International Journal of Orthopaedics Sciences

**ISSN:** 2395-1958
IJOS 2018; 4(2): 1049-1052

www.orthopaper.com
Received: 26-02-2018
Accepted: 30-03-2018

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# Factors influencing the functional outcome after primary total hip arthroplasty

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**DOI:** https://doi.org/10.22271/ortho.2018.v4.i2o.3511

**Abstract**
**Aim:** In order to ensure that patients undergoing the recovery program achieve the best possible functional outcome subsequent to the insertion of a primary total hip prosthesis, our objective is to forecast the various factors that may occur.
**Materials and Methods:** In this study, fifty consecutively included patients who had undergone primary total hip prosthesis surgery were provided with an immediate postoperative recovery program that incorporated an integrative component throughout their entire hospital stay. The individualized program was continued at home in accordance with the patients' specific characteristics, including gender, age, Body Mass Index (BMI), type of diagnosis necessitating prosthesis implantation, type of prosthesis implanted, and functional status of the contralateral hip. The Harris hip score was computed three months postoperatively, in comparison to the preoperative score, as well as the quality of life.
**Results:** Three months after the operation and recovery, the mean Harris hip score was more than double from its preoperative value of 30.01 to 85.79. Additionally, the patients, on average, reported a satisfactory quality of life. There were no statistically significant variations observed in the preoperative Harris hip score across various patient groups, with the exception of individuals aged 75 and above, for whom the score was significantly lower than that of the other age groups. The statistically significant differences between patient groups ceased to exist three months following the procedure. Three months after the procedure, the mean perceived quality of life was favorable.
**Conclusion:** The following elements contribute to a favorable functional outcome following primary total hip arthroplasty: initiation of a rehabilitation program promptly following the procedure, with its execution progressively progressing to resistance exercises, with its integrative component primarily focused on restoring walking independence and movement independence, and careful adaptation to the patient's unique characteristics, including but not limited to age, weight, and opposite hip condition. Gender, advanced age, the underlying condition necessitating prosthesis implantation, obesity, or a history of unoperated hip with functional impairment are not limiting factors and do not impede the achievement of favorable outcomes.

**Keywords:** Functional outcome, hip arthroplasty, Harris hip

## Introduction
Total hip arthroplasty (THA) is a surgical intervention given to individuals afflicted with osteoarthritis (OA) of the hip with the goals of improving pain and enhancing function. The Agency for Healthcare Research and Quality reports that annually, in the United States, over 305,000 total hip replacements are conducted [1]. The majority of patients who undergo THA report pain reductions, function enhancements, and an overall improvement in health-related quality of life [2].
Primary total hip arthroplasty is the surgical approach that is most commonly employed to treat coxarthrosis in its various forms. This technique enables the creation of a new joint that is stable, harmless, and mobile. The favorable postoperative outcomes stimulated a substantial surge in the implementation of this surgical technique, which increased by 40 to 70 percent from 1990 to 1998 [3]. Advancements in the design of acetabular and femoral components of primary total hip prostheses since the 1960s have significantly increased their longevity (15-20 years on average) and functional performance: friction couplings, modularity, and fixation to the host bone. Undoubtedly, the local condition in the immediate aftermath of primary total hip arthroplasty is the most significant functional prognostic factor.

Subsequent to an unsatisfactory condition, immediate substandard outcomes would ensue [4].

Recovery constitutes the remaining half of the battle to obtain a functional hip joint, after which surgery is only half. Numerous variables can significantly affect this functional outcome. Therefore, various factors such as age, preoperative function, non-surgical associated diseases, obesity, perioperative complications, prosthesis type-related variables, postoperative discomfort, and psychological factors may impede the successful recovery from surgery and hinder the attainment of an optimal functional outcome [5, 6]. An additional critical determinant of functional recovery output quality is the extent and regularity of the patient's program participation [7].

By analyzing the outcomes attained subsequent to the insertion of a primary total hip prosthesis and subsequent to the recovery treatment administered, our objective was to ascertain the extent to which each diverse factor contributes to an optimal functional result.

## Materials and Methods

A prospective study was undertaken, encompassing 50 patients who underwent primary total hip arthroplasty and were hospitalized and included in the study consecutively. With their signatures on an informed consent form, every patient consented to participate in this research.

### Inclusion criteria

- Individuals who undergo primary total hip arthroplasty on the day the recovery program commences.
- Individuals who do not present with early intraoperative or postoperative complications that could impede the prompt initiation of recovery.
- Patients who, at the follow-up appointment three months postoperatively, were able to have their Harris score computed.
- Patients who, at the same time, completed a postoperative satisfaction questionnaire.

### Exclusion criteria

- Individuals who experienced early intraoperative or postoperative complications that hindered their prompt recovery.
- Patients who have contraindications that prevent them from commencing recovery immediately.
- Individuals who were unable to have their Harris score or quality of life assessed three months after the procedure.

The study of results obtained at 3 months after the prosthesis implantation was performed according to gender, age, Body Mass Index (BMI), the diagnosis that required the performance of a primary total hip arthroplasty, type of prosthesis implanted and in terms of functional condition of the contralateral hip.

The study included 29 female patients and 21 male patients. Patients were divided into 4 groups: under 40 years old (4 patients), between 41 and 60 years old (18 patients), between 61 and 75 years old (22 patients), over 75 years old (6 patients). 18 patients were normal weight, 23 overweight, 9 obese (most of them belonging to obesity class II). Patients were divided into 4 groups: primary coxarthrosis (30 cases), secondary coxarthrosis due to developmental dysplasia of the hip (4 cases), secondary coxarthrosis due to aseptic necrosis of the femoral head (7 cases) and other causes (other secondary coxarthroses or after fractures of femoral neck - 9 cases). 17 patients with cemented prosthesis and 33 patients with uncemented prosthesis. 28 patients with normal opposite hip or operated opposite hip with total prosthesis (not impeding recovery in this situation) and 22 patients whose contralateral hip had a more or less pronounced coxarthrosis.

The recovery program commenced promptly for all patients following the operation. The patients returned home after a period of 5 to 7 days, and upon their discharge from the hospital, they were provided with a written recovery plan. At the follow-up review after three months, during which time the Harris scores of all patients were computed, they were also provided with a simplified questionnaire derived from the SF-36 [8, 9], which they were instructed to complete in order to assess their quality of life in terms of satisfaction level.

### The recovery protocol can theoretically be divided into 3 phases

- **Acute phase:** Executed promptly postoperatively while hospitalized.
- **Sub-acute phase:** Executed at home.
- **Maintenance phase:** Following the patient's professional and social integration.

In order to have objective results, the Harris hip score was calculated preoperatively and at 3 months after surgery. In addition, we considered that the patient’s subjective opinion on the quality of life expressed postoperatively, was at least equally important.

**Table 1:** Harris score results

| Attribute of Harris score | Poor | Fair | Good | Excellent |
|---|---|---|---|---|
| Points | <70 | 71-79 | 80-90 | 91-100 |

**Table 2:** Quality of life

| Attribute of quality of life | Worse | Moderate | Good | Very good | Excellent |
|---|---|---|---|---|---|
| Points | <35 | 35-60 | 61-80 | 81-90 | 91-100 |

### Statistical analysis

The outcomes underwent statistical analysis. The data were presented in the form of percentages, mean values, and standard deviations. The t-test (Student) and the one-way ANOVA test (with Bonferroni correction) were employed to evaluate the variations in mean quantitative computations. A p-value less than 0.05 was deemed to indicate statistical significance.

## Results

The preoperative Harris hip score in all 100 patients studied was 30.01. After 3 months, the average Harris hip score was more than twice the initial value, i.e. 75.79.

**Table 3:** Postoperative Harris score results

| Attribute of Harris score | Poor | Fair | Good | Excellent |
|---|---|---|---|---|
| Number patients | 4 | 5 | 23 | 18 |

Out of total 50 patients, 33 patients were having good score, 18 patients were having excellent score, 5 patients were having fair score and poor score was seen in 4 patients.

**Table 4:** Postoperative quality of life

| Attribute of quality of life | Moderate | Good | Very good | Excellent |
|---|---|---|---|---|
| Number of patients | 6 | 26 | 15 | 3 |

Out of total 50 patients, the 26 patients were having good quality of life followed by very good (15 patients), moderate (6 patients) and excellent (3 patients).

**Table 5:** Harris score and Quality of life, 3 months after the implantation of the prosthesis

| | | Preoperative average Harris score | Postoperative average Harris score | Quality of life - average |
|---|---|---|---|---|
| | All patients | 30.01 | 85.79 | 73.11 (good) |
| Age of patients | <40 | 27 | 86.43 | 74.00 (good) |
| | 41-60 | 30.05 | 82.21 | 77.08 (good) |
| | 61-75 | 30.11 | 86.43 | 72.34 (good) |
| | >75 | 24 (p=0.032) | 81.00 | 67.03 (good) |
| Gender of patients | Females | | 85.31 | 76.87 (good) |
| | Males | | 86.43 | 75.05 (good) |
| Contralateral hip | Functional With coxarthrosis | | 86.33 | 77.11 (good) |
| | | | 85.54 | 74.02 (good) |
| Diagnosis | Primary coxarthrosis | 31.02 | 86.11 | 74.10 (good) |
| | Primary coxarthrosis | 30.22 | 90.56 | 80.01 (very good) |
| | Secondary coxarthrosis due to necrosis | 30.14 | 85.22 | 75.22 (good) |
| Type of prosthesis | Other causes | 25.2 | 83.00 | 73.99 (good) |
| | Cemented | | 87.43 | 76.02 (good) |
| | Uncemented | | 85.22 | 74.11 (good) |
| Body Mass Index | Normal weight | 27.3 | 84.32 | 71.32 (good) |
| | Over weight | 30.2 | 74.43 | 76.01 (good) |
| | obese | 27.02 | 91.34 (p=0.002) | 83.22 (very good) |

The preoperative Harris score did not differ substantially among the patient populations, with the exception of those aged 75 and older, for whom it was considerably lower than in the remaining age groups. The statistically significant differences between the different patient groups ceased to exist three months following the surgery. Three months after the procedure, the patients reported a satisfactory quality of life. Statistically significant variations are exclusively observed among obese patients, who, on average, regarded it as exceptionally favorable.

## Discussion

The outcomes were favorable for all patient groups, irrespective of gender, age, Body Mass Index, or etiology of total prosthesis implantation. On average, the postoperative Harris hip score surpassed the preoperative average by more than twofold (85.79 after three months versus 30.01 preoperatively), with 96% of the patients experiencing functional gains exceeding twenty points. The research was unable to establish a definitive correlation between variables such as age, gender, Body Mass Index, etiology of coxarthrosis, prosthesis type, and opposite hip condition, and the evaluation of life quality as mediocre.

The mediocre quality of postoperative life among patients could not be attributed to any severe, invalidating form of coxarthrosis, as evidenced by the fact that the preoperative average Harris hip score was not only comparable to but exceeded the mean value among all 50 patients examined (30.01 points versus 41.09 points). The patients' condition at the time of hospital discharge was comparable to that of patients who achieved better outcomes. However, in contrast, the mean Harris hip score three months later was considerably lower than the mean value of all patients tracked in this investigation (69.08 points denoting a poor outcome versus 85.89 points signifying a good outcome). Comparative research examining patient groups distinguished by their level of engagement in the recovery program revealed that the group characterized by a significant increase in participation significantly enhanced both muscular strength and walking speed, in contrast to the group with a relatively low level of participation [7].

With one exception, there were no statistically significant differences observed among the examined samples in terms of the preoperative Harris hip score average values for the different categories (gender, age, condition of the opposite hip, type of prosthesis implanted). Statistically speaking, the average preoperative Harris hip score was considerably lower in the age group over 75 compared to other age groups. According to Brander *et al.* [10], coxarthrosis in older adults is associated with a more pronounced decline in overall functionality. This decline is primarily attributed to compromised muscle strength, prolonged periods of inactivity, and a precarious functional balance, all of which are reflected in the Harris hip score value.

Three months following prosthesis implantation, no statistically significant differences remained in the average Harris hip score among patient groups distinguished by age, gender, contralateral hip condition, or prosthesis type, with the exception of patients aged 75 years and older. Despite the average Harris hip score remaining below the overall average during this age group, the disparity did not reach statistical significance.

According to the findings of Bitar AA *et al.* [11], Maire J *et al.* [12], Hauer K *et al.* [13], and Hauer K *et al.* [14], progressive resistance exercises are recommended for geriatric patients as well, notwithstanding the fact that the precarious functional equilibrium is not solely determined by muscle strength and volume loss. Resistance training has the potential to diminish or eliminate the vulnerability of the functional equilibrium. Due to their decreased functional capacity and higher prevalence of chronic diseases, the elderly are the population segment that would most benefit from physiotherapy.[15] despite the fact that achieving global functionality and independence may be more challenging and time-consuming for elderly patients, their progress eventually catches up with that of other patient populations. In the event that coxarthrosis causes pain and functional impairment in the opposing hip, postoperative recovery should be administered in an equitable

manner to both hips. Particular emphasis must be placed on developing trunk and scapular belt muscle strength, which is essential for activities such as getting out of bed, resuming walking with the assistance of a cane or walking frame, and ascending and descending staircases. Utilizing assistive devices will require more time in this instance compared to those whose contralateral hip functions normally [16].

Bergmann *et al*. [16] and Bergmann *et al*. [17] state that the form of prosthesis - cemented or Uncemented - has a significant bearing on whether the recovery protocol is implemented individually. Certain authors assert that while a cemented prosthesis enables a rapid complete load, an uncemented prosthesis necessitates the implementation of a sequence of precautions. While there is no universal agreement on the matter, an uncemented prosthesis necessitates a prolonged period of progressive loading and, as a result, the prolonged use of assistive walking aids. As an alternative, this prosthesis will permit progressive muscle strengthening exercises for the operated pelvic limb from the outset, much like the cemented prosthesis.

The functional outcomes will be comparable to those observed in patients of normal weight and those who are overweight, according to the findings of the research conducted by Mancuso CA *et al*. [18]. This contradicts the stance of numerous orthopedic surgeons, who often advise against or delay total prosthesis implantation in obese patients. The sample population was most heavily composed of overweight patients (46%), followed by those of normal weight (36%), and finally obese individuals (18%). This is an example of a worldwide trend that is being emphasized.

Statistically, there was no significant difference in the average preoperative Harris hip score among individuals classified as normal-weight (27.3), overweight (30.2), or obese (27.02). However, variations in the mean Harris hip score were observed three months following surgery, contingent upon the patients' weight status. The Harris hip score for obese patients (those in obesity classes II and III) was an average of 91.34, which is regarded as an excellent outcome. This score is greater than that of overweight patients (74.43), who also achieved a good result, and is lower than that of normal-weight patients (84.32).

By utilizing the Harris hip score to evaluate the functional status prior to surgery, we endeavored to ascertain whether this condition could serve as a predictor of the outcome. After a period of three months, patients who had a preoperative Harris score below 35 points rated their quality of life as follows: mediocre in six cases, good in twenty-six cases, very good in fifteen cases, and outstanding in three cases.

## Conclusion

As a result of this research, we have determined that a number of variables are crucial in ensuring favorable functional outcomes following primary total hip arthroplasty recovery. Commencing an early recovery program on the day following surgery and progressively incorporating it until resistance exercises are performed, with an integrative component primarily focused on restoring walking and movement independence, careful adaptation to the patient's unique characteristics (e.g., weight, opposite hip status, and within each group, to the patient's physical capabilities), and program continuation at the time of surgery.

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