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Total arthroplasty and hemiarthroplasty in the treatment of hip fractures: a systematic review with meta-analysis

Bianca Gabriella de Oliveira

Médica pela Universidade Salvador-UNIFACS, Salvador, BA, Brasil

Rennan Martins da Cruz

Médico residente em Ortopedia e Traumatologia do Centro Médico de Campinas, Campinas, SP

Jorge Rangel Zilli

Médico residente em Ortopedia e Traumatologia do Hospital Regional da Ceilândia, Brasília, DF

Pedro Henrique Ribeiro de Oliveira

Médico residente em Ortopedia e Traumatologia do Hospital Regional da Ceilândia, Brasília, DF

Igor Santana Franco Amaral

Médico residente em Ortopedia e Traumatologia do Centro Médico de Campinas, Campinas, SP

Marcella Rodrigues Costa Simões

Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brasil

Corresponding author: Bianca Gabriella de Oliveira. Rua araçari, número 18, bairro muchila 2 (dois), Feira de Santana - Bahia, CEP 44005756

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Abstract: Objective: To analyze the effectiveness of hemiarthroplasty compared to total arthroplasty in the treatment of hip fractures. Methodology: Systematic literature review, with a quantitative and qualitative approach to the data collected, which was structured according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA): "total hip arthroplasty" and 'hemiarthroplasty' with 'AND' and 'OR' combinations. Results: The five articles selected evaluated the

effectiveness of hemiarthroplasty and total hip arthroplasty techniques using the WOMAC score, Harris Hip Score (HHS), SF-36 (Short Form Health Survey 36) and/or Visual analogue scale (VAS). Total arthroplasty showed better results in most studies ($p<0.01$). Conclusion: Total

arthroplasty was considered the procedure of choice, especially for active elderly patients.

Keywords: Arthroplasty Replacement Hip; Hemiarthroplasty; Hip Fractures.

Introduction: The impact of a hip fracture is life-threatening, with extensive health complications due to reduced quality of life as a result of potential thrombotic events and loss of function. Fractures of the proximal femur, which are more prevalent in the elderly, include the therapeutic options of hemiarthroplasty or total hip arthroplasty. Both involve the replacement of the femoral head with a prosthesis or the combined replacement of the femoral head and acetabulum with prostheses1.

The literature shows the benefits of total implantation in terms of patient function and quality of life compared to hemiarthroplasty. However, it is known that there is an increased risk of dislocation, greater caution immediately post-surgery, leading to the possibility of re-approach to reduce or revise the prosthesis. However, meta-analyses of recent studies involving patients with deviated hip fractures suggest that total hip arthroplasty results in fewer reoperations and substantially better function than hemiarthroplasty, taking into account physiotherapeutic management and mobility appropriate to the procedure performed2,3.

Previous studies have shown that in general there were fewer complications with total hip arthropathy than with hemiarthroplasty. Because of this, some health guidelines recommend this surgery for patients with displaced femoral neck fractures, which is associated with significantly better function over 24 months4.

Among the options for correcting deviated femoral neck fractures, articles have shown that hip arthroplasty has better benefits and quality of life for patients compared to hemiarthroplasty4,5. The aim of this study was therefore to analyze the efficacy of hemiarthroplasty (HA) compared to total arthroplasty (TA) in the treatment of hip fractures.

METHODOLOGY

Systematic literature review, with a quantitative and qualitative approach to the data collected, which was structured according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and a checklist was then structured to analyze the results. We considered: 1) framing the questions for a literature review; 2) identifying relevant research; 3) assessing the quality of the studies; 4) summarizing the evidence; 5) interpreting the results.

The search for studies that met the established criteria took place in June 2024 in databases linked to the Medical Literature Analysis and Retrieval System Online (MEDLINE), using the SPICE strategy to identify the relevant studies:

- Scenario: patients with hip fracture.

- Perspective: individuals with proximal femur fracture.

- Intervention: Surgical correction.

- Comparison: Ability to walk, improvement in quality of life and biomechanical function.

- Result: Total hip arthroplasty was more effective than hemiarthroplasty.

- Study design: Randomized controlled trials, counterbalanced crossovers.

Database search method From April to June 2024, records were analyzed from 3 electronic databases (Pubmed, Biblioteca Virtual da Saúde BVS, Ebsco Sportdiscus). The keywords were obtained using the PubMed "mesh terms" query. The search was conducted with the English terms for: TOTAL ARTROPLASTY OR HEMIARTROPLASTY with a combination of "AND" and "OR".

The studies were then screened according to their subject matter, restricting them to studies that dealt with the surgical correction of proximal femoral fractures.

The inclusion criteria were: studies comparing the techniques of total hip arthroplasty and hemiarthroplasty in the treatment of femoral neck fractures; studies published up to 15 years ago; studies with a population over 50 years old. We excluded animal studies; non-original studies; studies reporting treatments for fractures of other segments of the femur; studies published more than 15 years ago; studies with young patients.

This systematic review was registered in PRÓSPERO under ID

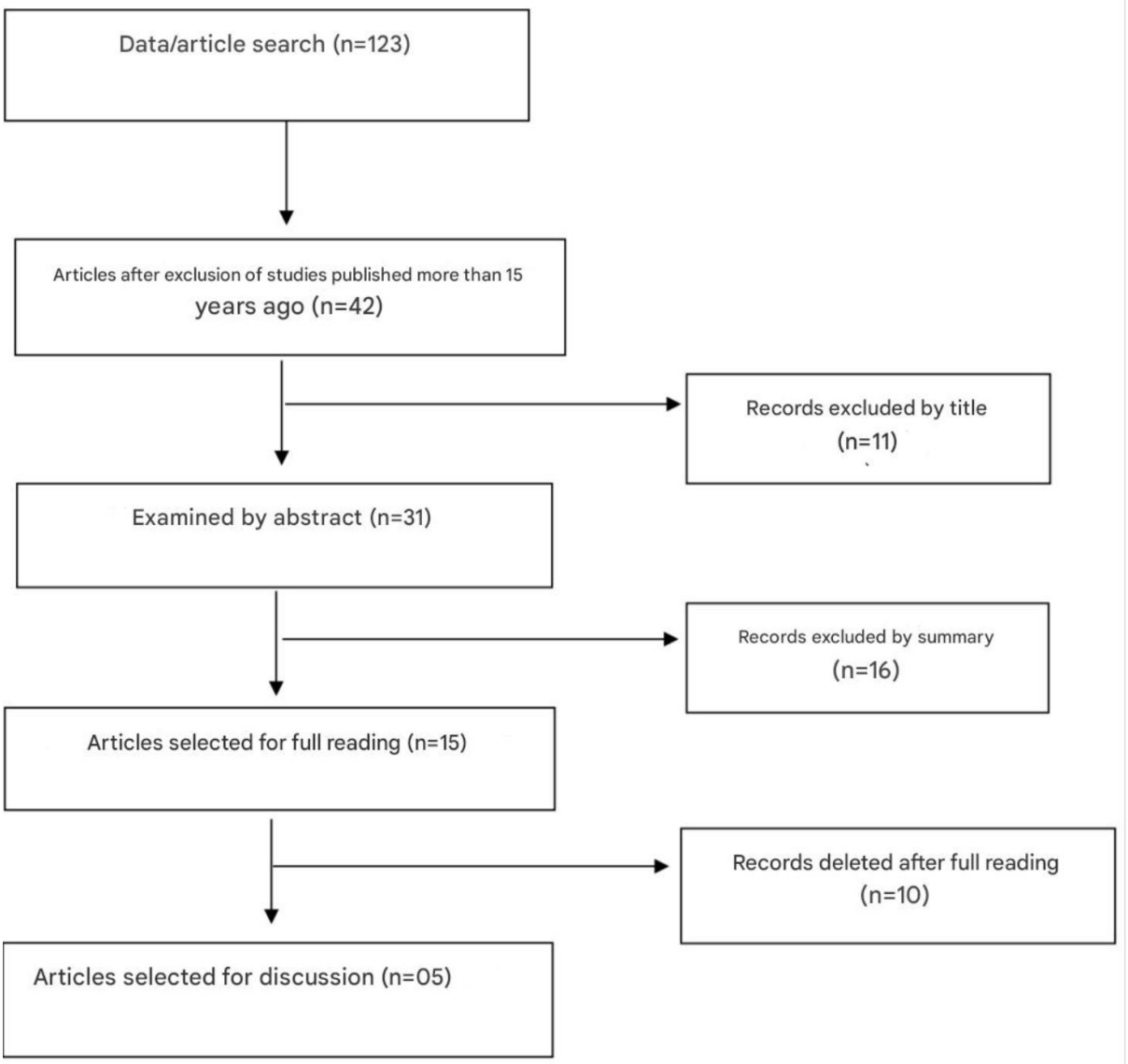
CRD42024572129.

RESULTS

A total of 123 articles were selected. 81 studies were eliminated due to their publication time of more than 15 years. An analysis of the title led to the exclusion of 11 articles and of a further 16 after reading the abstract,

which did not correspond to the objectives of the study. This left 15 articles for full reading, and only five studies were selected which compared hemiarthroplasty and total hip arthroplasty in patients with femoral neck fractures (Figure 1).

Figure 1- PRISMA protocol and selection of studies.



Source: Own authorship (2024)

The five articles selected evaluated the effectiveness of hemiarthroplasty and total hip arthroplasty techniques. The primary results of some of the studies took into account the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) a quality of life questionnaire (pain, joint stiffness and physical activity) in patients with osteoarthritis, the Harris Hip Score (HHS) a specific assessment tool for evaluating the results of total hip arthroplasty. The SF-36 (Short Form Health Survey 36) is a generic evaluation questionnaire with eight components: functional capacity, physical aspects, pain, general health, vitality, social aspects, emotional aspects and mental health. The main complications associated with the procedures were also analyzed. A total of 1988 participants were included, with an average age of 50 and 80 years.

Table 1 shows the studies chosen and their outcomes 6,7,8,9,10.

Table 1- Outcome of the selected studies.

Study	Sample	Age (years)	Primary and secondary results
Health Investigators	1495 patients	50 years	WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index); visual analogue scale (VAS); SF-12 (The 12-Item Short-Form Health Survey). Harris Hip Score (HHS);
Tol et al	252 patients	70 years	Satisfaction score; Complications.
Macaulay e col	40 patients	82 years	WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index); Harris Hip Score (HHS); Complications. Harris Hip Score (HHS);
Baker e col	81 patients	75 years	SF-36 (Short Form Health Survey 36); Complications.
Hedbeck e col	120 patients	80 years	Harris Hip Score (HHS); Complications.

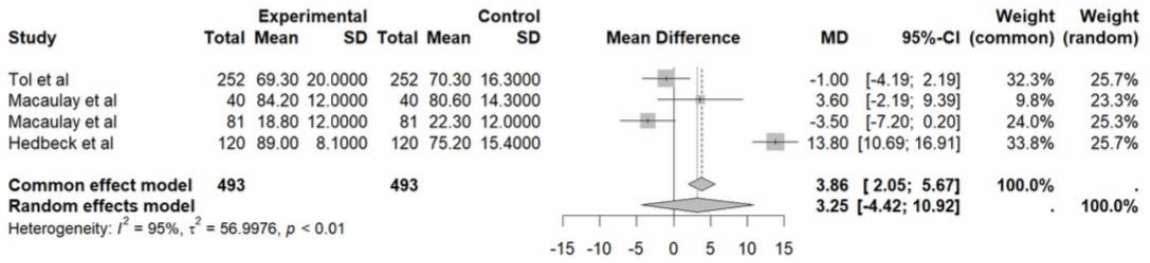
Table 2 contains the Harris Hip Score of surgical intervention by total hip arthroplasty or hip hemiarthroplasty during the final period of each study 6,7,8,9,10.

Table 2- Harris Hip Score of surgical intervention by total hip arthroplasty or hip hemiarthroplasty during the final period of each study.

Study	Study period	HHS Total Arthroplasty	**HHS Hemiartroplastia**
Tol et al	144 months	69.3+-20	70.3+-16.3
Macaulay e col	24 months	84.2+-12.0	80.6+-14.3
Baker e col	36 months	18.8+-12	22.3+-12
Hedbeck e col	48 months	89+-8.1	75.2+-15.4

Figure 2 shows the forest graph of the Harris Hip Score analysis of the patients analyzed in the study 6,7,8,9,10.

Figure 2- Forest graph of the Harris Hip Score analysis of the patients analyzed in the study.



The Health Investigators randomized clinical trial included 1495 patients over the age of 50 with femoral neck fractures. The patients were randomly divided into 718 who underwent total arthroplasty and 723 who underwent hemiarthroplasty. The primary outcomes were the number of patients undergoing a new procedure within 24 months, this figure was, as a percentage, 7.9% of patients assigned to total hip arthroplasty and 8.3% undergoing hemiarthroplasty (risk ratio, 0.95; 95% confidence interval [CI], 0.64 to 1.40; P=0.79). The main complications attributed to the groups were hip instability or dislocation in 4.7% of total

hip arthroplasty cases and 2.4% of hemiarthroplasty cases (CI 99%). The WOMAC score (Western Ontario and McMaster Universities

Osteoarthritis Index), which assesses pain, stiffness and function, showed a mean difference between the total arthroplasty and hemiarthroplasty groups, total WOMAC score (-6.37; -9.18 to -3.56), WOMAC function score (-4.97; -7.11 to -2.83), WOMAC pain score (-0.93; -1.42 to -0.44), WOMAC stiffness score (-0.44; -0.65 to -0.23). The EQ-5D visual analog scale (VAS) showed little significant difference between the groups (0.72; -2.02 to 3.46). The 12-item short form general health survey (SF-12) showed a difference between the groups in the mental component of 1.34 (-0.38 to 3.05) and the physical component of 1.41 (-0.33 to 3.14). 6

The randomized clinical trial by Tol et al included 252 patients over the age of 70 diagnosed with a femoral neck fracture, in which 137 underwent hemiarthroplasty and 115 total hip arthroplasty. After 12 years of study, only 20% of the patients were alive, with no significant difference between the groups. The modified Harris Hip Score (HHS), which does not assess physical findings, was recorded as the primary outcome. Patients undergoing hemiarthroplasty and those undergoing total arthroplasty had an HHS score of 70.3+-16.3 versus 69.3+-20 (p=0.85); HHS pain scale 39.8+-9.1 versus 37.2+-10 (p=0.44); HHS functional scale 16.4+-8.8 versus 18.3+- 7.4 (p=0.34); satisfaction was reached by 84% in the first group and 61% in the second (p=0.47); displacement of the prosthesis was not reported in either group. 97% of hemiarthroplasty procedures were associated with a blood loss of less than 500 ml, while this figure was 57% in total arthroplasty; surgical time was also longer in total hip arthroplasty (p<0.01). 7

Macaulay et al's randomized clinical trial evaluated the clinical results of patients with femoral neck fractures, 17 of whom underwent total hip arthroplasty and 23 of whom underwent hemiarthroplasty. The parameters between the two groups did not change at baseline, so the SF-16 scale showed at the end of the 24-month study physical function for total hip arthroplasty 38.6+-8.9 and hemiarthroplasty 35.1+-12.9; bodily pain 53.2+-10.2 versus 42.4+-11.5; mental health 54.9+-9.4 versus 40.9+-10.3. The WOMAC (Western Ontario McMaster Universities) index after the study period for the total arthroplasty and hemiarthroplasty groups for pain 94.4+-6.8 versus 77.8+-20.9, limb function 81.8+-10.2 versus 65.1+-18.1 and joint stiffness 79.7+-17.6 versus 77.8+-28.5. The average operative time for total arthroplasty was 89+-36 and for hemiarthroplasty 82+-35 (p=0.66), the average number of days spent in hospital for patients undergoing the first intervention was 7.7+-5.5 and 5.4+- 2.8 for the second group. The Harris Hip Score of patients undergoing total hip arthroplasty was 84+-12.2 and hemiarthroplasty 81.1+-11.7. Prosthesis dislocation occurred in one patient undergoing hemiarthroplasty. 8

Baker et al's randomized clinical trial analyzed 40 patients diagnosed with a femoral neck fracture who underwent total hip arthroplasty and 41 who underwent hemiarthroplasty. The primary results were based on the Harris Hip Score, the value reported for the total hip arthroplasty group was 18.8+-12.0 and for hemiarthroplasty 22.3+-12.0. The final physical component of the SF-36 for total arthroplasty was 40.5+-16 and for hemiarthroplasty 38.1+-10, while the mental component values were 52.0+-24.4 for total arthroplasty and 55.3+-39.0 for hemiarthroplasty. Displacement of the prosthesis occurred in three patients in the total arthroplasty group. 9

Hedbeck et al presented a randomized clinical trial in which 60 hemiarthroplasties and 60 total hip arthroplasties were performed to repair femoral neck fractures. The primary results of the article were that according to the Harris Hip Score, patients who underwent hemiarthroplasty of the hip had a score of 75.2+-15.4 at the end of the 48-month study, and those who underwent total hip arthroplasty had a score of 89.0+-8.1 (p<0.001). The pain subscale for the groups was 35.1+-7.0 versus 43.0+-1.8; the functional subscale was 31.4+-10.6 versus 37.2+-7.8; deformity and the degree of range of movement did not differ between the groups (p<0.001).10

DISCUSSION

Comparing total hip arthroplasty and hemiarthroplasty through the HEALTH study, it is possible to analyze that there is no identifiable difference in relation to reintervention procedures between the groups. 6 In addition, other studies state that patients with total hip arthroplasty have a reduced risk of mortality when compared to patients with hemiarthroplasty. On the other hand, some recent studies claim that hemiarthroplasty compared to THA has lower dislocation rates, less surgical complexity, shorter operating times and lower blood loss. 7,8

Hip fractures are responsible for more days of hospitalization than any other musculoskeletal injury and account for more than two thirds of patients hospitalized for fractures. Currently, surgical treatment is indicated for this type of pathology, which can be total hip arthroplasty (THA) or hemiarthroplasty (HA). Both procedures involve risks for patients, although they are widely accepted methods of hip replacement after fracture.14,15,16

There are several surgical approaches to total hip arthroplasty, including the posterior approach (PA), the

lateral approach (LA) and the direct anterior approach (DAA), all of which have their advantages and disadvantages. The PA involves splitting the gluteus maximus to access the hip joint posteriorly, and also allows excellent exposure of the acetabulum and femur and avoids disruption of the hip abductors. However, the PA has been linked to an increased risk of dislocation compared to the other types of approach. The AL involves splitting the gluteus medius to access the hip joint anterolaterally. It has a lower risk of dislocation, but is associated with injury to the superior gluteal nerve and impaired abductor function. Finally, the AAD has its internervous and intermuscular plane between the sartorius and tensor fascia lata. This last approach has some advantages, such as shorter hospital stays, earlier functional recovery and lower risk of dislocation, leading to its growing popularity as an approach to total hip arthroplasty. 12

The other surgical option for addressing hip injuries is hemiarthroplasty, which consists of partial hip replacement. In this surgical procedure, a quick but effective operation is required with minimal trauma or physiological disruption, so the approach can be carried out in three different ways, laterally with displacement of the greater trochanter, anteriorly through the anterior capsule of the hip joint and posteriorly through the posterior capsule of the hip joint. However, the lateral approach is considered inadequate because it causes excessive surgical trauma. Because of this, the main techniques for inserting a hemiarthroplasty are the anterior and posterior approaches. Because of this, the main techniques for inserting a hemiarthroplasty are the anterior and posterior approaches.11,13,16

CONCLUSION

Most studies have shown evidence of functional improvement, better quality of life and greater patient satisfaction when treated with total hip arthroplasty. Therefore, total arthroplasty was considered the procedure of choice, especially for active elderly patients.

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