FACTORS THAT MAY INFLUENCE THE FUNCTIONAL OUTCOME AFTER PRIMARY TOTAL HIP ARTHROPLASTY

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Abstract

Aim. The present paper aims to decipher the multiple factors occurring in patients on the recovery program, in order to obtain an optimal functional outcome after the implantation of a primary total hip prosthesis.

Material and Method. One hundred patients operated with primary total hip prosthesis, consecutively included in this study, underwent an immediate postoperative recovery program, with an integrative aspect, over the entire duration of hospitalization. The program was individualized according to the specific features of the patients, such as gender, age, Body Mass Index (BMI), type of diagnosis that required the prosthesis implantation, type of prosthesis implanted and functional status of the opposite hip, and it was continued at home. At 3 months postoperatively, the Harris hip score (in comparison with the preoperative one) and the quality of life were calculated.

Results. At 3 months post-surgery and post-recovery, the average Harris hip score was more than double in comparison with the preoperative one (85.89 as compared to 40.06), and on average the patients considered the quality of life as good. The preoperative Harris hip score had no statistically significant differences in different patient groups, except for the ones aged over 75, for whom it was statistically significantly lower than the score of other age groups. Three months after surgery, the statistically significant differences between different groups of patients disappeared. At 3 months postoperatively, the average perceived quality of life was good. There were statistically significant differences only in obese patients, who considered it to be very good.

Discussion. Correlations are sought between different categories of patients and the obtained results, to be compared with the data in specialized literature.

Conclusions. The factors contributing to a good functional outcome after primary total hip arthroplasty are the following: rehabilitation program beginning immediately after surgery, its performance gradually reaching exercises against resistance and its integrative aspect being mainly oriented towards obtaining movement independence and walking recovery, careful adaptation to the specific features of the patient, related to age, weight condition, opposite hip condition and, within each group, related to the physical possibilities of the person submitted to surgery, as well as the continuation of the rehabilitation program at home. Factors such as gender, old age, the cause requiring prosthesis implantation, obesity or unoperated hip with functional impairment are not limitative and do not prevent obtaining satisfactory results.

Keywords: hip arthroplasty, rehabilitation, Harris score, Quality of life, elderly patients.

Introduction

Primary total hip arthroplasty is the most frequently used surgical method in the therapy of various forms of coxarthrosis. Thanks to this method, we can obtain a new joint, which is mobile, stable and painless. Good postoperative results have encouraged a significant increase of the use of this surgical technique by 40 to 70% between 1990 and 1998. The data provided by the national health authorities of European countries showed in 1998 a number between 8 and 135 primary total hip prostheses used per 100,000 inhabitants [1]. Improvements brought from the '60s until now to the design of acetabular and femoral components of primary total hip prostheses – their friction couplings, their modularity and their fixation to the host bone – considerably increased their functional performance as well as their longevity (15-20 years on average). It is certain that the most important functional prognostic factor of primary total hip arthroplasty is the local condition immediately after surgery. An unsatisfactory condition would be followed by immediate poor results.

Surgery is only half the battle to get a new functional hip joint, the other half consisting in recovery. A number of factors can influence this functional result to a large extent. Thus, age, preoperative function, non-surgical associated diseases, obesity, perioperative complications, factors related to the type of prosthesis, postoperative pain and psychological factors may interfere with postoperative recovery in achieving an optimal functional result [2,3]. Another important factor, which determines the output quality of functional recovery is the degree and consistency of participation of the patient in the program [4].

By studying the results achieved after the implantation of a primary total hip prosthesis and after the recovery treatment performed according to the protocol of Foisor Orthopedic Hospital, we aimed to establish the contribution of all various factors to an optimal functional result.

Material and Method

We conducted a prospective study on 100 patients, consecutively included, hospitalized and operated with primary total hip arthroplasty in Foisor Orthopedic Hospital. All patients signed an informed consent, stating that they agreed to participate in this study.

The inclusion criteria comprised:

- patients with primary total hip arthroplasty (regardless of age, associated diseases, degree of obesity or type of prosthesis implanted) performed on the very day that the recovery program begins;

- patients without early intra- or postoperative complications that might prevent the immediate start of recovery;

- patients who, 3 months after surgery, came for follow-up check and were able to have their Harris score calculated;

- patients who completed, 3 months after surgery, a questionnaire regarding their satisfaction after surgery (to determine the quality of life).

The exclusion criteria comprised:

- patients with early intraoperative or postoperative complications that prevented the immediate start of recovery;

- patients with contraindications regarding the immediate start of recovery;

- patients who could not have their Harris score or/and their quality of life calculated at 3 months postoperatively.

The study of results obtained at 3 months after the prosthesis implantation was performed according to:

- gender: the study included 58 female patients and 42 male patients;

- age: patients were divided into 4 groups: under 40 years old (9 patients), between 41 and 60 years old (36 patients), between 61 and 75 years old (44 patients), over 75 years old (11 patients);

- Body Mass Index (BMI): 36 patients were normal-weight, 45 overweight, 19 obese (most of them belonging to obesity class II);

- the diagnosis that required the performance of a primary total hip arthroplasty. Patients were divided into 4 groups: primary coxarthrosis (60 cases), secondary coxarthrosis due to developmental dysplasia of the hip (8 cases), secondary coxarthrosis due to aseptic necrosis of the femoral head (15 cases) and other causes (other secondary coxarthroses or after fractures of femoral neck - 17 cases).

- type of prosthesis implanted: 34 patients with cemented prosthesis and 66 patients with uncemented prosthesis;

- in terms of functional condition of the contralateral hip: 56 patients with normal opposite hip or operated opposite hip with total prosthesis (not impeding recovery in this situation) and 44 patients whose contralateral hip had a more or less pronounced coxarthrosis.

Postoperatively, the recovery program began for all patients immediately. After a time interval between 5 and 7 days, the patients returned home and at discharge from the hospital, they received a written recovery plan. After 3 months, on the occasion of a follow-up check, all patients had their Harris score calculated and they were given a questionnaire derived from SF-36 [5,6] and simplified, requesting them to fill it in, in order to determine the quality of life, according to the degree of satisfaction.

The general recovery protocol, drawn up on the basis of specialized literature data [6-12] and relying on our own long experience, was applied to all patients studied. It can theoretically be divided into 3 phases: an acute phase – performed during hospitalization, immediately postoperatively, a subacute phase – performed at home and a maintenance phase – after the professional and social integration of the patient. The recovery program

focused on regaining the independence of movement and of daily functional activities. Movement amplitude and muscle contraction strength were secondary targets. The protocol was individualized according to the specific features of each patient: age-related features, diagnosis requiring arthroplasty, BMI, opposite hip condition, type of prosthesis. In order to have objective results, the Harris hip score was calculated preoperatively and at 3 months after surgery [13,14]. In addition, we considered that the patient's subjective opinion on the quality of life (SF-36 questionnaire), expressed postoperatively, was at least equally important. The qualitative assessment on Harris score and on the quality of life is shown in Tables I and II.

Table I. Harris score results.

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

Table II. Quality of life.

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

The results were statistically processed. Data were expressed as average values, standard deviations and percentages. The one-way ANOVA test (Bonferroni correction) and the t-test (Student) were used to assess the differences in average quantitative calculations. The StataC 11 Program (StataCorp LP, Texas, USA, version 2009) was used for the data analysis. The value of $p<0.05$ was considered statistically significant.

Results

The preoperative Harris hip score in all 100 patients studied was 40.06. After 3 months, the average Harris hip score was more than twice the initial value, i.e. 85.89 (Fig. 1). Except for 4 cases, in the remaining 96, the postoperative Harris hip score had at least 20 extra points as compared with the preoperative score. The distribution of patients according to the qualitative results of postoperative Harris hip score is shown in Table III. Patients rated the quality of their life at a mean index of 74.88 range 38 to 97), therefore as being good (with variations between excellent and mediocre) (Table IV).

Table III. Postoperative Harris score results.

Attribute of Harris score	Poor	Fair	Good	Excellent
Number patients	8	7	47	38

Table IV. Postoperative Quality of life.

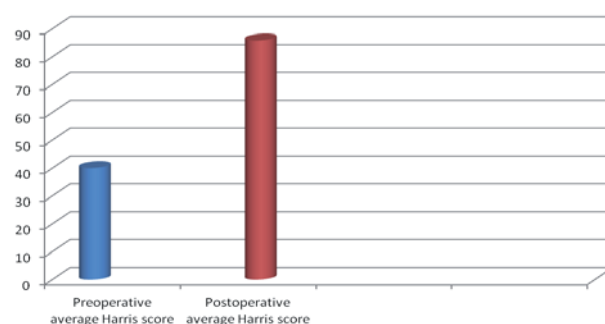| Attribute of Quality of life	Moderate	Good	Very good	Excellent
Number of patients	11	51	31	7

Figure 1. Average Harris score before and after the implantation of the prosthesis.

Harris score and quality of life at 3 months after the prosthesis implantation, depending on age, gender, functional condition of the opposite hip, the diagnosis that required arthroplasty, type of prosthesis and the Body Mass Index are shown in Table V. The preoperative Harris score had no statistically significant differences in the various groups of patients, except for the ones aged over 75, for whom it was significantly lower than that of other age groups. 3 months after surgery, the statistically significant differences between the various patient groups disappeared (Fig. 2). At 3 months postoperatively, the patients considered the quality of life as being good. Statistically significant differences are to be found only in obese patients, who considered it to be very good, on average (Fig. 3).
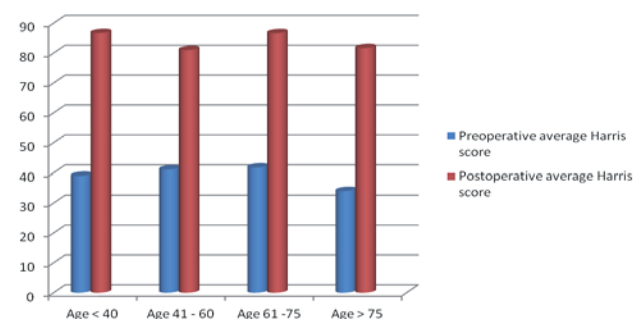

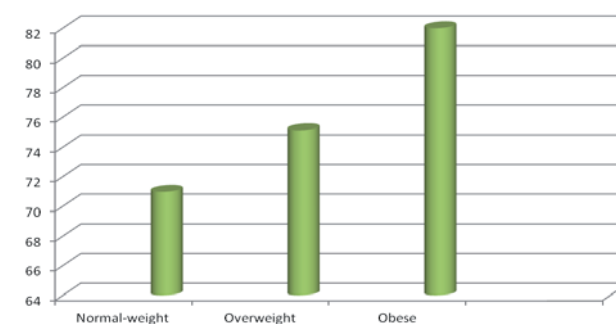**Figure 2.** The preoperative and postoperative average Harris score at the patients of the 4 age groups.

Figure 3. Average of Quality of life depending on Body Mass Index.

Table V. 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	40.06	85.89	74.88 (good)
Age of patients	<40	39	86.70	74.80 (good)
	41-60	41.10	81	77.10 (good)
	61-75	41.75	86.65	73 (good)
	>75	34.36 (p=0.041<0.05)	81.65	66 (good)
Gender of patients	♀		85.65	75.28 (good)
	♂		86.05	74.48 (good)
Contralateral hip	Functional		86.43	76.03 (good)
	With coxarthrosis		85.19	73.40 (good)
Diagnosis	Primary coxarthrosis	41.23	86.32	73.98 (good)
	Secondary coxarthrosis due to dysplasia	40.50	90.41	81.12 (very good)
	Secondary coxarthrosis due to necrosis	40.80	85.25	77.73 (good)
	Other causes	35.05	83.59	72.58 (good)
Type of prosthesis	Cemented		87.04	74.05 (good)
	Uncemented		85.26	75.30 (good)
Body Mass Index	Normal-weight	39.80	84.60	70.97 (good)
	Overweight	40.40	84.48	75.13 (good)
	Obese	39.73	91.63 (p=0.004<0.05)	81.68 (very good)

Table VI. Patients with postoperative moderate Quality of life.

Gender		Age of patients				BMI			Diagnosis				Type of prosthesis		Conlat hip	
♂	♀	<40	41-60	61-75	>75	Nw	Ow	O	PC	SCD	SCN	OC	Uc	Cm	F	C
6	5	1	3	4	3	7	4	0	7	0	2	2	7	4	6	5

Legend: Nw = normal-weight; Ow = overweight; O = obese ; PC = primary coxarthrosis; SCD = secondary coxarthrosis due to dysplasia; SCN = secondary coxarthrosis due to necrosis of the femoral head; OC = other causes; Uc = uncemented total hip prosthesis; Cm = C = cemented total hip prosthesis; Conlat hip = contralateral hip; F = functional; C = coxarthrosis.

Discussion

The results achieved in all categories of patients, regardless of gender, age, Body Mass Index or cause leading to total prosthesis implantation were good, the average postoperative Harris hip score being more than double the preoperative average value (85.89 after 3 months in comparison with 40.06 preoperatively), where 96% of the patients gained over 20 functional points. The patients considered the quality of their life (according to the questionnaire) as being good in 51% of cases and very good in 31% of cases. 82% of the patients were satisfied with their results. Extremes were represented by 7% of patients for whom the quality of life was excellent and 11% for whom the quality of life was mediocre. We studied in detail the 11 patients who considered the quality of their postoperative life as mediocre (Table VI).

The study was unable to make any conclusive correlation between gender, age, Body Mass Index, cause of coxarthrosis, type of prosthesis implanted and opposite hip condition on the one hand and the assessment of life quality as mediocre, on the other hand.

No serious, invalidating form of coxarthrosis could be incriminated as having caused the mediocre quality of postoperative life of patients, the preoperative average Harris hip score being close to, but higher than the average value in all 100 patients studied (41.09 points as against 40.06 points). Their condition at discharge from hospital was not different from that of patients with better results. In exchange, the average Harris hip score after 3 months was significantly lower than the average value of all patients followed in this study (69.08 points considered as a poor result, as compared to 85.89, considered to be a good result). The only obvious cause was a labile mental state, slightly depressive, which led 8 of the 11 patients not to continue their recovery at home. The other 3 patients, belonging to the age group over 75, did not attend the indicated program conscientiously either. It is worth noting the correlation between objective assessment - Harris score - and subjective assessment - quality of life. Comparative studies on groups differentiated by the degree of participation of patients in the recovery program showed that the group with a high degree of participation achieved a substantial improvement of muscle strength and of walking speed, as against the group with a low participation [4].

For the entire sample investigated, the differences between the average values of preoperative Harris hip score in the various categories analyzed (gender, age, condition of the opposite hip, type of prosthesis implanted), were not statistically significant, with one exception. The average preoperative Harris hip score in the age group over 75 was statistically significantly lower than at other ages. A coxarthrosis occurring in a person with an older age caused a more severe alteration of general functionality, due to a labile functional balance, to weaker muscles and to a long period of inactivity, which was reflected in the value of Harris hip score (preoperative average Harris hip score in patients

over 75 years old was 34.36, as compared to the average of the entire sample, which was 40.06). At 3 months after the prosthesis implantation, there were no more significant differences in statistical terms, as regards the average Harris hip score between patient groups differentiated by age, gender, opposite hip condition or prosthesis type used, not even for patients over 75 years old. Although the average Harris hip score at this age remained below the overall average (81.65 as against 85.89, both classified as good results), the difference was not statistically significant. The average value of assessments on the quality of life made by these elderly patients was 66.45, being classified as good quality, but in terms of value, being under the overall average (74.88).

We did not expect this homogeneity of recovery results at 3 months after the total prosthesis implantation. We believe that it is due to the precocity of initiating the physiotherapy and to its holistic aspect, focusing on regaining overall functionality and independence as well as to its individualization according to each category of patients (age, BMI, opposite hip condition, type of prosthesis implanted) and within each category, according to the specific features of each patient. Adapting the rehabilitation program according to age refers especially to patients over 75 years old who, from the very start, have a shortage of muscle contraction. Therefore, the dosage and intensity of daily physical exercise should be done very carefully and only according to the results obtained by each patient.

Data in literature emphasize that progressive resistive exercises are indicated also for elderly patients, even if the fragile functional balance is not determined only by the loss in muscle strength and volume. Resistive exercises may reduce or even remove the fragility of the functional balance [8,9,15,16]. Due to a poor functional status and to the increased incidence of chronic diseases, there is no other population segment that would benefit more from physiotherapy than the elders [17]. Even if the desired performance in gaining global functionality and independence is slower and more difficult for very old patients, in the course of time it is equalized with the performance of other groups of patients.

If the opposite hip hurts and if its functionality is reduced because of a coxarthrosis, postoperative recovery must be applied to both hips equally. Special attention is required in order to gain muscle strength of the trunk and of the scapular belt, which is necessary for the mobilization in and out of bed, for the resumption of walking with assistive means (walking frame, crutches, cane), for climbing and descending stairs etc. The use of assistive means will take a longer time in this case than it would take for persons whose contralateral hip has a good functionality. It is recommended to perform the self-care and current activities in sitting position. All this will lead to gaining functionality and independence, protecting the operated hip and preparing the opposite hip for arthroplasty.

The prosthesis type - cemented or uncemented - plays an important role in the individual implementation of the recovery protocol. If a cemented prosthesis allows a quick full load, an uncemented prosthesis requires, according to some authors, a series of precautions. Even though there is no unanimous opinion [18,19], an uncemented prosthesis requires a progressive loading over a longer time period and, consequently, the usage of assistive walking means over an extended time period. In exchange, this prosthesis will allow, from the very beginning, exercises for a progressive muscle strengthening of the operated pelvic limb, similarly to the cemented prosthesis.

If the rehabilitation program is identical for normal-weight and overweight patients, in case of the obese, a series of special measures are required. The amplitude of flexion and adduction movements is limited due to the abdominal prominence and to the massive thigh pattern. It is not indicated to force these movements, as the thigh could find a point of support on the abdomen, leading to the prosthesis dislocation. The changes of position, from supine decubitus to lateral decubitus, sitting on the edge of the bed, the transfer from bed to chair, walking, climbing and descending of stairs, are more difficult to perform in the acute postoperative phase, requiring the performance of these activities repeatedly. Finally, the functional results will be equal to those achieved by normal-weight and overweight patients, despite the opinion of many orthopedic surgeons, who tend to postpone or even to contraindicate implantation of total prosthesis in obese [20]. In our sample, overweight were represented by the most numerous group of patients - 45%, followed by normal-weight - 36% and by obese - 19%. This is part of a general trend, worldwide highlighted [21,22].

The average preoperative Harris hip score was not significantly different in statistics between normal-weight (39.80), overweight (40.4) and obese (39.73). In exchange, there were differences in the average Harris hip score at 3 months after surgery, depending on the weight status of patients. Obese patients (obesity class II and III) had an average Harris hip score (91.63, considered as an excellent result), higher than the score of overweight patients (84.48 – a good result) and than the one of normal-weight patients (84.61 - a good result). Although they seem important in terms of value, these differences are not statistically significant. The average assessments on life quality, made by obese patients (81.68 - very good), was statistically significantly higher than the average assessments made by normal-weight patients (70.97 - good). If a series of studies [23,24,25,26,27] state the negative influence of obesity on the outcome of primary total hip arthroplasty, some of them do not confirm these results [28,29,30]. The statistical results performed on our sample join those studies stating that the Body Mass Index has no influence on the functional outcome of total hip arthroplasty.

Using the Harris hip score to assess the preoperative functional status, we tried to determine whether the preoperative condition has a predictive value of the result, as stated in the specialized literature [31]. Out of the whole sample studied, 17 patients had a preoperative functional status assessed with a score lower than 35 points, hence with a major dysfunction. The average preoperative Harris score under 35 points was 27.94. The average value at 3 months after surgery was 82.62, slightly below the overall average Harris hip score after 3 months (85.89) and statistically insignificant. Within the group of patients with a preoperative Harris score lower than 35 points, after 3 months, the patients assessed the quality of their life as being mediocre in 2 cases, good in 9 cases, very good in 4 cases and excellent in 2 cases. In order to convince ourselves of the predictive role of the preoperative functional status, we also selected the 22 patients who had a preoperative Harris score higher than 45 points. The average preoperative Harris hip score was of 48.95 points, higher than the preoperative average Harris hip score of the whole sample (40.06). The average Harris hip score at 3 months after the prosthesis implantation was of 85.85 points, very close to the average of the whole sample (85.89). The quality of life was considered as mediocre in 4 cases, good in 7 cases, very good in 10 cases and excellent in one case. While within the group having an average preoperative Harris hip score below the overall average, the quality of life was mainly assessed as good (9 of 17 cases), within the group having an average preoperative Harris hip score above the overall average, the quality of life was mainly assessed as very good (10 of 22 cases). Therefore we can conclude that the predictive value of the preoperative functional status is real, but only informative.

We tried to assess whether there is a match between the Harris hip score at 3 months after the prosthesis implantation and the subjective assessment of the patient regarding the quality of life. To this purpose, we calculated an average Harris hip score at 3 months postoperatively, in each of the 4 categories of life quality. As against the average Harris hip score, calculated for the entire sample, at 3 months after surgery, which was 85.89, the average value was 69.08 for the assessment as mediocre, 84.32 for the assessment as good (close to the average of the entire sample), 91.75 for the assessment of life quality as very good and 94.80 for the assessment as excellent, both last values exceeding the average of the sample. We believe that between the assessment of the postoperative Harris hip score and the ratings on the quality of life, except for some special cases (e.g. postoperative Harris score 87.80 - a mediocre quality of life or a postoperative Harris score of 71.15 points - a very good quality of life) there is a good consistency.

Conclusion

From this study we concluded that several factors are of primary importance to obtain good functional results, due to recovery after primary total hip arthroplasty. Beginning an early recovery program, from the very day of surgery, applying it gradually until reaching exercises against resistance, its integrative aspect oriented mainly towards gaining independence of movement and walking recovery, careful adaptation to the patient's characteristic features related to age, weight status, opposite hip status and, within each group, to the physical possibilities of the operated patient as well as continuation of the recovery program at home, even unattended by the physiotherapist, all these represent the main factors that determined a great uniformity of the achieved results. An important negative factor consists in the early abandonment of rehabilitation, as soon as the patient reaches home. Factors such as old age, obesity or the unoperated hip with a functional impairment are not limiting and do not prevent achieving satisfactory results. The preoperative functional status (determined by Harris score) has a predictive, but only informative value for the final result. Between the assessment of the therapy team (Harris hip score) and the subjective assessment of the patient (quality of life) there is a good consistency.

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