joint surgery (recurrence). Patients at the extremes of these age ranges were excluded to avoid bias in overestimating or underestimating the Harris Hip Score (HHS), as it involves a functional assessment [18-20]. Similarly, other causes associated with total hip arthroplasty (THA) were excluded due to pre-existing symptoms that could influence the subjective scoring of the evaluation [1,2].

Data Analysis:

Inferential analysis was conducted using an IBM SPSS database for Windows version 10. Normality tests were performed using the Kolmogorov-Smirnov test and graphical methods for central tendency measures. Descriptive statistics were based on mean ± SD and median. Subsequently, an intergroup analysis was performed comparing the functional status according to the Harris Hip Score based on the type of surgical approach used: anterior, lateral, and posterior. Quantitative variables were assessed for skewness and kurtosis and summarized with mean and standard deviation or median and quartiles 1 and 3, depending on their distribution. Comparison of means or medians of the Harris Hip Score among the three surgical approaches was conducted using ANOVA test. A p-value < 0.05 was considered significant.

A one-way ANOVA test was used to correlate quantitative versus qualitative variables across more than two groups, along with post hoc tests to determine the significance value and the positive or negative impact or strength of the association. The Games-Howell test was applied due to rejection of equal variances favoring the posterior approach. Descriptive statistics with frequencies and percentages were used for qualitative variables. The chi-square test was used for comparing qualitative variables.

Results

We identified 101 candidates for hip joint replacement based on the Kellgren-Lawrence classification, with 81.2% (82) classified as grade IV and 17.8% (19) as grade III. The a was 67 years, with a predominance of females (72 patients) 71.3% compared to males (29) 28.7%. (Table 1).

Parameters	N = 101	
	Mean ± SD	Median
Age (Years)	65.6 ± 10.8	67
Sex (n %)		
• Males	29 (28.7%)	
• Females	72 (71.3%)	
Comorbidities (n %)		
• HTN	18 (17.8%)	
• DM2	16 (15.8%)	
Kellgren & Lawrence Classification (n %)		
• III	18 (17.8%)	
• IV	82 (81.2%)	

Table 1: Demographic characteristics of patients; SD: Standard deviation; HTN: Hypertension; DM2: Diabetes Mellitus 2

In 54 patients [53.5%], the procedure was performed on the right side, and in 47 patients [46.5%], on the left side. Regarding the surgical approach, 45.5% [46] used the posterior approach, followed by 27.7% [28] with the lateral approach, and 26.7% [27] with the anterior technique. The most commonly used prostheses were Trilock, accounting for 34.7%, Taperloc at 27.7%, and Medacta at 26.7%. Lepine and dual mobility prostheses were less common, each representing 4%. (Table 2).

Variable	N (%)
Laterality	
• Right	54 (53.5%)
• Left	47 (46.5%)
Surgical approach	
• Anterior	27 (26.7%)
• Lateral	28 (27.7%)
• Posterior	46 (45.5%)
Prosthesis	
• Trilock	35 (34.7%)
• Taperloc	28 (27.7%)
• Medacta	27 (26.7%)
• Lepine	4 (4%)
• Dual mobility	4 (4%)
• Coray	1 (1%)
• Sinergy	1 (1%)
• Smith	1 (1%)

Table 2: Surgical characteristics of patients.

Analyzing the hemoglobin levels of our patients versus the levels obtained after surgery, we observe a difference in the general population from a mean ± SD of 14.6 ± 1.6 g/dL to 10.9 ± 1.6 g/dL, changing from normal hemoglobin to Grade I anemia, with a significance of P=.000. This change is more pronounced in the anterior approach, which goes from 14.4 ± 1.4 g/dL preoperatively to 10.1 ± 1.6 g/dL postoperatively, followed by the lateral and posterior approaches as shown in the table. Using One-way ANOVA test, we determine a non-significant relationship with the type of approach, indicating that the type of approach does not have a direct relationship with the decrease in hemoglobin (P=.065). Regarding the days until our patients began walking, we observed short-term ambulation: 1 day for both anterior and lateral approaches, and 2 days for the posterior approach, with a significant difference of P=.029. However, with an effect size of less than 1%, this indicates a negligible relationship, and an observed power of 66%, suggesting the influence of other variables rather than a direct relationship between the surgical approach and ambulation days. For hospital stay, the average for the general population is 3 days, which is the same for both posterior and lateral approaches. Only the anterior approach group showed an average hospital stay of 1 day, with a significant difference of P=.001 and an effect size greater than 1%, indicating a direct relationship with a high observed power of 95%. (Table 3).

Variable	Total population N=101	Posterior Approach N=46	Lateral Approach N=28	Anterior Approach N=27	p-value
Presurgical Hb (g/dL) Mean ± SD	**14.6 ± 1.6**	**14.9 ± 1.7**	**14.3 ± 1.7**	**14.4 ± 1.4**	.065
Median	14.6	15.1	14.5	14.3	
Presurgical Hb (g/dL) Mean ± SD	**10.9 ± 1.6**	**11.2 ± 1.7**	**11.08 ± 1.5**	10.1 ± 1.6	
Median	10.8	11.1	10.8	**9.6**	
Assisted gait (days) Mean ± SD	1.5 ± 1.2	1.8 ± 1.6	1.04 ± 0.1	1 ± 0.1	**.029**
Median	**1**	**2**	**1**	**1**	
Days of hospital stay Mean ± SD	2.9 ± 1.8	3.1 ± 2.08	3.6 ± 1.6	1.8 ± 1.1	**.001**
Median	**3**	3	**3**	**1**	

Table 3. Comparison of clinical outcomes following hip arthroplasty based on the surgical approach used. Hb: Hemoglobin; SD: Standard deviation. *P value calculated with One Way ANOVA test*

The main complication observed in our patients was joint instability with subsequent implant dislocation (4 cases, 4%), which occurred proportionally among patients who underwent the lateral and posterior approaches. The remaining complications were distributed as follows: sciatic nerve neuropraxia in one case with the posterior approach, and intraoperative fractures with 2 cases—one during the lateral approach and one during the anterior approach—all without showing statistical significance. Functional evolution, evaluated with the Harris Hip score, was generally 79.03 ± 12.2 points, with a median of 85, indicating a population trend towards good functionality. The highest scores were seen in patients who underwent the anterior approach: 85.4 ± 9.3 points, with an average of 89. This was followed by patients who underwent the posterior approach: 76.6 ± 14.1 points, with a median of 84, and finally the lateral approach with 76.8 ± 9.2 points, averaging 76, resulting in a P-value of .006 with an effect size of less than 1% and an observed power of 83%. The Harris Hip score classification indicates a trend towards improvement with the anterior approach, as observed in the table, with a higher number of patients in the excellent functional category despite being the smallest sample population (P=<.001). (Table 4)

Complications					
• Neuropraxia	1 (1%)	1 (2.2%)			
• Instability	4 (4%)	2 (4.3%)	2 (7.1%)		.156
• Transurgical fracture	2 (2%)		1 (3.5%)	1 (3.7%)	
Harris hip score Mean ± SD	**79.03 ± 12.2**	**76.6 ± 14.1**	76.8 ± 9.2	**85.4 ± 9.3**	**.006**
Median	85	84	**76**	89	
Harris hip classification					
• Poor	21 (20.8%)	13 (28.3%)	5 (17.9%)	3 (11.1%)	
• Fair	22 (21.8%)	7 (15.2%)	13 (46.4%)	2 (7.4%)	**<.001**
• Good	39 (38.6%)	20 (42.5%)	9 (32.1%)	10 (37%)	
• Excellent	19 (18.8%)	6 (13%)	1 (3.6%)	12 (44.4%)	

Table 4. Comparison of complications and functional status at one year in post-hip arthroplasty according to surgical approach; SD: Standard deviation. *P value calculated with One Way ANOVA test*

Discussion

In developed countries, osteoarthritis is one of the leading causes of disability, and recent estimates indicate that the total number of people with osteoarthritis will double in the next 10 years [25]. Total hip arthroplasty and total knee arthroplasty are two popular and effective surgical procedures for treating arthritis, with the total number of procedures expected to increase by more than 600% for hip prostheses and nearly 200% for knee prostheses in the United States over the next 20 years [26]. Patient satisfaction measurements are important because they reflect a set of various goals. One of these goals is that when the patient is satisfied, they have an appropriate perspective on their health status and the medical process that led to it [27]. Surveys and questionnaires for patients are a way for physicians to measure a functional outcome related to the patient. Therefore, any measure related to patient satisfaction must be tested and validated through psychometric analysis [28]. In this case, we used a validated and modified tool from the Harris scale for the Spanish-speaking community. The importance of this study lies in the fact that there is little evidence using the Harris scale for the Spanish-speaking community in comparing different surgical approaches for total hip arthroplasty, in this case, anterior, lateral, and posterior approaches.

Regarding the demographic results of our population, they coincide with what was reported by Katz et al., where we observed that the population most affected by coxarthrosis is women over 45 years of age [29]. Another important aspect is the observed decrease in hemoglobin, which, as noted in various studies, decreases by an average of 3.0 g/dL after the arthroplasty procedure with a prevalence of anemia increase of 51%, regardless of the approach used [30]. This aligns with our results.Ambulation began within the first 2 days, with earlier initiation observed in the lateral and anterior approaches. Similarly, the hospital stay was significantly shorter in patients who underwent the anterior approach, with an average stay of 1 day. This may be explained by the various advantages attributed to the direct anterior approach, such as a shorter incision length, less soft tissue dissection, and less damage to the abductor musculature [31], although these variables are not analyzed in the present study. Moreover, as emphasized in other studies [32], the decision for home discharge is often influenced by local hospital protocols, the surgeon's decision, early recovery pathways, the patient's social and cultural expectations, the influence of insurance companies, home logistics, and bed demand at different hospital sites. For these reasons, it is a parameter that involves many variables that are difficult to analyze.

The main complication found in our patients was instability leading to dislocation, without preference in distribution related to the type of approach, indicating that it may be attributed to causes independent of the surgical method. However, this differs from other studies where dislocation has been reported as the main disadvantage of the posterior approach in a meta-analysis of more than 13,000 total hip arthroplasties with a dislocation rate of 3.23% compared to the anterolateral approach with 2.18% and the direct lateral approach with 0.55% [17].Finally, when we talk about the Harris Hip score, consistent with what was reported by Seng et al., patients who underwent total hip arthroplasty using the direct anterior approach had an average score of 81 compared to an average of 75 with the direct lateral approach. This comparison was made two months postoperatively, and at four months, the difference became narrower without statistical significance [33]. A strength of our study is that the evaluation of the Harris Hip score was done one year postoperatively, with favorable results for the direct anterior approach, showing a good to excellent evolution (>80 points) with statistical significance. This difference would probably be reduced when compared to other approaches if a longer-term comparison were made, as many authors have concluded that the Harris Hip score initially improves but that the benefits obtained are reduced or equalized in the long term when different approaches are compared [34]. Studies with different short, medium, and long-term evaluation points are needed to determine if this difference is consistent over time.

State limitations

Some of the limitations of this study are the following, the study is conducted at a single institution, which may limit the generalizability of the results to other settings or populations. The relatively short follow-up period (one year postoperative) also restricts the ability to assess long-term outcomes and potential complications that may arise beyond the study timeframe. Finally, the subjective nature of the Harris Hip Score, despite its widespread use and validation, may introduce bias in the evaluation of functional outcomes.

Conclusions

We concluded that while there are other factors influencing the functional outcomes of our patients (such as the postoperative physical rehabilitation protocol, preoperative muscle condition and strength, or long-term follow-up beyond one year), to increase the power of our study to over 70% for the variables discussed, we can advocate for the direct anterior approach as a safer procedure. Patients who underwent this approach walked sooner, had a shorter hospital stay, and demonstrated better functional outcomes one-year post-surgery.

Conflict of Interest

The research team is not in a conflict-of-interest situation regarding the conduct of this research project since there is no direct commercial or economic relationship with any sponsor, no direct professional relationship with any sponsor, and furthermore, there is no cause or reason that could affect the objectivity or independence in the performance of the functions of the researchers involved in this project.

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