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ORIGINAL ARTICLE

HEMODYNAMIC EFFECTS OF LATERAL DECUBITUS POSITIONING AFTER SPINAL ANESTHESIA IN HIGH-RISK GERIATRIC PATIENTS UNDERGOING LOWER EXTREMITY ORTHOPEDIC SURGERY: A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

Abstract

Introduction: Spinal anesthesia-induced hypotension is a frequent and life-threatening complication in high-risk geriatric patients. Lateral decubitus positioning after hyperbaric bupivacaine injection may restrict sympathetic blockade to the operative side, preserving hemodynamic stability. This study compared hemodynamic effects of 15-minute lateral decubitus versus immediate supine positioning after spinal anesthesia in ASA III–IV geriatric patients undergoing lower extremity orthopedic surgery.

Materials and Method: Seventy patients aged ≥65 years (ASA III–IV) were randomized to Group L (n=35; lateral decubitus for 15 minutes, operative side down, then supine) or Group S (n=35; immediate supine). All received 12 mg of 0.5% hyperbaric bupivacaine in the sitting position. Primary outcome was hypotension incidence (MAP <65 mmHg or ≥20% decrease from baseline) during the first 15 minutes. Secondary outcomes included bradycardia, vasopressor requirement, sensory block level, and peripheral oxygen saturation.

Results: Baseline characteristics were comparable. Hypotension occurred in 0 patients in Group L versus 11 (31.4%) in Group S ($p<0.001$). Bradycardia was observed in 1 (2.9%) versus 9 (25.7%) patients ($p=0.013$). Maximum sensory block was lower in Group L (T9 vs. T7; $p<0.001$); unilateral block rates at 15 and 30 minutes were higher (71.4% and 51.4% vs. 0%; $p<0.001$). MAP differences were evident from minute one (108.3±8.6 vs. 97.9±17.2 mmHg; $p=0.002$). Peripheral oxygen saturation did not differ at any time point.

Conclusion: Lateral decubitus positioning for 15 minutes after spinal anesthesia reduces hypotension and bradycardia in ASA III–IV geriatric patients without pharmacological intervention or equipment. This cost-free positional strategy may be safely integrated into routine anesthetic practice for high-risk elderly patients.

Keywords: Anesthesia, Spinal; Hypotension; Patient Positioning; Aged; Bupivacaine; Orthopedic Procedures.

INTRODUCTION

The global geriatric population is growing rapidly as it is in Turkey. According to 2024 data, individuals aged 65 years and older constitute 10.6% of the total population in Turkey, reaching 9.1 million while this rate is 10.3% of the world population (1,2). Older adults represent a surgical high-risk group due to their burden of comorbidities and frailty; the five-year cumulative risk of major surgery among individuals aged 65 and older reaches 13.8%, increasing markedly in those with frailty or dementia (3).

The geriatric population carries disproportionate anesthetic risk due to age-related physiological decline and high comorbidity burden. One-year mortality following major surgery is 13.4% in adults aged 65 and older, rising to 22.3% in non-elective procedures, descending to 7.4% in elective procedures and reaching 28–33% in the presence of frailty or dementia (4). General anesthesia-related mortality, estimated at 0.4 per 100,000 in low-risk (ASA I–II) patients, increases substantially in those with severe systemic disease (5). The use of opioids for intraoperative and postoperative analgesia further contributes to the risk of prolonged respiratory depression, particularly in patients over 60 years of age with reduced respiratory reserve or significant cardiac comorbidity (6,7). For suitable procedures such as lower extremity surgery, spinal anesthesia and other regional techniques are preferred over general anesthesia owing to their superior hemodynamic stability, avoidance of airway instrumentation, and facilitation of postoperative pain management (8).

Spinal anesthesia induces hypotension through three principal mechanisms: peripheral vasodilation and venous pooling secondary to sympathetic blockade, bradycardia resulting from blockade of cardiac accelerator fibers (T1–T4), and suppression of compensatory cardiovascular reflexes (9). The reported incidence of spinal anesthesia-induced hypotension in geriatric patients ranges from 16% to 33%, substantially exceeding that of the general population due to diminished sympathetic reserve and impaired baroreceptor responsiveness (10).

Positional manipulation following spinal anesthesia represents one strategy to reduce hypotension incidence. Hyperbaric bupivacaine, being denser than cerebrospinal fluid, tends to settle toward the dependent side under gravitational influence. When patients are maintained in the lateral position after injection, the local anesthetic preferentially distributes to the operative side, producing a predominantly unilateral sensory, motor, and sympathetic block (11). Preservation of contralateral sympathetic innervation results in less vasodilation and venous pooling compared with bilateral blockade, a mechanism through which hemodynamic stability may be maintained even in geriatric populations (12). However, the majority of existing studies have been conducted in ASA I–II patient groups and there is a need for further prospective randomized controlled studies investigating the hemodynamic effects of the lateral position following spinal anesthesia in high-risk geriatric patients with ASA III–IV (11–13).

This study aimed to compare the hemodynamic effects of maintaining the lateral position for 15 minutes after spinal anesthesia versus immediate supine positioning in ASA III–IV geriatric patients aged 65 years and older undergoing unilateral lower extremity orthopedic surgery.

MATERIALS AND METHOD

This prospective, randomized clinical trial was conducted at the Department of Anesthesiology and Reanimation, Balıkesir Atatürk City Hospital, between April 2026 and July 2026. The study was approved by the Scientific Research Ethics Committee of Balıkesir Atatürk City Hospital with the approval number of 2026/03/31, dated 26.03.2026. The study was registered at ClinicalTrials.gov prior to patient enrollment (NCT07597148). All procedures

were performed in accordance with the principles of the Declaration of Helsinki, and written informed consent was obtained from all participants before enrollment.

Patients aged 65 years or older with an American Society of Anesthesiologists (ASA) physical status of III or IV, scheduled for unilateral lower extremity orthopedic surgery (hip fracture, femoral fracture, knee arthroplasty, or tibia-fibula fracture, and similar procedures), and eligible for spinal anesthesia who gave written consent were enrolled.

Exclusion criteria were: contraindications to spinal anesthesia (coagulopathy, inadequate anticoagulant/antiplatelet washout, local infection at the injection site); severe neurological disease or pre-existing motor/sensory deficit; significant spinal deformity or prior spinal surgery (severe scoliosis, kyphosis); known allergy to local anesthetics; decompensated heart failure (ejection fraction <30%); uncontrolled hypertension (SBP >180 mmHg or DBP >110 mmHg); emergency surgery; severe hypovolemia or active bleeding; advanced dementia or inability to communicate; BMI >40 kg/m²; and refusal to participate.

Sample size was calculated using G*Power 3.1 based on a two-proportion comparison (chi-square test) for the primary outcome which is hypotension incidence. Expected hypotension rates of 30% (supine group) and 5% (lateral group) derived from comparable studies (10,11) yielded a Cohen's h of 0.72. With Type I α=0.05 and statistical power 1−β=0.90, a minimum of 30 patients per group was required; a 15% allowance gave 35 per group, totaling to 70 patients in the trial. Patients were randomized using computer-generated random number generator and variable block sizes (2, 4, and 6) into two equal groups.

Group L (Lateral Position; n = 35): following spinal anesthesia in the sitting position, patients were placed in the lateral position with the operative extremity down for 15 minutes, then repositioned supine. Group S (Supine Position; n = 35): patients were immediately turned supine after spinal anesthesia.

Blinding of the administering anesthesiologist was not feasible due to the nature of the positional intervention.

All patients underwent standard preoperative evaluation (anamnesis, physical examination, and laboratory investigations). Solid food intake was discontinued at least 6 hours before surgery, and clear liquids were withheld 2 hours before surgery.

No premedication was administered. An 18G peripheral intravenous catheter was inserted in the operating room, and a standardized maintenance infusion of 0.9% NaCl calculated per the 4-2-1 rule (Holliday-Segar formula) was initiated in both groups; no fluid preloading was performed. Intraoperative fluid volumes were recorded in both groups. Standard ASA monitoring was applied (electrocardiography, non-invasive blood pressure, peripheral oxygen saturation SpO_2). Supplemental oxygen via nasal cannula at 2–4 L/min was provided when baseline SpO_2 was below 95%.

Spinal anesthesia was performed in the sitting position using a 25G Quincke spinal needle at the L3–4 intervertebral level via a midline approach under sterile technique. Following the sterile intervention and confirmation of cerebrospinal fluid flow, 12 mg of 0.5% hyperbaric bupivacaine was injected over approximately 20 seconds in all patients.

Sensory block was assessed bilaterally using the pin-prick test every 2 minutes from the 1st to the 15th minute, and every 5 minutes from the 15th to the 30th minute. Maximum sensory block level and time to reach T10 on the operative side were recorded. Unilateral block was defined as complete sensory block at T10 or above on the operative side with absent or below-T12 block contralaterally. Surgery was not initiated until T10 sensory block was achieved on the operative side or the 15-minute waiting period had been completed.



Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and SpO_2 were recorded before spinal anesthesia (T0 = baseline) and after the application of spinal anesthesia at every 2 minutes from the 1st to the 15th minute, and every 5 minutes from the 15th to the 30th minute.

Hypotension was defined as MAP <65 mmHg or a 20% or more decrease from baseline, and was treated with intravenous ephedrine 5–10 mg IV bolus if it developed and repeated as necessary. Bradycardia was defined as HR <50 bpm and treated with atropine 0.5 mg IV bolus. Nausea and vomiting were treated with ondansetron 4 mg IV.

Patients' demographic characteristics (age, sex, height, weight and BMI), ASA scores, comorbidities, type of surgery, and block characteristics (maximum sensory block level, time to reach the T10 and block laterality), serial hemodynamic measurements, presence of hypotension and bradycardia, use of ephedrine and atropine, nausea and vomiting, high spinal block and neurological complications, adequacy of surgical anesthesia and the need for conversion to general anesthesia were recorded. Surgical duration (the time from skin incision to wound closure in minutes) was recorded in both groups.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Normality was assessed with the Shapiro-Wilk test. Continuous variables were expressed as mean ± SD or median (min–max) depending on normality and categorical variables as number (n) and percent (%). Between-group comparisons used the independent samples t-test for those showing normal distribution and Mann-Whitney U test for those showing no normal distribution in continuous variables. Categorical variables were compared using Chi-square or Fisher's exact test. Repeated measurements were analyzed using mixed-model repeated measures ANOVA (group x time interaction) with Bonferroni correction in post-hoc comparisons. Relative risk (RR) and 95% confidence intervals (CI) were calculated for categorical primary outcomes. Statistical significance was set at $p<0.05$.

RESULTS

Seventy patients were enrolled and randomized (35 per group) with no dropouts; all analyses were conducted on the full sample. Baseline demographic characteristics were similar in both groups. No statistically significant difference was seen between the groups in comorbidity distribution. The incidences of hypertension, diabetes mellitus, dementia, COPD, asthma, congestive heart failure (CHF), Parkinson's disease, peripheral angiopathy, and chronic kidney disease, as well as the mean ejection fraction values of patients diagnosed with CHF were similar between the two groups. No statistically significant difference was seen between the groups in surgery duration (Group L: 54.3±6.0 min; Group S: 54.8±5.5 min; p=0.709), intraoperative fluid volumes were comparable between groups (Group L: 685.7±81.0 mL [550–850 mL], Group S: 681.4±78.7 mL [500–900 mL]; t = 0.225, p = 0.823) (Table 1).

Time to reach T12 on the operative side was significantly shorter in Group S (3.0±0.9 min; vs. 4.8±1.3 min. $p<0.001$). Time to reach T10 on the operative side, representing the threshold for surgical adequacy, was also significantly longer in Group L (12.8±3.3 vs. 6.1±2.1 min; $p<0.001$). Maximum sensory block level on operative side was significantly higher in Group S (T7 [7.1±0.3] vs. T9 [9.2±0.5]; $p<0.001$).

At 15 minutes, unilateral block was achieved in 28.6% (10/35) of Group L patients, whereas no patient in Group S demonstrated unilateral block (0/35, 0%; $p<0.001$). At 30 minutes, unilateral block persisted in 48.6% (17/35) of Group L patients, while no patient in Group S had unilateral block (0/35, 0%; $p<0.001$). Among Group L patients who developed

Table 1. Demographic, Baseline Clinical Characteristics, Comorbidity Distribution, and Surgical Data

Parameter	Group L (Lateral) n = 35	Group S (Supine) n = 35	p
Demographic Characteristics			
Age (years)	72.6 ± 6.6	72.5 ± 6.2	0.926
Sex, n (M/F)	19/16	17/18	0.811
Height (cm)	157.4 ± 7.6	158.5 ± 7.8	0.576
Weight (kg)	72.9 ± 9.5	71.8 ± 10.7	0.635
BMI (kg/m²)	29.6 ± 4.8	28.8 ± 5.1	0.473
ASA classification, n (III/IV)	34/1	32/3	0.614
Comorbidities			
Hypertension, n (%)	15 (42.9%)	22 (62.9%)	0.150
Diabetes mellitus, n (%)	9 (25.7%)	16 (45.7%)	0.134
Dementia, n (%)	14 (40.0%)	8 (22.9%)	0.197
COPD, n (%)	3 (8.6%)	4 (11.4%)	1.000
Asthma, n (%)	9 (25.7%)	6 (17.1%)	0.561
Congestive heart failure, n (%)	5 (14.3%)	2 (5.7%)	0.428
Parkinson's disease, n (%)	1 (2.9%)	0 (0.0%)	1.000
Peripheral arteriopathy, n (%)	7 (20.0%)	4 (11.4%)	0.513
Chronic renal failure, n (%)	0 (0.0%)	5 (14.3%)	0.054
Ejection fraction (%)	49.3 ± 3.5	53.8 ± 9.5	0.276
Surgical Data			
Surgical duration (min)	54.3 ± 6.0	54.8 ± 5.5	0.709
Intraoperative fluid volume (mL)	685.7 ± 81.0	681.4 ± 78.7	0.823

Values are expressed as mean ± SD or n (%). BMI: Body Mass Index; ASA: American Society of Anesthesiologists; COPD: Chronic Obstructive Pulmonary Disease. Independent samples t-test was used for continuous variables; Fisher's exact test was used for categorical variables. $p > 0.05$: no statistically significant difference between groups.

contralateral block, time to T12 was significantly longer than in Group S (20.7±2.0 min vs. 2.7±1.0 min). Detailed block characteristics are presented in Table 2.

The baseline SBP (Group L: 151.7 ± 16.5 mmHg, Group S: 148.9 ± 16.5 mmHg; p = 0.480), baseline DBP (Group L: 89.0 ± 10.6 mmHg, Group S: 85.5 ± 12.8 mmHg; p = 0.207), baseline MAP (Group L: 109.9 ± 9.3 mmHg, Group S: 106.6 ± 10.2 mmHg; p = 0.159), and baseline HR (Group L: 77.4 ± 9.1 beats/min, Group S: 74.1 ± 10.8 beats/min; p = 0.181) values were similar between the two groups. The SBP, DBP, and MAP values were statistically significantly higher in Group L at all measurements between the 1st and 30th minutes for all three parameters. The intergroup difference in MAP became evident from the 1st minute after injection onward (Group L: 108.3 ± 8.6 mmHg vs. Group S: 97.9 ± 17.2 mmHg; p = 0.002). While no patient in Group L developed hypotension (0.0%), hypotension was observed in 11 patients in Group S (31.4%; p < 0.001).



Table 2. Sensory and Motor Block Characteristics, Hemodynamic Complications, and Interventions

Parameter	Group L (Lateral) n = 35	Group S (Supine) n = 35	p
Sensory Block			
Maximum sensory block level — operative side†	T9 (9.2 ± 0.5)	T7 (7.1 ± 0.3)	<0.001***
Time to T12 — operative side (min)	4.8 ± 1.3	3.0 ± 0.9	<0.001***
Time to T10 — operative side (min)	12.8 ± 3.3	6.1 ± 2.1	<0.001***
Unilateral block, n (%) — 15th min‡	10/35 (28.6%)	0/35 (0.0%)	<0.001***
Unilateral block, n (%) — 30th min‡	17/35 (48.6%)	0/35 (0.0%)	<0.001***
Motor Block (Modified Bromage Scale)			
Maximum Bromage score — operative side	2.9 ± 0.2	2.9 ± 0.2	1.000
Bromage = 3, n (%) — operative side	33/35 (94.3%)	33/35 (94.3%)	1.000
Maximum Bromage score — contralateral side	0.8 ± 0.4	2.9 ± 0.3	<0.001***
Bromage = 0 (no motor block), n (%) — contralateral	6/35 (17.1%)	0/35 (0.0%)	0.011*
Hemodynamic Complications and Interventions			
Hypotension, n (%)	0/35 (0.0%)	11/35 (31.4%)	<0.001***
Bradycardia, n (%)	1/35 (2.9%)	9/35 (25.7%)	0.013*
Total ephedrine dose (mg)	0.0 ± 0.0	4.1 ± 6.6	<0.001***
Total atropine dose (mg)	0.0 ± 0.1	0.2 ± 0.3	0.054
Minimum SBP (T1–T15, mmHg)§	131.9 ± 16.8	108.2 ± 18.3	<0.001***
Minimum MAP (T1–T15, mmHg)§	97.0 ± 10.0	76.5 ± 15.8	<0.001***

Values are expressed as mean ± SD or n (%). Hypotension: MAP < 65 mmHg or ≥20% decrease from baseline. Bradycardia: HR < 50 beats/min. Between-group comparisons were performed using the independent samples t-test (continuous), Fisher's exact test (categorical), or Mann-Whitney U test. *p < 0.05; ***p < 0.001.

† Sensory block level was compared using the Kruskal-Wallis test (numeric dermatomal score: T9 = 9, T7 = 7). Modal block level was T9 in Group L and T7 in Group S.

‡ Unilateral block: complete sensory block at T10 or above on the operative side with absent or below-T12 block on the contralateral side.

§ Minimum SBP and MAP represent the lowest recorded values during the 1st–15th minutes after spinal anesthesia.

HR was significantly higher in Group L at all time points between the 1st and 30th minutes except at the 20th minute measurement. Detailed hemodynamic data are presented in Figure 1. Bradycardia development after spinal anesthesia was seen significantly more often in Group S. Bradycardia was detected in 1 patient (2.9%) in Group L and 9 patients (25.7%) in Group S; all affected patients received atropine (p=0.013). Although total atropine dose was numerically lower in Group L (0.0±0.1 mg vs. 0.2±0.3 mg), this difference did not reach statistical significance (p=0.054), consistent with the lower absolute bradycardia incidence in that group.

Baseline SpO_2 was comparable between groups (Group L: 94.9±2.1%; Group S: 95.3±2.4%; p=0.462), with no significant intergroup differences at any time point (all p>0.05). No patient developed respiratory depression, high spinal block, or neurological complication. No patient required conversion to general anesthesia due to inadequate anesthesia.

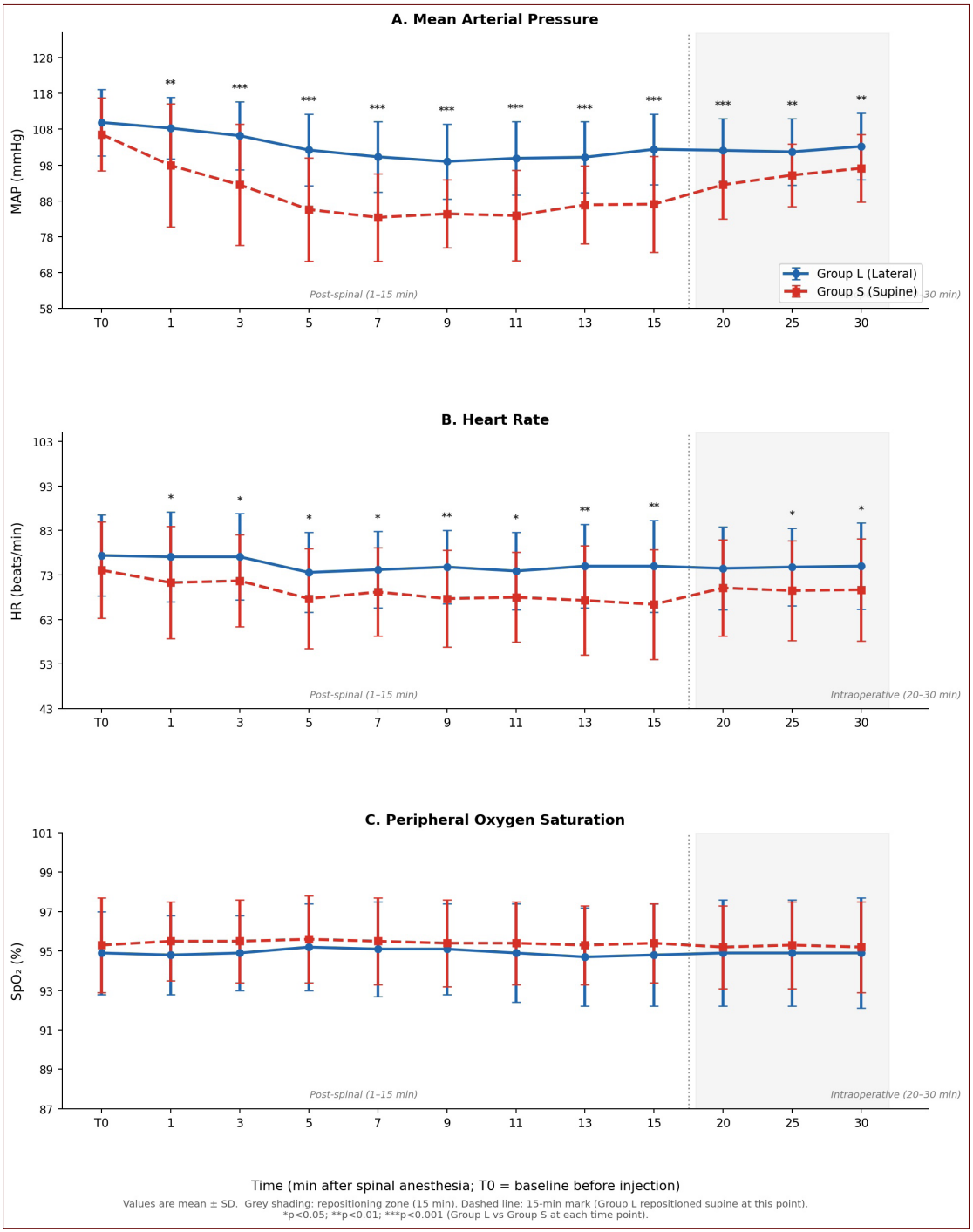


Figure 1. Time-course of hemodynamic parameters after spinal anesthesia. (A) Mean arterial pressure (MAP), (B) heart rate (HR), and (C) peripheral oxygen saturation (SpO_2) in Group L (lateral decubitus for 15 minutes, then supine) and Group S (immediate supine). Values are mean ± SD. The dashed vertical line at 15 minutes indicates when Group L patients were repositioned supine. *p<0.05; **p<0.01; ***p<0.001 (Group L vs. Group S at each time point).



DISCUSSION

The present study specifically targeted ASA III–IV geriatric patients, a subgroup underrepresented in the existing literature. Most studies investigating hypotension following spinal anesthesia in the geriatric population have been conducted in ASA I patients without comorbidities or ASA II patients with limited comorbidities (11–13). In contrast, studies involving high-risk patients are needed to better reflect the true clinical characteristics of the geriatric population requiring surgery. According to 2023 US Behavioral Risk Factor Surveillance System data, 93% of adults aged 65 and older have at least one chronic condition and 78.8% have two or more (14). A significant part of these patients are classified as ASA III–IV. Among these comorbidities, cardiovascular diseases, diabetes mellitus, and chronic respiratory diseases are particularly prevalent (14). Physiological decline in hemodynamic reserve and impaired cardiovascular compensatory mechanisms with aging amplify the hypotensive response to spinal anesthesia in this population (10).

The combined evaluation of age and ASA classification is of particular importance in our study. In a meta-analysis of elderly patients undergoing hip fracture surgery, Messina et al. identified hypotension as the most frequent cardiovascular adverse effect of spinal anesthesia (15). A more recent prospective study confirmed that high ASA score is an independent risk factor of hypotension due to spinal anesthesia in patients undergoing lower extremity orthopedic surgery under spinal anesthesia (16). Therefore, the findings of our study, conducted in a sample characterized by both advanced age and high ASA classification, may be generalizable to a broad geriatric population representative of real-world clinical practice.

No patient in Group L experienced hypotension, compared with 11 patients (31.4%) in Group S ($p<0.001$). Maximum sensory block level in operative side reached T9 in Group L versus T7 in Group S ($p<0.001$). Çağıran et al. reported hypotension in only 5 patients of ASA III–IV geriatric hip fracture patients with aortic stenosis undergoing unilateral spinal anesthesia, supporting the hemodynamic protective effect of limiting sympathetic blockade (17). Kelly et al. demonstrated that the maximum decreases in systolic blood pressure (36% ± 13) and MAP (27% ± 13) were significantly greater in the supine group than in the lateral group, and that the total ephedrine requirement in the supine group (30 mg) was twice that of the lateral group (15 mg) in hip fracture patients (13). In our study, hypotension in 11 patients (31.4%) in Group S, all of whom required ephedrine, is consistent with the findings of Kelly et al.

Bradycardia was observed in 1 patient (2.9%) in Group L and 9 patients (25.7%) in Group S. The two primary mechanisms of post-spinal anesthesia bradycardia are blockade of cardiac accelerator sympathetic fibers originating from T1–T4 segments and Bainbridge and Bezold-Jarisch reflexes triggered by reduced right atrial filling secondary to decreased venous return (9). In our study, the maximum block level in both groups remained well below the T1–T4 segments, from which the cardiac accelerator fibers originate. However, the limitation of the block to T9 in Group L provided a greater safety margin compared with the T7 level observed in Group S. On the other hand, the prevention of bilateral sympathetic denervation in Group L relatively preserved venous return, thereby reducing the likelihood of reflex bradycardia.

The unilateral block rate in Group L at the 30th minute mark was 48.6%. This rate was observed to be 94.45% in the study by Tekye and Alipour (11). Although a lower rate of unilaterality was achieved at the 30th minute compared with the literature, the absence of any contralateral block during the first 10 minutes in Group L suggests that the slow and asymmetric spread of the block preserved contralateral sympathetic innervation during the initial minutes, which are critical from a hemodynamic standpoint. This finding suggests that even if

complete unilateral block cannot be maintained throughout the entire duration of surgery, a limited sympathetic block may still be clinically protective.

The hemodynamic findings are mechanistically consistent with their block characteristics and can directly be explained with the physicochemical properties of hyperbaric bupivacaine. Being denser than cerebrospinal fluid, hyperbaric bupivacaine settles toward the dependent side in the lateral position with the help of gravity. The significantly longer time to T12 (4.8±1.3 vs. 3.0±0.9 min; $p<0.001$) and T10 (12.8±3.3 vs. 6.1±2.1 min; $p<0.001$) on the operative side in Group L reflects slower, staged cephalad spread of the local anesthetic, allowing gradual and limited sympathetic blockade rather than sudden, extensive denervation.

The maximum block level remaining at T9 in Group L and at T7 in Group S ($p < 0.001$) reflects a hemodynamically critical difference. When the block level reaches T6 or higher, venous pooling involving up to 20% of the circulating blood volume in the hepatosplanchnic region may occur, thereby leading patients to significant hypotension (9). Although the block level remained below this threshold in both groups, the T9 level in Group L was farther from the critical threshold than the T7 level in Group S, providing a greater safety margin. Together with reduced arteriolar vasodilation and preserved venous return, this difference in block level directly contributed to hemodynamic stability. Owing to the age-related decline in hemodynamic reserve and the limited capacity of cardiovascular compensatory mechanisms, this difference in block level is of particular clinical importance in ASA III–IV geriatric patients (10). The intergroup difference in MAP becoming apparent as early as the 1st minute after injection (108.3 ± 8.6 mmHg vs. 97.9 ± 17.2 mmHg; $p = 0.002$) indicates that this mechanism operates very early and rapidly. Similarly, Ferre et al emphasized that, in patients at high risk of hypotension, particularly elderly individuals, maintaining the lateral position with the operative side below for approximately 20 minutes to achieve a predominantly unilateral sympathetic block minimizes hemodynamic consequences (9).

No respiratory depression, high spinal block, or neurological complication occurred in either group, and no patient required conversion to general anesthesia. These findings confirm the safety and feasibility of the positional intervention specifically in ASA III–IV geriatric patients.

The strengths of this study include its prospective randomized controlled design with block randomization, focus on a clinically underrepresented high-risk geriatric subgroup, standardization of anesthetic technique and fluid management, and complete follow-up of all enrolled patients. The intervention requires no additional cost, equipment, or pharmacological agent.

Several limitations should be acknowledged. The single-center design may limit generalizability. Spinal anesthesia was administered in the sitting position in both groups, precluding the additional unilateral block advantage that lateral injection might have conferred to Group L. All surgical procedures were completed within 65 minutes; applicability to longer procedures cannot be established.

In conclusion, our study demonstrates that maintaining the lateral position for 15 minutes following spinal anesthesia is a safe and feasible strategy that preserves hemodynamic stability in high-risk geriatric patients with ASA III–IV status. This approach requires no additional pharmacological intervention, specialized equipment, or increased cost, and may be readily integrated into standard anesthetic practice. In particular, integration of this approach into standard anesthetic protocols for geriatric patients with a high burden of cardiovascular comorbidities may significantly reduce the incidence of hemodynamic complications. Confirmation of these findings in multicenter trials with larger sample sizes and varying bupivacaine doses would further strengthen the evidence base for this simple and clinically applicable strategy.



Conflict of Interest: The authors declare no conflict of interest.

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Ethical Approval: This study was approved by the Scientific Research Ethics Committee of Balıkesir Atatürk City Hospital (Approval No: 2026/03/31, Date: 26.03.2026). All procedures were performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Author Contributions: SK: Study concept and design, data collection, manuscript writing, final approval. HD: Study concept and design, data collection, data analysis, statistical analysis, manuscript writing, critical revision, final approval. ED: Study concept and design, data collection, data analysis, critical revision, final approval.

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