Int Surg 2017;**102:**178–183
DOI: 10.9738/INTSURG-D-17-00098.1

The Type of Anesthesia Technique Does Not Have an Impact on 30-Day Mortality in Geriatric Patients Undergoing Lower Extremity Amputation

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This study aimed to determine the appropriate anesthetic technique for patients who underwent amputation due to peripheral vascular disease. The anesthetic technique to be applied during lower extremity amputations in geriatric patients with limited functional capacity may be important in terms of clinical outcomes and mortality rates. Patients aged older than 65 years who had undergone major lower extremity amputation were retrospectively evaluated. The patients were divided into 2 groups: regional anesthesia (RA) and general anesthesia (GA). Demographic characteristics, comorbidities, medications used, anesthesia technique, the durations of anesthesia and surgery, need for blood transfusion, 30-day mortality, postoperative cardiac and pulmonary complication rates were recorded from the medical records of the patients. Among the 441 patients, 244 had received RA, while 197 had received GA. The average length of stay in the hospital was longer in the GA group ($P = 0.001$). The use of antiplatelet drugs ($P = 0.001$) and the number of transfusions were higher ($P = 0.045$) in the GA group. No

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significant difference was found between the groups in terms of mortality and postoperative cardiac or pulmonary complication rates. We determined that the anesthesia technique does not have an effect on 30-day mortality and complication rates. The regional anesthesia technique may be preferred in geriatric patients who will undergo major lower extremity amputation because of the shorter hospital stay and theoretical advantages. However, considering the general functional status of patients, the importance of patient-based evaluation should not be forgotten.

Key words: Amputation – General anesthesia – Geriatric patient – Regional anesthesia – Mortality – Patient care

Lower extremity amputations performed in geriatric patients with peripheral vascular disease have high morbidity and mortality rates due to comorbid systemic diseases.[1] In the literature, factors such as increased age, diabetes mellitus, coronary artery disease, and chronic renal failure were associated with poor outcomes.[2] The 30-day mortality rate ranged between 5% and 15%.[3] Considering the increase in the elderly population, the incidence of lower extremity amputation performed due to peripheral vascular disease will inevitably increase.

There are different views on the anesthesia technique to be applied to patients who have undergone lower extremity amputation.[4,5] The generally accepted approach is that while the regional anesthesia technique is suggested for patients with pulmonary problems, the general anesthesia technique is more appropriate for patients who take antiplatelet medications or anticoagulants.[6] The selection of the anesthetic technique in amputations in geriatric patients who have limited functional capacity may be important in terms of clinical outcomes and mortality rates.

The purpose of this study was to determine the appropriate anesthetic technique for geriatric patients who have undergone amputation due to peripheral vascular disease.

Methods

In total, 496 patients aged older than 65 years who underwent major lower extremity amputation (MLEA; above knee/below knee) between 2008 and 2015 were included in the study after obtaining the approval of the Institutional Research and Ethics Committee. Our institutional ethics committee waived informed consent due to the retrospective design of the study. Fifty-five patients who did not have adequate records and who did not undergo major amputation were excluded. The remaining 441 patients were retrospectively evaluated. From the medical records in the electronic system, the demographic characteristics, preoperative hemoglobin levels, and comorbid diseases (hypertension, diabetes mellitus, coronary artery disease, congestive heart failure, cardiac intervention history, chronic renal failure, chronic obstructive pulmonary disease, and smoking status) of the patients were recorded. The medications used by the patients (beta blockers, calcium channel blockers, digoxin, nitrates, statins, antiplatelet drugs, and anticoagulant drugs) and American Society of Anesthesiology (ASA) scores were recorded. The anesthesia technique applied during surgery, the durations of anesthesia and surgery, and whether or not a blood transfusion was performed were noted. The patients' 30-day mortality and cardiac and pulmonary complication [postoperative ventilation support longer than 24 hours; pneumonia; myocardial infarction (MI); and arrhythmia] rates were calculated. The 30-day mortality rates were calculated using data from the Republic of Turkey Ministry of Interior, General Directorate of Population and Citizenship Affairs using the patients' identification numbers. The patients' deep vein thrombosis (DVT), surgical site infection, and urinary tract infection rates, and length of stay in the intensive care unit and in the hospital were calculated.

The decision to perform amputation and the level of amputation in case of persistent infection causing loss of limb function, necrosis, gangrene, tissue necrosis, or life-threating sepsis symptoms were determined by the orthopedic surgeon in charge and on cardiovascular surgery consultation. The patients were divided into 2 groups according to the anesthesia technique applied: regional anesthesia (RA) and general anesthesia (GA). The patients for whom the spinal or combined (spinal–epidural) technique were applied were included in the RA

Table 1 Comparison of descriptive characteristics by type of anesthesia

	Total (n = 441)	Regional anesthesia (n = 244)	General anesthesia (n = 197)	P^a
Age (years), mean ± SD	76.62 ± 4.61	78.55 ± 3.64	73.76 ± 4.42	0.001
Sex, n (%)				
Female	250 (56.6)	142 (58.1)	108 (54.8)	0.520[b]
Male	191 (43.4)	102 (42.9)	89 (46.2)	
ASA, mean ± SD	3.3 ± 0.51	3.28 ± 0.49	3.33 ± 0.53	0.438[c]
Preoperative Hg values	9.8 ± 3.1	10.8 ± 2.1	8.9 ± 2.2	0.045
Duration of anesthesia, mean ± SD	66.06 ± 4.74	66.14 ± 4.69	65.95 ± 4.84	0.761
Duration of surgery, mean ± SD	55.39 ± 4.4	55.39 ± 4.49	55.38 ± 4.29	0.990
ICU length of stay (days), mean ± SD	0.35 ± 0.85	0.26 ± 0.61	0.48 ± 1.11	0.613[c]
Length of stay in hospital (days), mean ± SD	15.32 ± 3.82	13.31 ± 2.57	18.29 ± 3.41	0.001
Smoking, n	171	92	79	0.903
Amputation level, n				
Above	203	109	94	0.499
Below	238	135	103	

Hg, hemoglobin; ICU, intensive care unit.

[a]Student's *t*-test.

[b]Pearson's χ^2 test.

[c]Mann-Whitney *U* test.

group. Patients in whom endotracheal intubation was performed or those who were operated under general anesthesia with a laryngeal mask were included in the GA group.

Number Cruncher Statistical System 2007 Statistical Software (Kaysville, UT, USA) was used for statistical analyses. When evaluating data, in addition to the descriptive statistical methods (mean, standard deviation, median, frequency, and rate), Student's *t*-test was used to compare parameters with normal distributions between the groups, and the Mann–Whitney *U* test was used to compare parameters without normal distribution. In the comparison of qualitative data, Pearson's χ^2 test, Yates' continuity correction test, and Fisher's exact *t*-test were used. The results were evaluated at 95% confidence interval, and $P < 0.05$ was considered statistically significant.

Results

In 244 of the 441 patients who were included, regional anesthesia had been applied, while in 197, general anesthesia had been applied. The average age of the patients was higher in the RA group ($P = 0.001$). The average length of stay in the hospital was longer in the GA group ($P = 0.001$). The demographic data and descriptive characteristics of the patients are shown in Table 1.

When the groups were compared in term of comorbidities, the amputation rates were found to be higher in patients who received regional anesthesia ($P = 0.001$). There was no significant difference in comorbidities (Table 2). The use of antiplatelet drugs was determined to be higher in the GA group compared to the RA group ($P = 0.001$; Table 3).

No significant difference was found between the groups in terms of mortality, MI, DVT, and pulmonary complications. In the patients receiving general anesthesia, the preoperative hemoglobin levels were lower ($P = 0.045$); erythrocyte transfusion ($P = 0.016$) and fresh frozen plasma transfusion ($P = 0.008$) rates were significantly higher (Table 4).

Discussion

We investigated the effect of anesthesia techniques applied during MLEAs in geriatric patients on 30-day mortality and early complication rates. We determined that the anesthesia technique does not have an impact on mortality and complication rates. The general anesthesia technique was more preferred in the patients who are under antiplatelet drugs, and length of stay in the hospital was longer in the patients who are operated under general anesthesia.

MLEAs performed due to peripheral arterial diseases have a poor prognosis because of serious complications and an approximate 30% 2-year mortality rate.[7] While there are studies in the literature investigating the effect of the anesthesia technique applied to patients who had revascularization on clinical outcomes, there are a limited

Table 2 Evaluation of comorbid diseases by groups

	Total (n = 441) n (%)	Regional anesthesia (n = 244) n (%)	General anesthesia (n = 197) n (%)	P^a
Previous amputation	91 (20.7)	73 (29.9)	18 (7.2)	0.001
Additional disease	418 (95)	232 (95.1)	186 (94.8)	1.000[b]
Hypertension	313 (71)	177 (72.9)	136 (68)	0.414
DM	171 (39)	98 (40.3)	73 (37.1)	0.621
CRF	305 (69.3)	167 (68.8)	138 (70.1)	0.823
CAD	248 (56.4)	140 (57.6)	108 (54.6)	0.645
CHF	400 (90.9)	215 (88.2)	185 (94.8)	0.126[c]
Previous cardiac intervention	364 (82.6)	203 (83.3)	161 (81.4)	0.704
COPD	400 (90.9)	216 (88.9)	184 (93.8)	0.193

CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CRF, chronic renal failure.

[a]Pearson's χ^2 test.

[b]Fisher's exact *t*-test.

[c]Yates' continuity correction test.

number of studies where anesthesia techniques were compared in patients who underwent a major amputation.[6]

Regional anesthesia has many theoretical advantages over general anesthesia.[6,8] These include peripheral vasodilation, increase in blood flow, lower risk of thrombosis, and less pain severity.[8,9] In a meta-analysis where geriatric patients undergoing different types of surgery were compared, mortality rates, MI and DVT incidences, and blood transfusion rates were lower in patients who received regional anesthesia.[8] The patients who underwent MLEAs were not considered as a subgroup in this study. In another meta-analysis where patients who had lower extremity revascularization were evaluated, pulmonary complications were lower in the RA group, but there was not sufficient evidence to compare other parameters.[6] Chery *et al*[10] have reported that pulmonary complications and arrhythmia are observed less often in the RA group for MLEA. Contrary to their result, there is a recent study where mortality, hospital length of stay, and postoperative complication rates were similar in MLEA patients who received general and regional anesthesia.[11] When general anesthesia and peripheral nerve block in lower extremity amputations were compared, they were reported to have similar effects on 30-day mortality rates.[12] Given the fact that postsurgical complications are usually associated with the applied surgical procedure, it is difficult to evaluate complications associated with the anesthesia technique only. It should be noted that in geriatric patients with a quite limited physiologic reserve, complications arise because of multifactorial reasons.

In our study, the patients in the RA group were determined to have a higher average age and a higher presence of a previous amputation. On the other hand, in patients in the GA group, the length of hospital stay and transfusion rates were found to be higher. High transfusion rates in in the GA group can be explained by the fact that they had lower preoperative hemoglobin levels. No significant difference was detected between the groups in

Table 3 Evaluation of drugs used by groups

	Total (n = 441) n (%)	Regional Anesthesia (n = 244) n (%)	General anesthesia (n = 197) n (%)	P^a
Beta Blocker	213 (48.5)	118 (48.6)	95 (48.5)	0.981
Calcium	93 (21.2)	52 (21.5)	41 (20.6)	0.865
Digoxin	41 (9.5)	28 (11.8)	13 (6.2)	0.145
Nitrate	29 (6.6)	16 (6.9)	13 (6.2)	1.000[b]
Statin	144 (32.8)	77 (31.9)	67 (34)	0.736
Aspirin	230 (52.3)	123 (50.7)	107 (54.6)	0.548
Anticoagulant	119 (27)	34 (13.9)	85 (46.4)	0.001

[a]Pearson's χ^2 test.

[b]Yates' continuity correction test.

Table 4 Evaluation of mortality and complication features of the groups

	Total (n = 441)	Regional (n = 244)	General (n = 197)	P^a
Mortality	47 (10.8)	20 (8.3)	27 (14.4)	0.134
MI	76 (17.4)	37 (15.3)	39 (20.6)	0.284
DVT	33 (7.5)	12 (4.9)	21 (11.3)	0.104[b]
PE	11 (2.5)	3 (1.4)	8 (4.1)	0.223[c]
Complications				
Wound infection	49 (11.2)	25 (10.4)	24 (12.4)	0.792[b]
UTI	80 (18.3)	44 (18.1)	36 (18.6)	0.921
Pneumonia	44 (10)	29 (11.8)	15 (7.2)	0.343[b]
Ventilation support	49 (11.2)	27 (11.1)	22 (11.3)	1.000[b]
Arrhythmia	86 (19.5)	40 (16.7)	46 (23.7)	0.176
Erythrocyte	68 (15.4)	25 (10.4)	43 (22.7)	0.016[b]
FFP	29 (6.6)	7 (2.8)	22 (12.4)	0.008[b]

DVT, deep vein thrombosis; MI, myocardial infarction; PE, pulmonary embolism; FFP, fresh frozen plasma; UTI, urinary tract infection.

[a]Pearson's χ^2 test.

[b]Yates' continuity correction test.

[c]Fisher's exact *t*-test.

terms of mortality and postoperative complication rates. The length of hospital stay in the GA group was longer; therefore, regional anesthesia is more appropriate in terms of patient costs.

In the literature, three studies are similar to ours for MLEA in the geriatric patient population. The first was published in 1983 and the other two are more recent.[10,11,13] In this context, given the limited number of comparative studies that examine the geriatric subgroup, we believe that our findings are valuable. The limitations of our study are its retrospective design, low number of patients, the fact that other perioperative data that could have had an impact on the results were not evaluated, and the inclusion of patients who began with regional anesthesia but then received general anesthesia in the GA group.

Conclusion

In geriatric patients who will undergo MLEA, regional anesthesia techniques may be preferred due to the shorter length of hospital stay and theoretical advantages. However, considering the general functional status of patients and magnitude of the surgery to be undergone, the importance of patient-based evaluation should be remembered.

Acknowledgments

Funding/Support Statement: none

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

The ethical approval is obtained from the Institutional Research and Ethics Committee of Bakırkoy Teaching and Research Hospital.

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