



## ORIGINAL ARTICLE

# Effect of regional or general anesthesia methods on mortality according to age groups in geriatric hip surgery patients

*Geriatrik kalça cerrahisi hastalarında rejyonal ve genel anestezi yöntemlerinin yaş gruplarına göre mortaliteye etkisi*

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## Summary

**Objectives:** Hip surgeries performed in elderly patients are important in terms of both the physiological features of geriatric patients and the risks of surgery. The aim of this study was to evaluate the effects of age and the anesthesia method used on morbidity and mortality in geriatric patients who had hip surgery.

**Methods:** Patients who were aged 65 and older who also had hip surgery and had American Society of Anesthesiologists (ASA) Physical Status Scale scores were included in the study. The patients were classified as aged (Group AG) for those  $\geq 65$  years of age, and very aged (Group VAG) for those  $\geq 75$  years of age. Details obtained from the hospital electronic records system of the patients' age, sex, ASA score, anesthesia method used, intraoperative and postoperative blood transfusion requirements, respiratory and cardiovascular complications, postoperative intensive care requirements, duration of hospital treatment, period of development of any postoperative complications, morbidity, and mortality were evaluated by age group.

**Results:** A total of 258 patients between the ages of 65 and 95 who had hip surgery and available ASA scores were included in the study. In Group VAG, the rate of morbidity and mortality of ASA III and IV patients was high in the postoperative period. Regional anesthesia methods were used more often in Group VAG patients, and there were more cardiovascular complications developing in the intraoperative period in the general anesthesia patients, although there was no difference between anesthesia methods in terms of postoperative morbidity and mortality.

**Conclusion:** In this study of elderly patients who had hip surgery, there was no correlation between the anesthesia method used and morbidity and mortality. Advanced age ( $\geq 75$  years) and a high ASA score were the most important risk factors for mortality.

Keywords: Anesthesia; general; geriatrics; regional; hip surgery.

## Özet

**Amaç:** Çalışmamızda kalça cerrahisi geçiren geriatrik dönem hastalarında yaş faktörünün ve anestezi yöntemlerinin morbidite ve mortalite üzerine olan etkilerini değerlendirmeyi amaçladık.

**Gereç ve Yöntem:** Kalça cerrahisi geçiren, ASA I-IV grubuna giren, 65 yaş ve üstü hastalar çalışmaya dâhil edildi. Hastalar, yaşlı grup ( $\geq 65$  yaş) Grup YG ve çok yaşlı ( $\geq 75$  yaş) Grup ÇYG olarak sınıflandırıldı. Hastane elektronik kayıt sisteminden hastaların yaşı, cinsiyeti, ASA skoru, anestezi yöntemleri, intraoperatif ve postoperatif kan transfüzyonu gereksinimi, solunum ve kardiyovasküler komplikasyonlar, postoperatif yoğun bakım ihtiyacı, hastanede kalış süreleri, postoperatif dönemde komplikasyonların gelişme süresi, rejyonal ve genel anesteziye göre morbidite ve mortalite oranları yaş gruplarına göre değerlendirildi.

**Bulgular:** Kalça cerrahisi geçiren ASA I-IV grubuna giren 65 ile 95 yaş arasında toplam 258 hasta çalışmaya dâhil edildi. 75 yaşın üzerindeki Grup ÇYG, ASA III ve IV hastaların postoperatif dönemde morbidite ve mortalite oranları yüksek bulundu. Ayrıca Grup ÇYG hastalarında rejyonal anestezi yöntemlerinin daha çok tercih edilirken, anestezi yöntemleri arasında postoperatif morbidite ve mortalite açısından farklılık olmamak ile birlikte intraoperatif dönemde gelişen kardiyovasküler komplikasyonlar genel anestezi uygulanan hastalarda daha yüksek bulundu.

**Sonuç:** Kalça cerrahisi uygulanan hastaların yaş grupları ve anestezi yöntemlerine göre karşılaştırıldığı bu çalışmada uygulanan anestezi yöntemleri ile morbidite ve mortalite ilişkilendirilememek ile birlikte, mortalite için ileri yaş ( $\geq 75$  yaş) ve yüksek ASA skoru en önemli risk faktörleridir.

Anahtar sözcükler: Anestezi; rejyonal; genel; geriatri; kalça cerrahisi.

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## Introduction

The geriatric population is increasing as the life has prolonged due to the improvement of life standards. Accordingly, hip fracture cases are more frequently seen, and moreover, this situation continues to be an important reason for death and disabilities among old people. Hip fractures are serious injuries, with an estimated annual incidence of more than 1.5 million worldwide. Mortality in the first-year changes between 15–30% in hip fracture cases.<sup>[1–5]</sup> Going back to the functional level before the fracture in these patients is possible by the best surgical treatment.<sup>[2–4]</sup>

Substantial evidence indicates that anesthesia type influences clinical outcomes following hip fracture surgery, but the exact effects of differing types of anesthesia are elusive and controversial. Previously, the American College of Surgeons National Surgical Quality Improvement Program provided important information, but controversy between anesthesia types continued. Several investigations have attempted to determine whether regional anesthesia offers benefits over general anesthesia for surgeries generally, but evidence remains conflicting.<sup>[2,3,6–8]</sup> However, discussions on the selection of the most appropriate anesthesia are continuing.<sup>[4]</sup>

In this study, we have had a retrospective search on the effects of age factors and anesthesia methods on mortality in patients who had hip surgery in the geriatric period.

## Materials and Methods

258 patients who were at the age of 65 and older, who had hip surgery and involved in ASA I-IV group were included in the study. Information was obtained from the hospital's electronic registration system, patient files, anesthesia follow-up forms and the Ministry of Health, Public Health Institution, Death Notice System. Files of patients who have taken anesthesia and had another operation within 6 months after the hip surgery or had an operation in another region and the hip surgery at the same time were not included in the study.

Data from the hospital's electronic registration system and patient files on Patients' age, sex, ASA score, intraoperative and postoperative blood transfusion requirement, preoperative and postoperative respi-

ratory complications (peripheral oxygen saturation  $\leq 90\%$ , pulmonary thromboembolism, mechanical ventilation need, etc.) and cardiovascular complications (bradycardia, ventricular extrasystole, hypotension, etc.), postoperative intensive care requirement, period of staying at the hospital, delirium, period of development of complications in postoperative period, and whether they had taken anesthesia and had another operation within 6 months after the orthopedic surgery were evaluated by age groups.

From the anesthesia follow-up forms, the anesthesia method administered to the patients, duration of the surgery, complications developed in the intraoperative period, intraoperative period blood transfusion requirement and how the patients have come out of the operation were recorded.

Dates of death were obtained from the Death Notice System. Considering the dates of surgeries obtained from the hospital's electronic registration systems and patient files, mortality situations within the 6 months were determined by dates of death.

After obtaining data from patient files, patients were taken for evaluation in two groups according to anesthesia methods, ASA Scores and the surgery type applied.

Groups were classified as Aged Group (AG): patients between 65–74 years of age including 65 and Very Aged Group (VAG): patients who are 75 years of age and older, including 75.

Patients were evaluated both as ASA scores and ASA Score Groups in terms of ASA scores. Patients with no additional disease or with an additional disease at the mild level were grouped as ASA Group (I-II) and with the more severe additional disease or having organ failures were grouped as ASA Group (III-IV). Approval was obtained from the local ethics committee before beginning the study.

## Statistical evaluation

While evaluating the findings obtained in the study, SPSS (Statistical Package for Social Sciences) for Windows 21.0 program was used for statistical analyses. In presenting the descriptive analyses, mean, standard deviation, median and minimum-maximum values were used. The compatibility of variables

**Table 1.** Intraoperative complication frequency by anesthesia methods

	General anesthesia (n=141)		Regional anesthesia (n=117)		p
	n	%	n	%	
Intraoperative hypotension development	77	62.6	46	37.4	0.014 <sup>a</sup>
IntCC development	82	63.4	48	36.9	0.006 <sup>a</sup>
Intraoperative blood transfusion need	42	76.4	13	23.6	<0.001 <sup>β</sup>

IntCC: Intraoperative cardiovascular complications; IntRC: Intraoperative respiratory system complication; α: p<0.05; β: p<0.001.

with normal distribution was reviewed by histogram graphics and Kolmogorov-Smirnov test. T-Test was used when variables showing normal distribution (parametric) which evaluated in independent groups and Mann Whitney U test was used when variables not showing normal distribution (nonparametric) were evaluated. Kruskal Wallis analysis test was used in evaluating variables involving more than two groups and not showing normal distribution. Spearman Correlation Test was used in the analysis of measurable data with each other. As univariate, factors correlated with mortality were analyzed by logistic regression and the 'Enter' method was used. Results were evaluated in 95% confidence interval, at p<0.05 and p<0.001 significance levels.

## Results

258 patients in total between the ages of 65 and 95 (avg.±sds: 76.83±8.21), who had hip surgery and involved in ASA I-IV group were included in the study. 157 of the patients (60.9%) were female and 101 of them (39.1%) were male. Regarding the age groups, there were 104 patients (40.3%) in the aged group and 154 patients (59.7%) in the very aged group. 124 patients (48.1%) underwent closed reduction and internal fixation, 104 patients (40.1%) underwent arthroplasty, 16 patients (6.1%) underwent open reduction and internal fixation, 14 patients (5.4%) underwent revision hip arthroplastic surgery. According to ASA score; 10 patients (3.9%) were determined as ASA I, 90 patients (34.9%) were determined as ASA II, 111 patients (43%) were determined as ASA III and 47 patients (18.2%) were determined as ASA IV.

According to the anesthesia method adopted, general anesthesia was applied to 141 patients (54.7%) and regional anesthesia was applied to 117 patients (45.3%). This process is applied by 4 different

methods to patients in which regional anesthesia is applied. Combined spinal-epidural anesthesia is administered to 46 patients, the spinal catheter is administered to 39 patients, spinal anesthesia was administered to 28 patients and the peripheral block was administered to 4 patients. Durations of the surgeries were changing between a minimum of 1 hour and a maximum of 8 hours (avg.±sds77±1.28).

While hypotension was determined as the most frequently seen complication in the intraoperative period with a rate of 47.7%, pulmonary embolism was observed only in 1 patient. Respiration problem was the most frequently developed complication in the postoperative period with a rate of 10.5%. 32 patients (12.4%) were monitored at intensive care in the postoperative period and exitus has occurred in 13 patients (5%) at the hospital.

No difference was observed between sex and ASA scores according to anesthesia methods (p>0.05). The significant difference was detected between anesthesia methods in terms of intraoperative period hypotension (p=0.014) and cardiovascular problem development (p=0.006) and intraoperative period blood transfusion requirement (p<0.001) (Table 1). While the duration of surgery in patients in which general anesthesia was applied is 2.9±1.3 hours, this period was evaluated as 2.5±1.1 in patients which regional anesthesia was applied, and the difference was significant (p<0.05). No difference was observed in postoperative complications according to the anesthesia methods (p>0.05).

Rate of regional anesthesia administration in Group VAG (70.1%) was found significantly higher compared to AG (29.9%) (p=0.001). No difference was observed in intraoperative period complications between age

**Table 2.** Anesthesia method and complication frequency by age groups

	AG (n=104)		VAG (n=154)		p
	n	%	n	%	
Anesthesia method					
General anesthesia (n=141)	69	48.9	72	51.1	0.002 <sup>α</sup>
Regional anesthesia (117)	35	29.9	82	70.1	
1 <sup>st</sup> week PostCM development (n=27)	5	18.5	22	81.5	0.015 <sup>α</sup>
Total PostCM development (n=31)	6	19.4	25	80.6	0.011 <sup>α</sup>
Postoperative delirium development (n=25)	2	8.0	23	92.0	0.001 <sup>α</sup>
1 <sup>st</sup> week postoperative general morbidity (n=78)	19	24.4	59	75.6	0.001 <sup>α</sup>
Postoperative general morbidity (n=94)	28	39.8	66	70.2	0.009 <sup>α</sup>

AG: Aged group; VAG: Very aged group; α: p<0.05; β: p<0.001.

**Table 3.** Month mortality by age groups, anesthesia method and ASA groups

	Right (n=196)		Exitus (n=62)		p
	n	%	n	%	
Age groups					
Group AG (65–74 age)	94	90.4	10	9.6	<0.001 <sup>β</sup>
Group VAG (≥75 age)	102	66.2	52	33.8	
Anesthesia method					
General anesthesia	113	80.1	28	19.9	0.085
Regional anesthesia	83	70.9	34	29.1	
ASA group					
I-II	95	95.0	5	5.0	<0.001 <sup>β</sup>
III-IV	101	63.9	57	36.1	

AG: Aged group; VAG: Very aged group; α: p<0.05; β: p<0.001.

groups. The operation period in Group AG (average  $3.19 \pm 1.47$ ) was found significantly high compared to VAG (average  $2.49 \pm 1.04$ ) ( $p < 0.001$ ). A significant difference was determined between two groups in terms of the 1<sup>st</sup> week and total postoperative cardiovascular morbidity (PostCM) development and postoperative 1<sup>st</sup> week and total developing morbidities ( $p < 0.05$ ). Besides, it was observed that delirium development in the postoperative period was significantly high in Group VAG ( $p < 0.001$ ) (Table 2).

Mortality rates were found at 5% within the hospital, 2.7% within the first 7 days, and 24% for 6 months. While no difference was observed in mortality developed within 7 days in terms of ASA, age groups and anesthesia methods, significant results were obtained in mortality developed within 6 months between age groups and ASA groups (Table 3).

The significant difference was found between age groups in terms of 6-month mortality development ( $p < 0.001$ ). It was detected that there was a significant relation between ASA groups in terms of 6-month mortality ( $p < 0.001$ ) and mortality was significantly increased in those with a high ASA score. It was found that 57 (91.9%) of 62 patients which mortality had developed were determined among ASA III and IV score.

When factors correlated with mortality were univariately analyzed by logistic regression; it was detected that mortality risk between age groups in Group VAG had increased by 3.22 (95% G.A. 1.457–7.116) compared to Group AG, and ASA score being III-IV had increased mortality risk by 14.348 (95% G.A. 4.508–45.666) compared to ASA I-II ( $p < 0.05$ ) (Table 4).

**Table 4.** Logistic regression analysis of factors correlated with mortality

	B	S.E.	Wald	p	Exp(B)	95% CI	
						Lower	Upper
Group VAG	1.170	0.405	8.359	0.004	3.221	1.457	7.116
ASA III and IV	2.664	0.591	20.335	0.000	14.348	4.508	45.666

CI: Confidence interval; VAG: Very aged group; ASA: American Society of Anesthesiologists.

## Discussion

The importance of hip surgeries in the geriatric period is gradually increasing both for the geriatric patients' physiological features and the risks of surgery for our world with an increasing aged population. However, there is no consensus on anesthesia methods preferred and which method to be used in terms of the intraoperative and postoperative period effects. Here, we have discussed the effects of the age factor in our patients who had hip surgery and anesthesia methods on morbidity and mortality with other studies in the literature.

Various factors have impacts on mortality in hip surgeries arising mostly from hip fractures in geriatric patients.<sup>[9]</sup> Specifically, ASA score affects morbidity and mortality in hip surgery.<sup>[2-5,10]</sup> In a study where complications developing after the surgery of hip fractures in the aged patient group and comorbid situations are developed, it is stated that ASA scoring promotes early diagnosis of high-risk patients, has relations with intraoperative problems and provides forecasting in determining both intraoperative and postoperative mortality.<sup>[11]</sup> It is reported in the literature that 70% of the aged patients planned to have hip surgery are from ASA score III or IV.<sup>[9]</sup> The majority of the patients in our study are evaluated as ASA III and IV, in their distribution by age groups, ASA III and IV score patients are determined significantly high in Group VAG and have significant relation with mortality.

Anesthesia method selection in hip surgery is still a subject of discussion. Although many studies are performed on the advantages of general and regional anesthesia methods among each other, contradictions continue.<sup>[1-5,12-14]</sup> According to the news stating that Regional Anesthesia reduces postoperative confusion development, to the selection of anesthesia technique in patients in which hip frac-

ture surgery is being planned, spinal or epidural anesthesia is expressed to be in the first plan which should be thought if there is no contraindication.<sup>[15]</sup> Despite there is no material evidence on the superiority of the techniques to each other in a survey study conducted, anesthetists have preferred spinal anesthesia in patients who had femoral neck fracture surgery.<sup>[16,17]</sup> In another study which short time morbidity is evaluated in hip fractures, general anesthesia is used in the rate of 72.6% and spinal anesthesia is used in the rate of 27.4% and no difference is found in their age average.<sup>[2]</sup> In another study they found the use of general anesthesia and conversion from regional to general anesthesia were associated with a higher risk of mortality during the in-hospital stay compared with regional anesthetic techniques so they suggest regional anesthetic techniques may be preferred when possible in this patient population.<sup>[18]</sup> Although general and regional anesthesia is applied in equal rates to our patients here, regional anesthesia is preferred at a high rate in Group VAG.

Hip fractures in the geriatric population may cause an economic burden for the health system as they are under risk in terms of morbidity development in the postoperative period. Various factors as advanced age, cardiovascular disease, and respiratory system diseases affect morbidity risk after surgery. Many studies are examining the effect of anesthesia methods on postoperative morbidity development.<sup>[14-21]</sup> In a study in which general and regional anesthesia methods are compared in hip replacement, surgical wound infection, cardiovascular and respiratory system complications are found significantly low in regional anesthesia.<sup>[1]</sup> In our study, it is observed that most frequently developed morbidities in the postoperative period are respiration problem and delirium. No difference is seen in terms of morbidity development and anesthesia methods. On the other hand, significant results are observed in the evalua-

tion of morbidity in age groups and determined that cardiovascular system morbidities developed in total and in the first 7 days and general morbidities developed in the first 7 days and total are more in Group VAG. When postoperative morbidities are evaluated according to ASA scores, a significant increase is determined in the postoperative cardiovascular, respiratory system and general morbidity in patients in ASA III or IV, in a way supporting the literature. Significant morbidity increase in Group VAG may be associated with high ASA III or IV scores in Group VAG.

Many studies are performed to identify the most appropriate anesthesia method in geriatric period hip surgeries and results different from each other are obtained.<sup>[1-4]</sup> In a meta-analysis in which differences between the anesthesia methods are searched, it is reported that 1-month mortality is significantly low in patients in which regional anesthesia is applied while there is no difference in 3-month mortality.<sup>[22]</sup> In another meta-analysis, 1-month mortality is found in the rate of 6.4% in those which regional anesthesia is applied and of 9.4% in those which general anesthesia is applied, and regional anesthesia is associated with reducing early mortality.<sup>[23]</sup> In the studies of Parker and Griffiths<sup>[4]</sup> which they have compared anesthesia methods in 322 patients, 30-day mortality is found as 4.9% in those which general anesthesia is applied and as 3.2% in those which regional anesthesia is applied, and no difference is seen between two methods in terms of mortality.

In another study, it is stated that 7-day mortality may be sourced from sudden complications related to anesthesia and the first 7-day mortality is found in the rate of 1.6% in that regional anesthesia is applied and in the rate of 1.3% in that general anesthesia is applied.<sup>[13]</sup> In a study which effects of ASA score on 1-year mortality in hip fracture cases in 90 years of age are examined, it is stated that ASA score has close relation with postoperative morbidity and 1-year mortality.<sup>[24]</sup> In our study, rates of mortality development and time are found similar to those in the literature. While no relation is found between sex and anesthesia methods and mortality in the examination of factors which shall affect mortality, age and ASA scores are observed related to mortality. More mortality risk is determined in ASA III and IV compared to ASA I and II in Group VAG compared to Group AG.

We believe that a few limitations of this study are worthy of discussion. We were not able to evaluate the potential effects of perioperative medications along with anesthesia type; this would be of interest in a future investigation. Because of our patients 65 years of age and older with fragility fractures restriction, our conclusions may not be applicable to other age groups or hip fractures from different pathologies. Another limitation is that the power of our study is limited due to the size of the sample.

## Conclusion

We compared patients who had hip surgery according to age groups and anesthesia methods in this study. Anesthesia methods are not associated with morbidity and mortality. We think that postoperative morbidity and mortality development are high in Group VAG 75 years of age and older, however this is due to ASA III and IV patients being high in Group VAG. Although it is seen that ASA score increases as the age increases and is over 75 years of age specifically, we believe that studies involving more patients should be conducted to obtain independent effects of age and ASA factor in geriatric hip surgeries. Based on these findings, healthcare providers may same benefit from considering the utilization of regional and general anesthesia for fragility hip fracture surgery in the geriatric population while evaluating the full clinical picture.

**Ethics Committee Approval:** This study was approved by the Osmangazi University, Non-Interventional Clinical Research Ethics Committee (date: 30.06.2016, number: 203).

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