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Effect of sitting time on the vasopressor requirement in elderly patients after spinal anesthesia: A randomized controlled study

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ABSTRACT

Background: Neuraxial anesthesia appears to be a highly recommended, well-accepted technique for minimizing perioperative adverse effects in elderly patients. This research was designed to compare the impact of sitting for one, three, and 5 min on ephedrine consumption following spinal anesthesia in the elderly.
Methods: This randomized, controlled, double-blinded trial was conducted on 66 patients above 65 years undergoing surgeries under spinal anesthesia. Patients were randomly assigned to three equal groups. Patients received spinal anesthesia and then sat before they began to lie down for 1 min in the sitting-1 group, 3 min in the sitting-3 group, and 5 min in the sitting-5 group.
Results: The most reduction of mean arterial blood pressure (MAP) is in the Sitting-1 group, followed by the Sitting-3 group, and finally, the Sitting-5 group ($p < 0.05$). The most needed ephedrine was in the sitting-1 group (10 patients), followed by the sitting-3 (6 patients) and then the sitting-5 group (one patient) ($p < 0.05$). The sensory level was significantly higher in the sitting-1 group, followed by the sitting-3 and then sitting-5 group ($p < 0.001$).
Conclusions: Sitting for 5 min after spinal anesthesia in elderly patients decreases the ephedrine requirement and maintains adequate sensory block for surgery.

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Sitting time; vasopressor requirement; spinal anesthesia; Elderly

1. Introduction

As the age of individuals increases, the incidence of both surgery and mortality increases. However, age itself is not considered a disease process but a risk factor for age-related disorders [1,2].

Neuraxial anesthesia appears to be a highly recommended, well-accepted technique for minimizing perioperative adverse effects in elderly patients [3].

With increasing age and related physiological changes, some anatomical changes (myelin sheaths degeneration, intervertebral foramen's sclerotic closure, decreased neuronal number, etc.) influence the neuraxial anesthetic approaches [4]. Also, a high prevalence of medical disorders and a decline in physiologic compensatory mechanisms are noticed among the elderly [5]. Regarding spinal anesthesia, the level of analgesia increases following intrathecal injection of hyperbaric solutions, which is often associated with a risk of persistent severe bradycardia and hypotension [6,7]. This is owing to the sympathetic block's fast expansion, which impedes cardiovascular adaptation and causes significant morbidity and mortality [6,8].

Vascular system physiological changes include increased arterial wall thickness and atherosclerosis. In addition, the extent of the cardiovascular system's autonomic control diminishes with age. That is why patients suffer from lower cardiac output as their age increases. The systolic function may be adequately maintained. However, a reduction in the cardiac response to adrenergic stimulation was noticed [9,10].

Therefore, baroreflex responses will not be able to fully maintain hemodynamic stability under stressful circumstances. Hence, it is necessary to look for a secured, appropriate anesthesia technique capable of maintaining perioperative and postoperative hemodynamic stability [11].

The patient's body position, on the other hand, has had several impacts on the occurrence of hypotension following spinal anesthesia [12,13].

There is controversy about the role of delayed supine position in improving the hemodynamic profile after spinal anesthesia [14–16]. We assumed that maintaining the patient in an upright seating position for 1, 3, and 5 min following the injection of spinal anesthesia would likely reduce the diffusion of local anesthetic and reduce the risk of hypotension, resulting in an overall reduction in intraoperative fluid and ephedrine requirements.

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2. Materials and methods

This randomized, controlled trial, double-blind was conducted between June 2021 and May 2022 on 66 patients over 65 years of age, both genders, American Society of Anesthesiologists (ASA) I, II, and III, undergoing surgeries under spinal anesthesia. This study received the approval from the Cairo University Hospitals' ethical committee, Egypt (Approval code: MS-286-2021). All patients signed an informed consent document.

Exclusion criteria were cardiovascular disorders, any allergies to the used drugs, contraindications of spinal anesthesia, and spinal deformities.

Patients were randomly divided into three equal groups according to computer-generated codes using an online Randomizer concealed in closed, sequentially numbered envelopes. Sitting-1 group: injected spinal anesthesia and sat for 1 min before lying down. Sitting-3 group: received spinal anaesthesia and sat for 3 min before they started lying down. Sitting-5 group received spinal anesthesia and then sat down for 5 min before they started lying.

An 18-G peripheral intravenous cannula was inserted in the preparation room before surgery. The patients were transferred to the operating room and monitored with non-invasive blood pressure, ECG, and pulse oximeter during the operation. Each patient started a crystalloid co-load of 15 mL/kg.

In a sitting position, spinal anesthesia was performed under complete aseptic technique. After carefully locating the intervertebral spaces, 5 ml of lidocaine 2% was injected into the skin, subcutaneous tissue. A spinal needle (25 G) was inserted into the intrathecal space. When obtaining cerebrospinal fluid free flow, 25 µg of fentanyl (0.5 ml) and 15 mg of hyperbaric bupivacaine 0.5% (3 ml) were slowly injected intrathecally.

Oscillometric non-invasive blood pressure (NIBP) was continuously monitored every 2 min for the first 20 min, then every 3 min.

Block level was tested using response to cold. The block is considered successful if the T6 level is achieved. If hypotension (more than 20% reduction in MAP from baseline) occurred, it was treated with a bolus of 9 mg ephedrine hydrochloride intravenously. The bolus was repeated if the MAP did not return to >80% from the baseline value within 2 min. If bradycardia (heart rate below 50 beats/minute) occurred, it was treated with a 0.01 mg/kg atropine sulfate. After the operation ended, patients were subsequently sent to a post-anesthesia care unit (PACU) till full recovery.

Sensory block was measured by sensitivity to changes in temperature (such as the cold of ice applied to the skin). Motor block was measured by Bromage score (Table 1).

Table 1. Bromage score description.

Grade	Criteria	Degree of block
I	Free movement of legs and feet	Nil (0%)
II	Just able to flex knees with free movement of feet	Partial (33%)
III	Unable to flex knees, but with free movement of feet	Almost complete (66%)
IV	Unable to move legs or feet	Complete (100%)

The primary endpoint was intraoperative ephedrine consumption. The secondary endpoints were changes of MAP and heart rate during the first 45 min, level of sensory and motor block and block failure rate (failure of the level to reach T6 or the need to conduct general anesthesia or re-spinal).

3. Sample size calculation

The sample size calculation was done by G*Power 3.1.9.2 (Universitat Kiel, Germany). Power analysis was performed on the total intraoperative ephedrine consumption as the primary outcome of our study using a one-way ANOVA test. Based on a previous study by Favarel-Garrigues et al. [8] the mean intraoperative consumption of ephedrine was 19.4 + 3.3 mg. If sitting position would result in at least a 20% reduction of total ephedrine consumption; α error of 0.05, and power of 0.9. Not less than 60 patients were calculated. The sample will be increased by 10% for the possible dropouts so 66 patients will be recruited (22 patients in each group).

4. Statistical analysis

SPSS v26 (IBM Inc., Chicago, Illinois, USA) was used to conduct the statistical analysis. The quantitative variables of the three study groups were analyzed using an ANOVA (F) test followed by a post hoc test (Tukey), and the results were presented in terms of mean & standard deviation (SD). While qualitative variables were analyzed using the Chi-square test and presented in terms of percentage (%) and frequency. It was considered to have statistical significance if the two-tailed *p* value was less than 0.05.

5. Results

Our study carried out on 66 patients divided into three equal groups: (Sitting-1 group) received spinal anaesthesia and sit for 1 min before lying down; (Sitting-3 group) received spinal anaesthesia and sit for 3 min before lying down; (Sitting-5 group) received spinal anaesthesia and sit for 5 min before lying down, with the same inclusion and exclusion criteria. Figure 1

No statistically significant difference was observed between the study groups regarding demographic data. Table 2

Regarding the spinal block level, there was a statistically significant higher sensory level in the

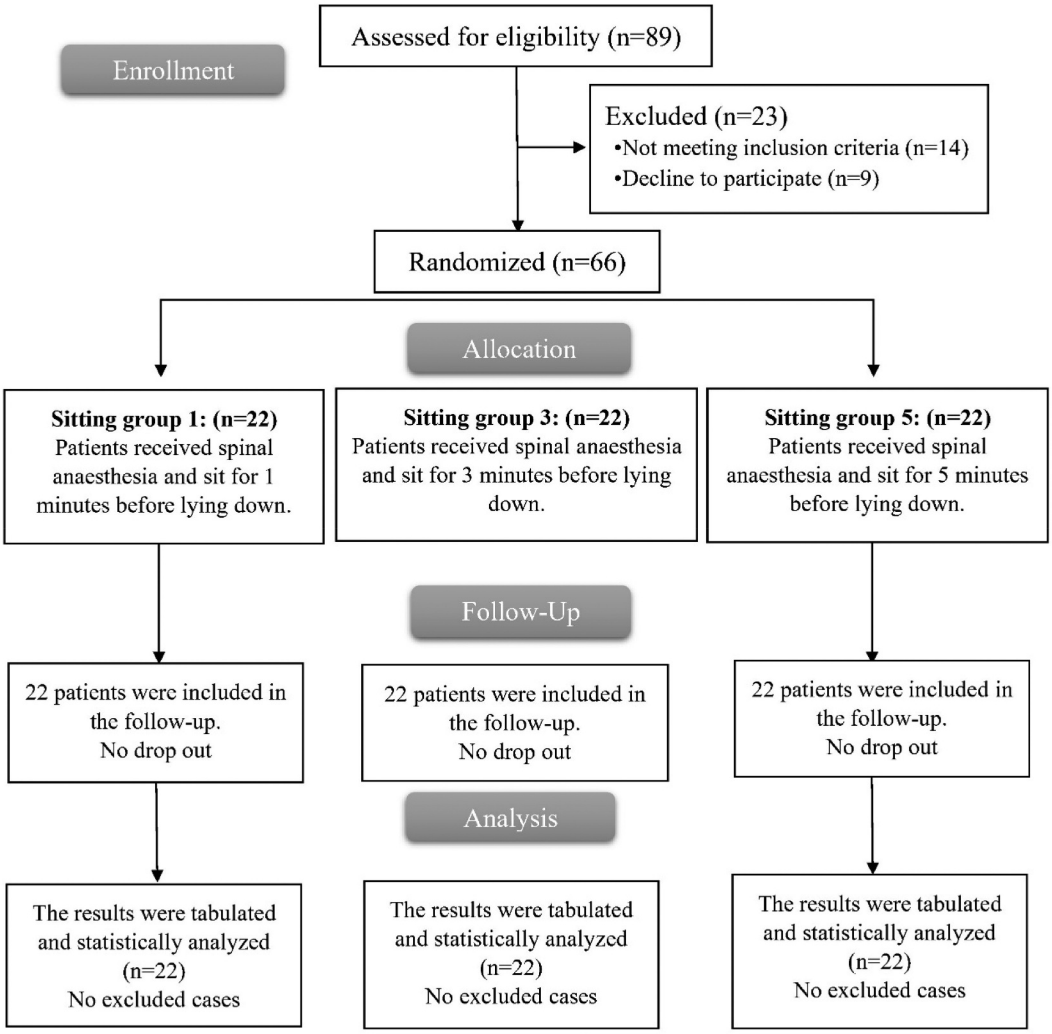

Figure 1. Consort flowchart of the enrolled patients.

Table 2. Comparing the study groups regarding their demographic data.

		Sitting-1 group (*n* = 22)	Sitting-3 group (*n* = 22)	Sitting-5 group (*n* = 22)	p-value
Age (years)		68.41 ± 2.40	68.82 ± 2.72	69.82 ± 2.81	0.201
Sex	Female	13 (59.1%)	9 (40.9%)	11 (50.0%)	0.483
	Male	9 (40.9%)	13 (59.1%)	11 (50.0%)	
ASA	I	4 (18.2%)	5 (22.7%)	2 (9.1%)	0.102
	II	11 (50.0%)	8 (36.4%)	17 (77.3%)	
	III	7 (31.8%)	9 (40.9%)	3 (13.6%)	

Data are presented in terms of Mean ± SD and number (%). p-value >0.05 is insignificant.

Sitting-1 group, followed by Sitting-3 group and then the Sitting-5 group ($p < 0.001$). While all cases in the groups showed a Bromage score IV. Table 3

A statistically significant difference was noticed between the study groups according to MAP at 16 min, at 18 min, at 20 min, at 23 min, at 35 min, at 41 min and at 45 min ($p < 0.05$). The most reduction was in the Sitting-1 group, followed by Sitting-3 group and finally the Sitting-5 group. Figure 2

Differences between the study groups regarding heart rate at 8 min, at 10 min, at 38 min, and at 41 min were statistically significant ($p < 0.05$). The most reduction is in the Sitting-1 group, followed by Sitting-3 group and finally the Sitting-5 group. Figure 3.

Table 3. Comparing the study groups regarding sensory and motor level.

		Sitting-1 group (*n* = 22)	Sitting-3 group (*n* = 22)	Sitting-5 group (*n* = 22)	p-value
Sensory Level	T4	9 (40.9%)	3 (13.6%)	0 (0.0%)	**<0.001****
	T6	13 (59.1%)	17 (77.3%)	14 (63.6%)	
	T8	0 (0.0%)	2 (9.1%)	6 (27.3%)	
	T10	0 (0.0%)	0 (0.0%)	2 (9.1%)	
Motor Level	IV	22 (100.0%)	22 (100.0%)	22 (100.0%)	1.000

Data are expressed as number (%). p-value >0.05 is insignificant; **p-value <0.001 is considered highly significant.

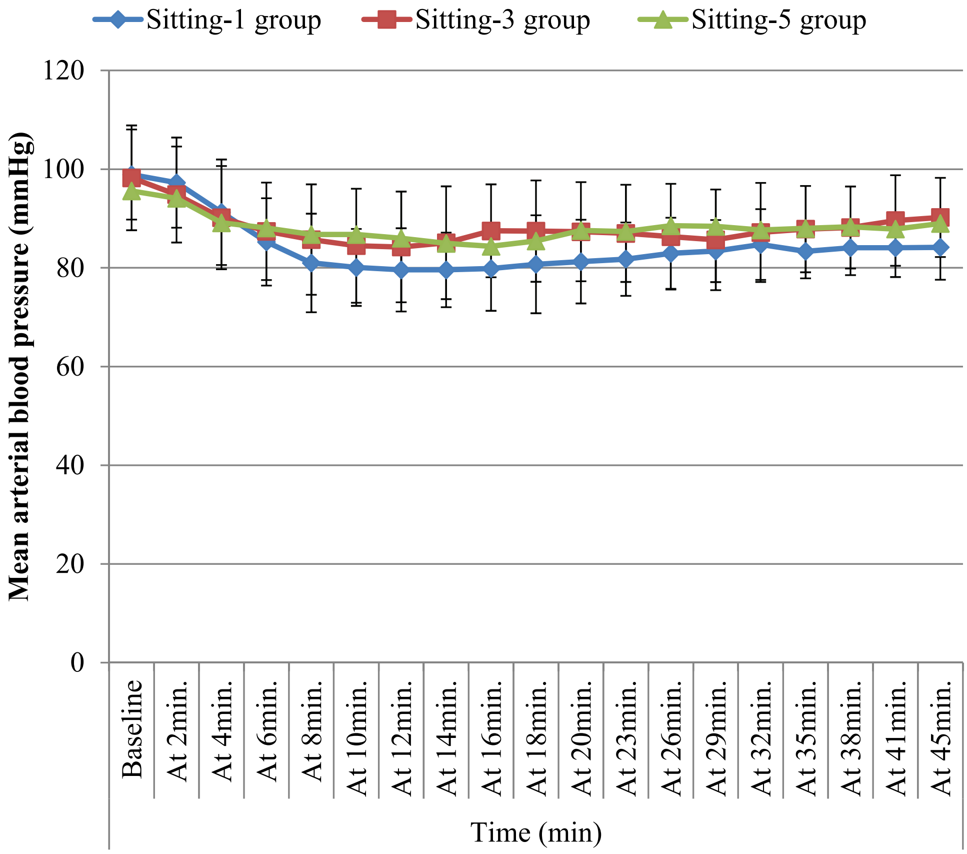

Figure 2. Comparing the study groups regarding mean arterial blood pressure.

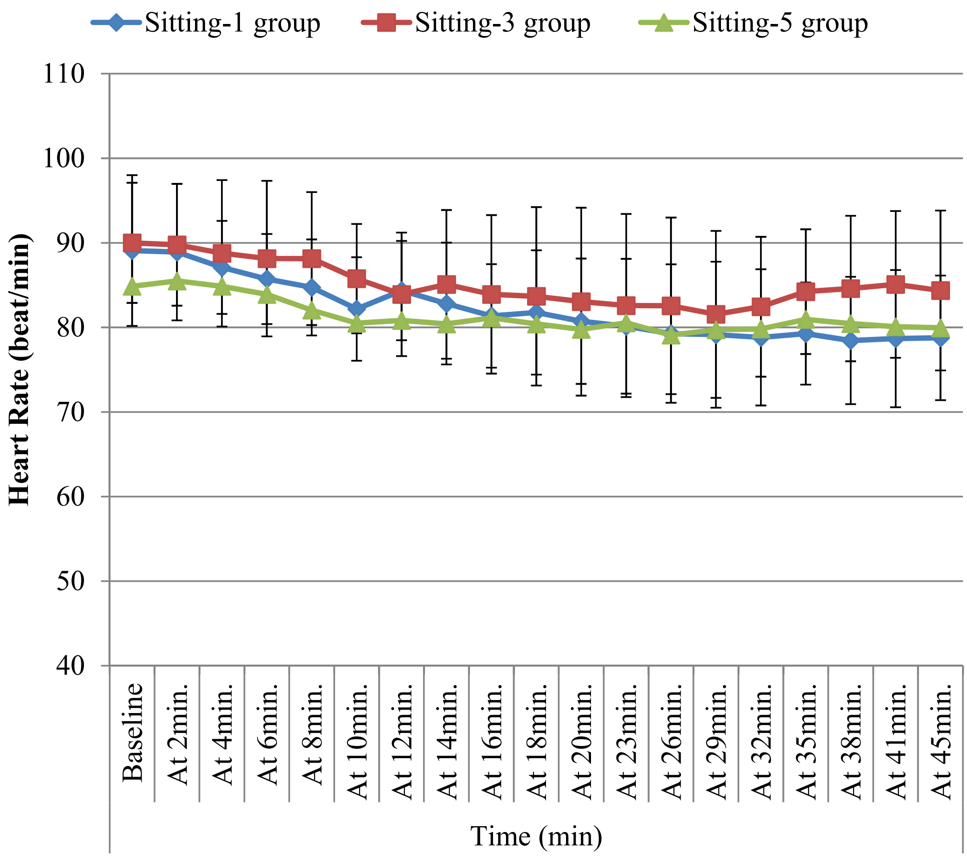

Figure 3. Comparing the study groups regarding heart rate.

Table 4. Comparing the study groups according to need of ephedrine, its total dose, and need of atropine.

	Sitting-1 group (*n* = 22)	Sitting-3 group (*n* = 22)	Sitting-5 group (*n* = 22)	p-value	Post Hoc
Need of ephedrine	10 (45.5%)	6 (27.3%)	1 (4.5%)	0.008*	P1 = 0.215 **P2 = 0.002*** **P3 = 0.041***
Total dose of ephedrine (mg)	12.97 ± 2.21	11.00 ± 2.10	9.00 ± 0.00	0.581	
Need of atropine	0 (0.0%)	1 (4.5%)	1 (4.5%)	0.597	

Data are presented as number (%) or mean ± SD. *p-value <0.05 is significant. P1:*p* value between Sitting-1 and Sitting-3, P2: *p* value between Sitting-1 and Sitting-5, P3: *p* value between Sitting-3 and Sitting-5.

The need of ephedrine in the Sitting-1 group was 10 patients (45.5%), followed by Sitting-3 group was 6 patients (27.3%) and one patient (4.5%) in the Sitting-5 group ($p < 0.05$). No statistically significant difference was found between the study groups regarding total ephedrine dose and needed of atropine. Table 4

6. Discussion

The presence of numerous frequent comorbidities in elderly patients continues to pose a medical challenge for anesthesiologists; furthermore, the incidence of these comorbidities has become more prevalent over the past few years [17].

There's no single anesthetic technique or drug proven to have the potential to guarantee universal benefits in terms of survival for older surgical patients. Geriatrics are more likely to experience adverse effects from both general and local anesthetics [18].

In our clinical study, the duration of sitting decreased the ephedrine requirement significantly in Sitting-3 and Sitting-5 groups. This corresponds to a research done by Amer et al. [16] where the ephedrine requirement was significantly reduced in the sitting groups more the than the instantly lying group. Also, Agrawal and Rawlani [19] found that keeping the patients undergoing lower abdominal surgeries for 30 seconds in a sitting position after spinal anesthesia gives better hemodynamic stability.

In contrast with our results, Veering et al. [14] had previously evaluated the effect of delayed supine position on hemodynamic and analgesic profiles in elderly patients after a spinal block. He did not demonstrate any advantage for a delayed supine position in these patients. However, the mentioned study had many limitations, such as the low sample size (15 patients per group).

In our study, there is a reduction of MAP in the three groups over the periods from the baseline, but the most reduction is in the Sitting-1 group, followed by Sitting-3 group and finally the Sitting-5 group.

In agreement with our results, Han et al. [20] demonstrated that the reduction in MAP at each time point within 30 min after anesthesia was more significant in the decubitus group than in the sitting group after combined spinal epidural anesthesia in elderly patients undergoing elective total hip replacement.

Also, Kim et al. [21] tested the impact of posture changes in elderly after receiving low-dose bupivacaine spinal anesthesia. Patients who immediately laid down after being given spinal anesthesia appeared to have significantly lower sensory block levels at all time points than patients remained seated for 2 min before lying down. However, no significant differences were observed regarding the changes in the peak sensory block level between both groups.

Moreover, a randomized controlled trial done by Sargin et al. [22] found that maintaining parturients going through cesarean delivery in a seated position over a period of 3 min following spinal injection of the local anesthetic led to lower sensory block levels, ephedrine requirements, and hypotension compared to parturients who seated for 1 min and who lie down immediately to a tilted supine position.

Further studies are required with larger groups in different types of surgery and different centers.

7. Conclusions

In elderly patients, sitting time after spinal anesthesia decreases the ephedrine requirement and maintains enough sensory block adequate for surgery.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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