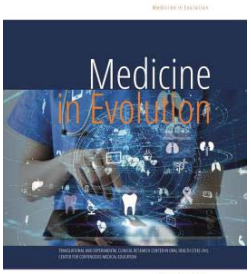
Factors influencing the postoperative evolution of patients underwent total hip arthroplasty



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Abstract

This study aimed to explore the preoperative risk factors related to blood transfusion after hip arthroplasty and the benefits of anterior approach over the traditional lateral approach and to determine the influence of selected factors on the intensity of postoperative pain after hip total hip arthroplasty.

Methods: Patients underwent preanesthetic assessment, checking preoperative hemoglobin (Hgb) levels and reassessing on the first and second postoperative days. We also controlled postoperative pain according to our pain control protocol to track opioid need at 6, 12, 24, 48, 96 hours after hip arthroplasty.

Results: Risk factors affecting postoperative blood transfusion were highly correlated with preoperative Hgb level. In anterior approach the needed quantities of opioids is lower.

Keywords: Blood transfusion, postoperative pain, total hip arthroplasty

INTRODUCTION

Total hip arthroplasty (THA) is the primary most common orthopedic surgery to alleviate hip pain duet to degenerative diseases by replacing pathogenic hip joint to artificial joint, resulting in improved quality of life [1,2]. The success of THA for the treatment of symptomatic osteoarthritis of the hip is well recognized and the operation has been described as the operation of the 20th century [3].

The anterior approach is a minimally invasive technique that involves accessing the hip joint from the front of the hip, rather than the side or back. This approach has several advantages over the traditional lateral approach. First of all, it has been shown to result in less postoperative pain, which is due to the fact that the muscles and soft tissues around the hip joint are not disrupted during surgery. Additionally, the anterior approach is associated with a faster recovery time, as patients are able to start weight-bearing on the affected hip much sooner after the surgery. The lateral approach is the more traditional method of performing total hip arthroplasty. This approach involves accessing the hip join from the side of the hip and requires the surgeon to detach the muscles and soft tissue around the joint. This can result in more postoperative pain and a longer recovery time.

Inappropriate management of postoperative pain delays recovery of the patient. Pain prevents the patient from undertaking rehabilitation, induces physical and mental suffering, sleeping disorders, lowers the quality of life and increases treatment costs [4,5].

Aim and objectives

This study aimed to explore the preoperative risk factors related to blood transfusion after hip arthroplasty and the benefits of anterior approach over the traditional lateral approach and to determine the influence of selected factors on the intensity of postoperative pain after hip total hip arthroplasty.

MATERIAL AND METHODS

Data collection

Our clinical study, a prospective observational cohort study, has been conducted in the Orthopedics Department of Oradea Pelican Clinical Hospital between January 2022-December 2022 and we selected a number of 121 patients, who underwent THA after a diagnosis of osteonecrosis of the femoral head or osteoarthritis of the hip joint (degenerative, secondary). The research has been analyzed and approved by the hospitals Ethics Committee and in case of identifying an eligible patient, we proceeded to present and sign an informed consent protocol.

Exclusion criteria: age under 18, inflammatory hip arthritis, periprosthetic joint infection, history of revision surgery, patients with special devices due to severe instability, anatomical deformity, refusing participation in this study.

We split the group in two bathes. Patient went under preanesthetic evaluation, controlling preoperatory Hgb level and reevaluation on 1st and 2nd postoperative day. We also monitored postoperative pain according to our control protocol to track opioid need at 6, 12, 24, 48, 96 hours after hip arthroplasty.

Statistical analysis

The medical statistics program MedCalc® version 12.5.0.0 (MedCalc® Software, Mariakerke, Belgium) was used to store the information entered on the study sheet in a database and to perform statistical analysis. The results of the statistical tests are presented by the probability of the "null" hypothesis (p), its value below 0.05 proves a statistically

significant difference between the studied batches. Certain results will also be displayed in graphic form using the same statistical program.

Each continuous variable will be checked for the distribution of values compared to the normal population using the Kolmogorov-Smirnov test. Depending on the result of this test, the continuous variables with normal distribution will be represented by the mean and standard deviation (in brackets), and those with asymmetric distribution by the median and the 10th and 90th percentiles (in brackets). Depending on the nature of the variable, parametric (for variables with normal distribution) or non-parametric (for variables with asymmetric distribution) tests will be used. Among the parametric tests used, we mention the Student test (t-test) for independent groups, and Mann-Whitney test for the non-parametric tests.

Categorical variables will be described by their absolute values and percentages, in brackets. They will be studied using the following tests: the chi-square test with Yates' correction for continuity in the case of 2x2 frequency tables and the simple chi-square test – for the other types of frequency tables (3x2, 3x3, etc.).

In order to study the involvement of some variables as risk factors for transfusion / early mobilization, the relative risk of mortality was determined by calculating the OR (odds ratio) with a 95% confidence interval. In order to demonstrate which of these factors have independent prognostic value for mortality, a multiple regression model was constructed with gradual, conditional introduction of the variables (if $p<0.05$). The result of this test will give us the relative independent risk for each individual variable.

RESULTS

Following selection criteria, there have been included in the study a number of 121 patients, of which 6 did not sign the informed consent. Out of remaining 115 patients, a number of 66 underwent hip arthroplasty through an anterior approach, and a number of 49 through lateral approach.

Comparing the quantity of transfusion needed and the quantity of analgesic treatment in the postoperative period we show that the two groups did not differ significantly demographically and clinically at baseline. Patients divided according to the surgical technique are described with the following criteria (Table 1).

Table 1. Baseline demographic and clinical criteria for the two study arms

	Anterior approach (n=66)	Lateral approach (n=49)	Statistical significance (p)
Gender (M/F)	32/34	19/30	0,3972
Age – media (SD)	62,9 (12,5)	65,3 (10,7)	0,3080
Environment of origin (U/R)	49/17	32/17	0,4055
BMI (kg/m²) – media (SD)	28,5 (3,9)	29,9 (5,7)	0,1333
Comorbidities (percentage %)			
• **HTN**	43 (65,2)	30 (61,2)	0,4513
• **CHD**	1 (1,5)	2 (4,1)	
• **MI**	0 (0)	1 (2,0)	
• **CVA**	0 (0)	2 (4,1)	
• **DM**	13 (19,7)	10 (20,4)	
• **RhD**	1 (1,5)	1 (2,0)	
Preoperatory hemoglobin level (g/dl) – media (DS)	13,8 (1,4)	13,5 (1,5)	0,2458

M = male, F = female, SD = standard deviation, U = urban, R = rural, BMI = body mass index, HTN = hypertension, CHD =coronary heart disease, MI = previous myocardial infarction, CVA = cerebrovascular accident, DM= diabetes melitus, RhD = rheumatic disease

Among the clinical criteria, only the body mass index BMI showed differences between the two groups, being lower among patients with anterior approach, but this difference did not reach the threshold of statistical significance either. So, we can state that the two groups were comparable in preoperative condition.

To describe the comparative bleeding risk for the two surgical techniques we have presented in the following table both evolution of the hemoglobin level and blood transfusion requirement in the first two postoperative days, along with the total number of RBCs administered. (Table 2).

Table 2. Comparison of study groups in terms of blood loss

	Anterior approach (n=66)	Lateral approach (n=49)	Statistic significance (p)
Preoperatory hemoglobin level (g/dl) – media (SD)	13,8 (1,4)	13,5 (1,5)	0,2458
Postoperatory hemoglobin level day 1 (g/dl) – media (SD)	11,3 (1,3)	11,4 (1,5)	0,6933
Postoperatory hemoglobin level day 2 (g/dl) – media (SD)	10,3 (1,2)	10,5 (1,4)	0,2311
Intraoperatory transfusion needed - nr. of patients (%)	1 (1,5)	2 (4,1)	0,7931
Postoperatory transfusion needed, day 1 - nr. of patients (%)	4 (6,1)	3 (6,1)	0,7035
Postoperatory transfusion needed, day 2 - nr. of patients (%)	3 (4,5)	5 (10,2)	0,4186
Total number of RBCs units perfused – media (IQR)	1 (1-1,5)	1 (1-1,75)	0,5390
SD= standard deviation, IQR = interquartile range, RBCs = washed red blood cells			

The values remain comparable on the 2nd postoperative day, both in terms of the hemoglobin level (Figure 1) and the blood transfusion requirement.

Analyzing data that could constitute a risk factor for postoperative transfusion, we built a logistic regression model targeting postoperative blood transfusion. Thus, we included age, gender, preoperative hemoglobin levels, comorbidities and type of surgical approach in the model. The results show us that in this research only the low level of preoperative hemoglobin was an independent risk factor for postoperative transfusion: relative risk = 0.3866 (95% CI: 0.23-0.64), $p < 0.0001$. So, neither age, nor comorbidities, nor surgical technique contributed to the risk of blood transfusion for these patients.

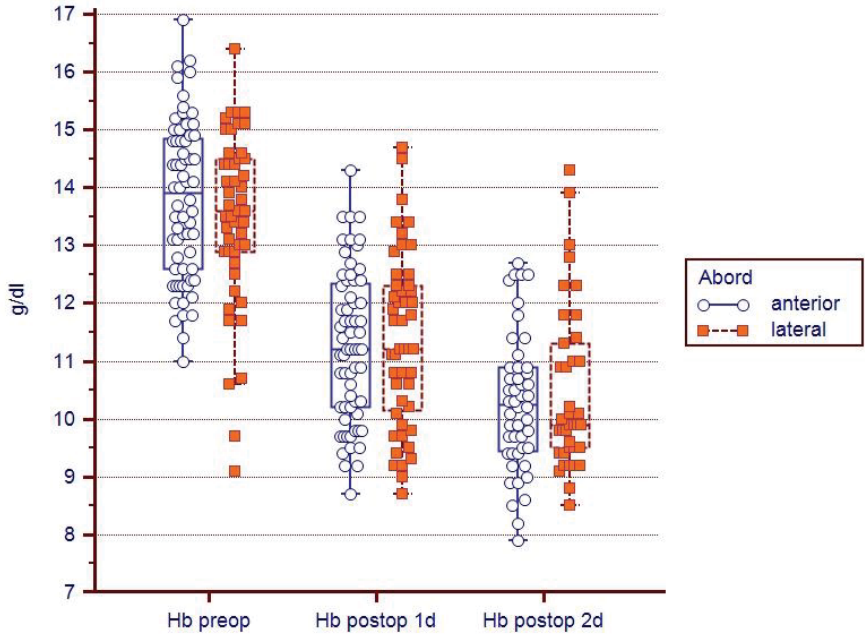

Figure 1. Postoperative hemoglobin level (Hbg) evolution (1d/ 1st = day 1, 2d/ 2nd = day 2) for the two study groups (mean values and standard deviation with scoring of all values)

The efficacy of postoperative analgesia was checked by noting the pain scores in the study sheets, at regular intervals. The results of these values, summarized in the following table (Table 3), show us that pain relief was effective in both groups of patients, the medians not exceeding a score of 3 in the first 4 postoperative days. To achieve this goal, comparable doses of opioids were needed for the two groups of patients (Table 3).

Table 3. Comparison of study groups in terms of postoperative analgesia needed

	Anterior approach (n=66)	Lateral approach (n=49)	Statistic significance (p)
Postoperator VAS at 6 hours – media (IQR)	0 (0-0)	0 (0-0)	0,6594
Postoperator VAS at 12 hours– media (IQR)	0 (0-2)	1 (0-3)	0,1355
Postoperator VAS at 24 hours – media (IQR)	3 (2-5)	3 (2-5)	0,4834
Postoperator VAS at 48 hours – media (IQR)	2,5 (2-4)	3 (1-5)	0,8844
Postoperator VAS at 72 hours – median (IQR)	1 (0-3)	1 (0-3)	0,6563
Postoperator VAS at 96 hours – media (IQR)	0 (0-0)	0 (0-2)	0,3465
Tramadol (total quantity perfused) in postoperatory period (mg) - media (IQR)	200 (150-200)	150 (150-300)	0,5303
Morfin (total dose perfused) in postoperatory period (mg) - media (DS)	10 (7,5-15)	10 (7,5-15)	0,7663
IQR = interquartile range, SD = standard deviation, VAS = pain visual analog scale			

DISCUSSIONS

The conducted study concerned the determination of the influence of selected factors on the intensity of postoperative pain after hip arthroplasty and blood transfusion needed. The analysis included the dependence of the pain intensity on the type of approach performed. The time that elapses after the surgery affects the intensity of postoperative pain. The highest intensity of pain occurs on day 0 and decreases in the following days. There are reports confirming this relationship in the literature. In the research conducted by Sobieralska-Michalak K. *et al*., the respondents experienced the greatest pain on day 0 and the lowest on day 3 postoperatively [6].

Our study indicated that the sex of the patients did not significantly affect the level of the perceived intensity of postoperative pain. Mei W. et al. reported that female sex belongs to the group of independent risk factors for the development of postoperative pain shortly after a surgical procedure [7]. Kołodziej W. and Karpel E., proved that more pain intensity occurs in women than in men [8] Regardless of the type and extent of surgery, women reported slightly higher pain scores in the research of Gerbershagen HJ *et al*. [9]. Haghighi M.J. *et al*., in their studies, showed that in patients undergoing general surgery, the mean pain intensity was significantly higher in men than in women [10]. There is no consensus in the literature regarding pain perceiving. This is the reason why we have not split the study group based on gender, but we wanted to see the intensity of pain corelated with the type of the surgical approach and the need of analgesics used, including opioids.

Orthopedic procedures turned out to be among the most painful procedures [11]. The postoperative analgesic medication is standard for all types of surgical procedures. The difference is in the needed quantity of opioids and that is the main goal of our study to see the required quantity of morphine and tramadol in the two type of approach.

Fu Cheng Bian *et al*. proves that risk factors affecting postoperative blood transfusion were highly correlated with preoperative Hgb, type of anesthesia, TXA, and age [12]. Our study proves the same regarding correlation of needed blood transfusion and preoperative Hgb level and we did not found any correlation in between age and blood transfusion.

CONCLUSIONS

Patients report the strongest pain on the day of the procedure, with a decreasing tendency in the following days. In anterior approach the needed quantities of opioids are lower and is justified by the lower trauma level of anatomical structures. The mean factor that influences the quantities of needed blood transfusion is preoperative hemoglobine level.

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