



RESEARCH ARTICLE

RISK FACTORS FOR COMPLICATIONS IN HIP ARTHROPLASTIES:
A CONFINING STUDY OF 1220 PATIENTS

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ABSTRACT

Objective: As mean life expectancy increases in recent years, it is evident that hip fractures will constitute a severe health problem in future. The number of hip arthroplasties will increase accordingly. We aimed to examine the factors which are related to complications in our patient population.

Methods: Retrospective evaluation of the medical reports of hip arthroplasty patients in University of Health Sciences Kartal Dr. Lutfi Kirdar Education and Research Hospital between January 2012 and December 2017 was performed. Age, gender, American Society of Anesthesiology (ASA) grade, clinical comorbidities, anesthesia type, type of operation, length of surgery, blood transfusion requirement, complications, intensive care unit requirement, were documented.

Results: During the study period, 1220 patients (530 male, 690 female) were included to the study. Mean age of the patients was 63.1 ± 7.7 . Out of 1220 patients, 35.1% (n=428) were operated under general anaesthesia, 29.2% (n=356) under combined spinal-epidural anaesthesia, 22.1% (n=270) under spinal anaesthesia, and 13.6% (n=166) under epidural anaesthesia. Mean hospital stay was five days in the general anesthesia group and seven days in the regional anesthesia group. Cox regression analysis showed that ASA, comorbidities, type of operation, length of operation and transfusion were associated with a higher risk of complication ($p < 0.05$). Age, gender, and type of anesthesia had no relationship with risk of complication ($p > 0.05$).

Conclusion: The risk factors of complications in hip arthroplasties should be carefully evaluated in surgical preparation of hip arthroplasties, and proper procurement of equipment and medications will be helpful in decreasing mortality rates.

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INTRODUCTION

Geriatric patients are vulnerable to environmental traumas due to decrease in reflexes, systemic disorders and cerebrovascular diseases. Their bones are also susceptible to fractures because of the decrease in bone mass (Vidan *et al.*, 2005). Hip arthroplasties have high morbidity and mortality rates depending on the characteristics of both the patients and the surgical procedure (Davis *et al.*, 1987). Today there is a controversy about which type of anesthesia is safe in these operations (Rodgers *et al.*, 2000). Several studies reported that regional anesthesia decreased blood loss and as a result the demand for transfusions. They were also claimed to reduce venous embolism, myocardial infarction and the mortality in these studies (Keith, 1977; Borghi *et al.*, 2002).

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But regional anesthesia has some disadvantages like insufficient block, delay at the beginning of the operation and the demand of an experienced anesthesiologist for proper establishment of the procedure (Becchi *et al.*, 2008; Oldman *et al.*, 2004). In this study, we aimed to examine the factors which are related to complications in our hip arthroplasty patient population.

Patients and methods

After ethical approval by the institutional committee, retrospective evaluation of the medical reports of hip arthroplasty patients in University of Health Sciences Kartal Dr. Lutfi Kirdar Education and Research Hospital between January 2012 and December 2017 was performed. The demographic data, ASA scores, the methods of anesthesia, the type of hip arthroplasties, the length of the operations, preoperative comorbidities, transfusions during the procedures and the intraoperative complications were recorded.

For the statistical analysis of the results, SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc. was used. Descriptive statistics are presented as numbers and percentages for categorical variables, and as means and standard deviation or median for numerical variables. Comparison of the two independent groups of variables was carried out using Student's t-test if the data were normally distributed, or the Mann-Whitney U test when normality criteria were not met. Chi-square analysis evaluated the differences between categorical variables. A statistical α (alpha) significance level was accepted when the p-value was below 0.05. A Cox multiple regression models were used to assess complication risk (hazard ratio (HR)) with a 95% confidence interval (CI) and with adjusted hazard ratio (aHR) for ASA, age, gender, comorbidities, anesthesia management, type and length of operation, transfusions.

RESULTS

In the period of the study entirely 1220 patients were operated. Mean age of the patients was 63.1 ± 7.7 . Mean length of the operations was 244.7 ± 57.8 minutes (Table 1).

Table 1. The distribution of various characteristics (Mean \pm SD)

Variable	Mean \pm SD
Age (year)	63.1 \pm 7.7
Weight(kg)	66.5 \pm 4.5
Length(cm)	159 \pm 24.7
Length of operation(min)	244.7 \pm 57.8

Table 2. The distribution of various characteristics (n; %)

Variable	N	%	
ASA	I	143	11.8
	II	410	33.6
	III	519	42.5
	IV	148	12.1
Age (year)	50-59	420	34.7
	60-69	590	48.8
	70-79	160	13.2
	80<	40	3.3
Gender	Female	690	56.6
	Male	530	43.4
	HT	340	27.9
	Comorbidities (In total 710 patients)	COPD	260
	DM	70	5.7
	CAD	20	1.6
Anesthesia management	General	428	35.1
	Combined Spinal-Epidural	356	29.2
	Epidural	270	22.1
	Spinal	166	13.6
Type of operation	Total Hip Arthroplasty	783	64.2
	Partial Hip Arthroplasty	437	35.8
Length of operation(min)	100-199	200	16.4
	200-299	770	63.1
	300<	250	20.5
	Complications (In total 118 patients)	Hypotension	53
	Bradycardia	60	4.9
	Cardiac arrest	2	0.2
	Emboli	3	0.2
Transfusion during the operation (In total 771 patients)	Total Hip Arthroplasty	682	55.9
	Partial Hip Arthroplasty	89	7.3

ASA: American Society of Anesthesiology, HT: Hypertension, COPD: Chronic Obstructive Pulmonary Disease, DM: Diabetes Mellitus, CAD: Coronary Artery Disease

690 (56.6%) of the patients were male, and 530 (43.4%) of them were female. 145 (11.8%) of the patients were in ASA I, 410 (33.6%) of them were in ASA II, 519 (42.5%) of them

were in ASA III, and 148 (12.1%) of them were in ASA IV group. The type of anesthesia was general anesthesia in 428 (35.1%) patients, combined spinal-epidural anesthesia in 356 (29.2%) patients, spinal anesthesia in 270 (22.2%) patients and epidural anesthesia in 166 (13.6%) patients. 783 (64.2%) of the operations were total hip arthroplasty, and 437 (35.8%) of them were partial hip arthroplasty (Table 2).

In 710 of the total 1220 patients, there were preoperative comorbidities. These comorbidities were Hypertension (HT) in 340 patients, Chronic Obstructive Pulmonary Disease (COPD) in 260 patients, Diabetes mellitus (DM) in 70 patients and Coronary Artery Disease (CAD) (Table 2). The number of transfusions was significantly high in total hip arthroplasty group ($p < 0.05$) (Table 3).

Table 3. Distribution of transfusions due to the type of operation

Type of operation	Transfusion (In total 771 patients)		P
	n	%	
Total Hip Arthroplasty	682	55.9	0,0
Partial Hip Arthroplasty	89	7.3	15

* $P < 0,05$; significant

In 118 of the total 1220 patients, there were complications during the surgery. When we examine these complications, hypotension in 53 patients (4.3%) and bradycardia in 60 patients (4.9%) were the most common two complications. Pulmonary embolism in 3 patients (0.2%) and cardiac arrest in 2 patients after insertion of the cement were rare complications. These two cardiac arrest patients were in spinal anesthesia group. We observed hypotension in 12% of the general anesthesia group and 30% of the regional anesthesia group (Table 2). There was no significant difference between different types of anesthesia about the complications ($p > 0.05$) (Table 4).

Table 4. Distribution of complications due to anesthesia management

Anesthesia management	Complications (In total 118 patients)		P
	n	%	
General	35	(29.6%)	0,768
Combined Spinal-Epidural	29	(24.6%)	
Spinal	28	(23.7%)	
Epidural	26	(22.1%)	

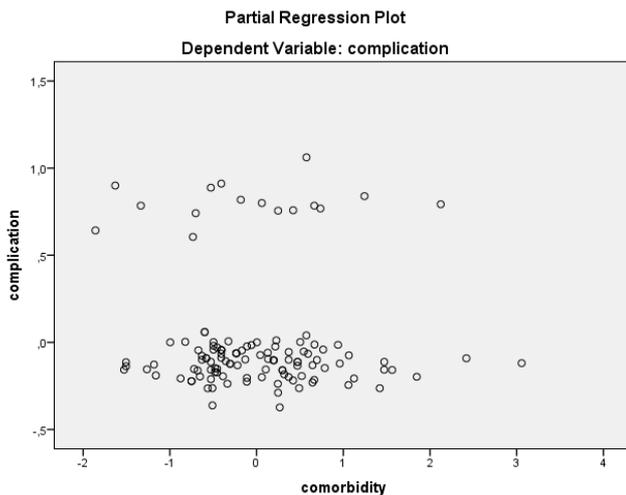
$p > 0.05$

The hospitalization frequency in intensive care unit was 40% in general anesthesia group and 25% in regional anesthesia group. Meantime of discharge was five days in regional anesthesia group and seven days in general anesthesia group. The intraoperative mortality rate was 0.2% and the mortality within postoperative 30 days was 6.2% (Table 2).

In the multivariable Cox regression model adjusted for age, gender, comorbidities, anesthesia management, type and length of operation, transfusions, ASA (aHR=1.5 (95% CI: 1.0–2.2), $p=0.02$) comorbidities (aHR=1.5 (95% CI: 1.1–2.0), $p=0.003$), type of operation (aHR=1.5 (95% CI: 1.1–2.0), $p=0.02$), length of operation (aHR=1.5 (95% CI: 1.1–2.0), $p=0.011$) and transfusion (aHR=1.5 (95% CI: 1.1–2.0), $p=0.002$) were associated with a higher risk of complication ($p < 0.05$). Age, gender and type of anesthesia had no relationship with risk of complication ($p > 0.05$) (Table 5) (Graphic 2).

Table 5. Regression analysis of various parameters with complications in the operations

Parameter	Pearson Correlation	P value
Age	0,003	0,486
Gender	0,031	0,371
ASA	0,193	0,02*
Comorbidites	0,252	0,003*
Anesthesia management	0,013	0,445
Type of operation	0,192	0,02*
Length of operation	0,215	0,011*
Transfusion	0,352	0,002*

**Graphic 1. Distribution of operations due to years****Graphic 2. Partial regression plot**

DISCUSSION

Today, the anesthesia management in hip arthroplasties is a controversial issue. Several researchers studied which method of anesthesia is safe in these patients and published a meta-analysis concerning the decrease of risk of mortality, venous embolism, intraoperative blood loss and myocardial infarction by regional anesthesia such as spinal and epidural anesthesia (Rodgers *et al.*, 2000; Salvati *et al.*, 2000; Neuman *et al.*, 2012). Many factors may have a role in morbidity and mortality in hip arthroplasties, but the way of anesthesia have a limited effect in decreasing the mortality and morbidity in these patients. The choice of anesthesia method depends on the preference of the patient, comorbidities of the patient, the experience of the anesthesiologist and the type of the surgery (Karaca *et al.*, 2012; Luger *et al.*, 2010). In our study, both general and regional anesthesia was used in patients, and the frequency of regional techniques (spinal, epidural and combined) was 64.9%. In a study, the authors conclude that there was a tendency to regional methods in these operations (Liu *et al.*, 2009).

Our results are compatible with this review with a higher number of regional anesthesia. Regional anesthesia was preferred in patients with older ages, higher ASA scores and with several comorbidities but our results offered no relationship with the complications observed during the operations in Cox regression analysis. Also, the number of complications seen in different types of the anesthesia techniques were not significantly different. Several studies concluded many factors affecting the morbidity and the mortality after administration of different anesthesia techniques. Advanced age, cardiovascular and pulmonary disorders, diabetes mellitus, were reported to have a relationship with the increase in mortality independent from the type of the anesthesia (Mangano *et al.*, 1990; Larsen *et al.*, 1987; Bilsel *et al.*, 2013; Kopp *et al.*, 2009; Meyer *et al.*, 2000). There are not so many studies about the mortality in hip arthroplasties performed with general or regional anesthesia. The mortality rate within one year after hip arthroplasty was 25% (Liu *et al.*, 2009). In another retrospective study, mortality in 30 days after the operation was 4.4% in general anesthesia group and 5.4% in regional anesthesia group (O'Hara, 2009).

Intraoperative mortality rate was 0.2%, the mortality rate within 30 days after the operation was 6.4% (4.6% in regional anesthesia; 4.8% in general anesthesia) in our study. Our results are compatible with the results of the previous reviews. The most common intraoperative complication in our patient group was hypotension. It was 12% in general anesthesia group and 30% in regional anesthesia group. Hypotension in these patients was an expected symptom due to loss of vascular tonus in regional anesthesia (O'Hara *et al.*, 2000). The prominent hypotension observed after implication of the cement may result in cardiac arrest and death. Cardiac arrest was observed in 2 patients, and embolism was recorded in 3 patients after insertion of the cement. All of these patients had a positive response to cardiopulmonary resuscitation. Pulmonary embolism is a destructive complication of the total hip arthroplasty. Its incidence is 0.2-2% (Meyer *et al.*, 2000). Regional anesthesia may decrease profound venous thrombosis incidence from 56% to 29% and pulmonary embolism from 20% to 7.2% (19). Epidural anesthesia was reported to reduce stress response to the surgical operation, postoperative hypercoagulopathy and postoperative respiratory depression (Go, 1996; Önal, 2005). It also decreases the intraoperative bleeding and the demand for transfusion (Morrison *et al.*, 1998). One may think that regional techniques may delay the beginning of the operation due to the delay of maintenance of the block, the probability of return to general anesthesia but Parker *et al.* (Parker, 2006) reported that the method of anesthesiology has no role in the length of anesthesia. Our results are also compatible with this study. Another concept in this concern is the demand of intensive care unit follow up of these patients. 40% of the patients in general anesthesia group and 25% of the patients in regional anesthesia group were hospitalized in intensive care unit. We think that comorbidities of the patients have a central role in demand of intensive care unit follow up. Kaufmann *et al.*, 2002 reported the decrease of intensive care unit follow up in patients with regional anesthesia in hip arthroplasty operations. Regional anesthesia may also decrease the mechanical ventilation in intensive care unit follow up (Weissman, 2000). Meantime of discharge was five days in regional anesthesia group and seven days in general anesthesia group. These numbers were also compatible with the calculated 4.5 days of discharge in a recent study (Liu

et al., 2009). As a result, some factors are important in complications and mortality of the geriatric hip arthroplasty patients. Ercin E et al. found transfusion requirement, ASA grade 4 and having comorbidities are risk factors for mortality in geriatric hip fractures. Our results are similar to this recent study as ASA, comorbidities, type of operation, length of surgery and transfusion were found as associated with a higher risk of complication ($p < 0.05$). Age, gender, and type of anesthesia had no relationship with risk of complication ($p > 0.05$). Our study is a retrospective type of an investigation. In multivariate analysis, there are no patients without surgery. Some other characteristics like bone mineral density, body mass index and smoking status may be studied. These may be the limitations of the study. In conclusion; as mean life expectancy increases in recent years, it is evident that hip fractures will constitute a severe health problem in future. The risk factors of complications in hip arthroplasties as defined in this study and other studies should be carefully evaluated in surgical preparation of hip arthroplasties, and proper procurement of equipment and medications will be helpful in decreasing mortality rates.

Compliance with ethical standards

Funding: Any institution did not fund this study.

Conflict of interest: The authors declare that they have no competing interest.

Ethical approval: All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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