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A Study on the Effect of Lateral and Sitting Positions in Spinal Anesthesia for Cesarean Sections

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Abstract

Background: Spinal anesthesia has become the choice in obstetric patients awaiting cesarean section for its characteristics in providing rapid onset of anesthesia, allowing the mother to immediately interact with her baby. We were going to investigate the effect of the sitting and the lateral decubitus positions in the performance of spinal anesthesia for elective cesarean sections. The objective was to compare the onset time of anesthesia, the total requirement of ephedrine and hemodynamic changes in the Two Groups. *Materials and Methods:* After ethics committee approval, this comparative observational study was conducted in the Department of Anesthesiology at Sri Manakula Vinayagar Medical College and Hospital, Puducherry. A total of 72 parturients who met the inclusion criteria were enrolled into the study and were alternatively prepared for spinal anesthesia either in the sitting or in the left lateral position. The onset time taken for anesthesia to reach T4 level, the total requirement of ephedrine and hemodynamic parameters were recorded. *Results:* The Two Groups were comparable with regards to age, weight, gestational period and ASA grade. The mean and SD of onset time - Sensory Blockade in minute after Injection in sitting position group was 3.833 ± 2.049. Similarly it was 4.75 ± 2.089 for the lateral position group. The mean and SD of Ephedrine requirement in milligram in sitting position group is 8.5 ± 6.313. Similarly it was 7.5 ± 6.934 for the lateral position group. There were no significant difference between the groups. *Conclusion:* Our results showed no significant differences between the sitting and left lateral positions regarding the time taken to achieve T4 dermatomal level of anesthesia, the incidence of hypotension depicted by the total requirement of injection ephedrine and overall hemodynamic variables. We concluded that the sitting or the left lateral decubitus position in the performance of spinal anesthesia for cesarean section does not influence on the onset time of anesthesia and incidence of hypotension.

Keywords: Cesarean section; Spinal anesthesia; Sitting position; Lateral position.

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Introduction

Subarachnoid block has become the choice of anesthesia in obstetric patients for its characteristics in providing very rapid onset of anesthesia, allowing the mother to immediately interact with her baby. And in obstetrics, it is also safer than general anesthesia. So, the complications following

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neuraxial anesthesia has become of great interest either to the anesthesiologist and to the patient.[1,2]

Spinal and epidural block may lead to complications in the acute form such as of pain on injection, high or total spinal anesthesia and hypotension or postoperative complications as backache, Post Dural Puncture Headache, urine retention, meningitis and nerve injury.[3] Many studies were done to detect and analyze incidence, pathophysiology and effective measures to minimize or prevent these complications.

The majority of the physiologic effects of spinal anesthesia and essentially all the cardiovascular effects, are mediated by preganglionic sympathetic blockade. Sympathetic nervous system fibers are more peripherally located in the nerve roots than are the sensory fibers. The level of sympathetic fiber blockade is produced at two or more dermatomes higher than the sensory blockade. These facts are clinically confirmed by the loss of cold sensation and an increase in skin temperature (thermography).[4]

Maternal hypotension is the most frequent complication of spinal anesthesia for cesarean section. Most clinicians define hypotension as a maternal systolic blood pressure below 70–80% of baseline recordings and/or an absolute value of < 90–100 mm Hg. Hypotension is often associated with nausea and vomiting and, if severe, ends in serious risks to mother (unconsciousness, pulmonary aspiration) and baby (hypoxia, acidosis and neurological injury).[5,6]

Cesarean sections are either performed under combined spinal-epidural, spinal anesthesia alone, or under general anesthesia. Indeed in our institute, they are done usually under spinal anesthesia alone. The effects of spinal anesthesia are sympathetic blockade to leading hypotension and bradycardia depending on the spread of the anesthetic agent in the subarachnoid space, followed by sensory and motor blockade.[7] The gravid uterus compressing the inferior vena cava, leads to low venous return so reduced cardiac output and finally accounts to further hypotension. So, hypotension is an important factor to consider during cesarean sections performed under spinal anesthesia.[8]

Spinal anesthesia is achieved either in sitting or lateral decubitus positions according to the patient's condition and the anesthetist's preference. The two positions are routinely used for administration of spinal anesthesia and there is no side effects specific to the positions. However, researchers have been giving conflicting opinions about the incidence of hypotension and the need of vasopressors after the execution of spinal anesthesia in different positions. While some stated high incidence of hypotension and the need of vasopressors in the lateral position, others concluded the same in the sitting position.[9]

Therefore in this study, we are going to investigate the effect of the sitting and the lateral decubitus positions in the performance of spinal anesthesia for elective cesarean sections, in our institute. The study will seek to a better performance of the spinal anesthesia technique, optimum operative conditions and high standard perioperative care of the patient.

Materials and Methods

An observational comparative study was carried out at Sri Manakula Vinayagar Medical College and Hospital, Puducherry during the period of November 2015–August 2017 as per Good Clinical Practice (GCP) guidelines of WHO. Sample size (n = 72) was calculated using the statistical software Open Epi version 3.03, considering the mean difference of 1.7 min, 95% of confidential interval and 80% power. Parturients undergoing elective cesarean section with prior written, informed valid consent were allocated alternatively into Sitting group with 6 Parturients and Left Lateral group with 36 Parturients.

Inclusion criteria

Women posted for elective cesarean section, Gestational age more than 37 weeks, Aged 18 to 35 years, having weight between 50 and 80 kg.

Exclusion criteria

Patients of ASA status III and IV, Patients with severe cardiopulmonary diseases, Uncontrolled diabetes mellitus, Thyroid disorders, Neurologic, psychiatric, neuromuscular diseases, Renal or hepatic disease, Other contraindications of spinal anesthesia.

Procedure

Tablet ranitidine 150 mg will be given orally the night before surgery and Injection ranitidine 50 mg IM; Injection metoclopromide 10 mg IM in the morning as premedication before shifting to operation theater. In the preoperative room, intravenous access was secured with 18-G cannula on the non-dominant upper limb and intravenous crystalloid fluid (Ringer's lactate) was started. Preloading of 10 mL/kg was done.[7] Baseline parameters such as Heart Rate (HR), Systolic Blood Pressure (SBP),

Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP) and oxygen saturation (SpO_2) were observed and noted. All patients received the routine method of spinal anesthesia in our institute: Midline approach in the L3-L4 inter-space, with 10 mg (2 mL) hyperbaric 0.5% bupivacaine, using a 25 gauge Quincke spinal needle. Sitting Group received spinal anesthesia in the sitting position and the Lateral group received it in the left lateral decubitus position. Women in the sitting group were placed with their feet resting on a stool. Patients in the lateral group were positioned in the full left lateral position with a pillow supporting the head. Immediately after the procedure, the patient was immediately positioned in the supine position and a wedge was placed under the right side of the hip. Anesthesia was considered successful when fine touch sensation (cotton wool test) was lost at the dermatomal level of T4 bilaterally. If after 20 minutes, surgical anesthesia was not achieved, the surgery was performed under general anesthesia and patient excluded from the study. Heart rate of less than 50 bpm was managed with injection atropine 0.6 mg bolus intravenously, hypotension considered as mean arterial pressure less than 60 mm Hg, was managed with injection ephedrine 6 mg bolus intravenously.

The following parameters were studied:

Onset time of sensory blockade–sensory blockade upto T4 bilaterally (level of nipples) was achieved by checking the level every 2 minutes, by cotton wool test, scored according to a two point scale. Score 1: present, Score 0: absent.

Hemodynamic parameters: Systolic blood pressure (mm Hg), Diastolic blood pressure (mm Hg), Mean arterial pressure (mm Hg), Heart rate (bpm) and saturation of oxygen (%) were recorded 10 minutes before the procedure and then every 2 minutes until baby delivery and thereafter, every 5 minutes until end of surgery.

Results

In our study a total of 72 patients were enrolled and finally analyzed. Each group consisted of 36 patients who were comparable in age, weight, gestational age, ASA status, obstetric code, sensory blockade and hemodynamic parameters. All the values were expressed as Mean ± Standard deviation, except ASA grading and obstetric code of the patients. All the patients in both the groups belong to ASA Grade II and majority of the patients, sitting (24) & lateral (27) out of 36 were multi in their obstetric code distribution.

The two groups showed similar onset time of anesthesia and the same incidence of hypotension. There were no statistically significant differences in patient demographics with respect to age, weight and the operative time. Similarly, there were no statistically significant clinical differences regarding the obstetric code and gestational age of patients. All patients had a sensory block reaching at least T4, but the onset time to reach the dermatomal level was shorter for the sitting group (3.83 ± 2.05 min) in contrast to the lateral group (4.75 ± 2.09 min). Nevertheless, these values did not establish statistical significance (Table 1).

Table 1: Demographic data of the patients

Parameters	Sitting Group	Left Lateral Group
Age (years)	25.333 ± 2.229	26.083 ± 3.263
Weight (Kg)	66.755 ± 7.186	69.444 ± 8.265
Gestational Age (weeks)	38.194 ± 0.709	38.222 ± 0.831
ASA status (Grade II)	36	36
Obstetric code (primi / multi)	12/24	9/27
Sensory blockade (minutes)	3.833 ± 2.049	4.75 ± 2.089
Requirement of Ephedrine (mg)	8.5 ± 6.313	7.5 ± 6.934

Baseline Systolic blood pressures were almost similar in both groups (121.97 ± 12.86 mm Hg *versus* 119.47 ± 10.94 mm Hg in the sitting and lateral group, respectively. The incidence of hypotension, represented by the requirement of injection ephedrine intraoperatively, was apparently higher in the sitting group (8.5 ± 6.31 mg) than the lateral group (7.5 ± 6.93 mg), but this difference did not achieve statistical significance. There were no significant difference observed between the Systolic BP, Diastolic BP, Mean arterial pressure (Tables 2–3) and Heart rate (Figs. 1–2) between the two study groups.

Table 2: Systolic and Diastolic blood pressure at various time intervals in both the study groups

Sl No	Group	Time in Minutes	Systolic Blood Pressure		Diastoli Blood Pressure	
			Sitting	Left Lateral	Sitting	Left Lateral
1	Before Delivery	Baseline	121.972 + 12.859	119.472 + 10.943	76.028 + 7.264	75.639 + 10.023
		2	105.528 + 12.934	111.5 + 13.179	65.472 + 11.58	66.278 + 13.073
		4	102.889 + 16.381	103.75 + 16.013	61.083 + 13.174	61.25 + 14.393
		6	98.222 + 18.32	100 + 15.853	55.444 + 14.709	55.167 + 13.704
		8	109.69 + 13.779	105.933 + 14.851	69.517 + 9.753	63.4 + 14.952
		10	111.8 + 11.1	112 + 14.549	72.333 + 7.933	69.65 + 15.291
		12	113.778 + 8.511	118.444 + 9.926	75.444 + 5.876	77.444 + 13.343
		14	122.75 + 12.5	129 + 0	77 + 6	80 + 0
2	After Delivery	5	113.056 + 7.856	116.694 + 8.847	69.667 + 8.291	69.833 + 9.388
		10	114.917 + 6.72	114.611 + 9.241	70.583 + 9.281	67.639 + 9.418
		15	115.556 + 11.244	116.083 + 12.258	72.25 + 11.315	67.167 + 12.963
		20	117.139 + 8.513	112.611 + 10.53	71.278 + 10.366	65.333 + 12.24
		25	116.556 + 6.199	105.972 + 23.777	72.5 + 7.173	65.944 + 9.639
		30	117.528 + 9.173	111.222 + 7.838	76.528 + 8.477	68.75 + 10.349
		35	114.885 + 18.098	112.414 + 9.187	74.5 + 14.295	67.69 + 11.641
		40	106.333 + 28.525	111.174 + 11.42	71.083 + 20.215	67.522 + 12.915
		45	117 + 6.141	112 + 11.328	75.5 + 8.384	64.526 + 13.176
		50	113 + 4.243	111.75 + 11.72	70 + 5.657	65.125 + 13.185
		55	–	99 + 0	–	49 + 0
		60	–	–	–	–

Table 3: Mean Arterial blood pressure at various time intervals in both the study groups

Sl No	Group	Time in Minutes	Mean Arterial Blood Pressure	
			Sitting	Left Lateral
1	Before Delivery	Baseline	89.75 + 7.145	89.028 + 8.45
		2	76.389 + 12.07	79.917 + 12.374
		4	74.194 + 13.386	76.778 + 17.003
		6	69.333 + 16.357	72.972 + 16.841
		8	80.552 + 11.073	77.667 + 12.962
		10	85.095 + 7.911	83.05 + 13.926
		12	87.111 + 5.6	90.444 + 11.759
		14	89.75 + 6.5	93 + 0
2	After Delivery	5	82.028 + 10.525	116.694 + 8.847
		10	82.278 + 11.252	114.611 + 9.241
		15	86.583 + 9.998	116.083 + 12.258
		20	86.028 + 10.429	112.611 + 10.53
		25	86.611 + 7.624	105.972 + 23.777
		30	89.056 + 9.384	111.222 + 7.838
		35	88.154 + 16.151	112.414 + 9.187
		40	83.5 + 23.57	111.174 + 11.42
		45	89.375 + 7.425	112 + 11.328
		50	84.5 + 4.95	111.75 + 11.72
		55	–	99 + 0
		60	–	–

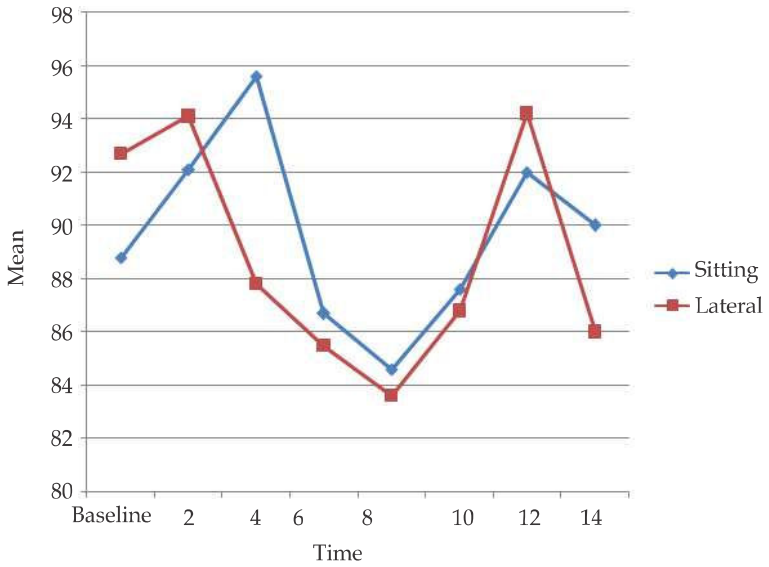

Fig. 1: Mean Heart Rate of the patients before delivery.

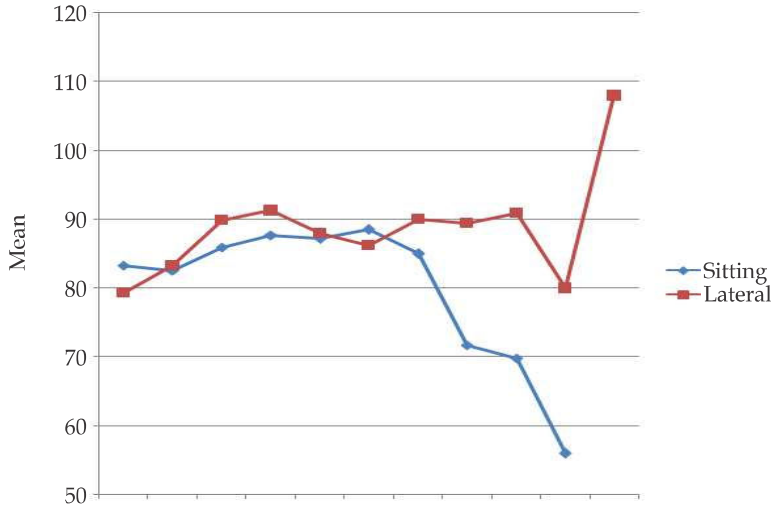

Fig. 2: Mean Heart Rate of the patients after delivery.

Discussion

Studies comparing the left and right lateral position were unable to find a final preference. The first investigators evaluating the sitting *versus* the lateral position during induction of spinal anesthesia placed patients back in the supine position immediately after a single-dose intrathecal injection.[10,11] Because of the extremely short interval between injection and resuming the supine position, it is not surprising that the block characteristics did not differ significantly.

Similarly, Inglis A et al. Found that onset time to T4 was the same in both groups.[11] This result correlates with the onset time to T4 in our study which in turn reflected the identical requirement of ephedrine in the two groups.

Similar to our study Ortiz-Gomez JR et al.[12] evaluated the effect of different positions for the induction of spinal anesthesia for cesarean section on the hemodynamic changes and side effects, their findings are in accordance with our results regarding same incidence of hypotension as well as requirement of ephedrine and phenylephrine perioperatively. They clearly posited that the position did not influence the arterial hypotension and need of vasopressors.

Chevuri SB et al. found same hemodynamic stability in both the groups studied on induction of spinal anesthesia for cesarean section and an easier placement of the spinal needle in the sitting group[9] and these results are consistent with our results as seen in the sitting position *versus* in the left lateral position which showed statistically similar hemodynamic variations throughout the anesthetic procedure and perioperative period.

Kharge ND et al. made a comparison of the lateral and sitting positions for performing combined spinal anesthesia for elective cesarean section[13] and their results are in accordance with our results regarding absence of influence of the induction position on hemodynamic parameters and anesthetic block characteristics.

Despite the authors with their respective studies mentioned above show similar results to the outcome of our study, there are other studies presenting antithetical conclusions. So, here we stand in the need of elaborating the theory behind the intrathecal drug spread which is responsible for differential aspects of hemodynamic variations as well as sensory and motor blockade characteristics.

As the local anesthetic solution is injected, it will spread initially by displacement of CSF and as a result of any currents created within the CSF. The next stage, which may well be the most crucial, is spread due to the interplay between the densities of both CSF and local anesthetic solution under the influence of gravity. Gravity will be 'applied' through patient position (supine, sitting, etc.) and, in any horizontal position, by the influence of the curves of the vertebral canal. Many factors are said to affect these mechanisms,[14] with some having greater impact than others.

The key ones are the physical characteristics of CSF and the solution injected, the clinical technique used and the patient's general features. These interrelate in complex ways and it is important that comparative studies are designed in such a way that two groups of patients receive a technique that differs in one factor only. That is what we intended to perform in our study by comparing two different induction postures of spinal anesthesia.

CSF is an isotonic, aqueous medium with a constitution similar to interstitial fluid. The terms density, specific gravity and baricity define its physical characteristics, but are often used loosely and interchangeably, causing confusion. Precise definitions are as follows: The factors affecting intrathecal drug spread are mutilple. The baricity of the drug solution injected plays an important role. Hyperbaric solutions are more predictable, with greater spread in the direction of gravity[15] and less interpatient variability.[16] In contrast, most plain solutions exhibit greater variability in effect and are less predictable.[16–18]

The volume and concentration of the local anesthetic solution has an appreciable impact on the intrathecal spread. Both CSF and local anesthetics exhibit a curvilinear decrease in density with increasing temperature. CSF is at core body temperature whereas local anesthetic solutions are administered at room temperature. There will be some local decrease in CSF temperature immediately after injection,[19,20] but the core temperature is restored within 2 min, so solution density should be reported at body temperature.

This factor of viscosity of the injected solution has received little attention, but addition of glucose to an aqueous solution changes viscosity as well as density. Studies of a wide range of local anesthetic drugs indicate that intrathecal spread is the same, no matter which one is used, as long as the other factors are controlled.[21,22]

The patient position during and after induction is a very important clinical factor determining the drug spread. It is widely believed that injection of a hyperbaric solution in a seated patient will result in a more restricted block. However, a number of studies have shown that the block, while initially more restricted, eventually extends to a level equivalent to that which would have been obtained had the patient been placed supine immediately after injection.[23–25]

Other clinical factors are the level of injection, the needle type and alignment, intrathecal catheters, fluid currents, epidural injection and finally patient characteristics such as age, weight, height, sex, intraabdominal pressure, spinal anatomy, lumbosacral CSF volume and pregnancy.[26]

Nevertheless, it should be known that obstetric patients awaiting cesarean section under spinal anesthesia are destined to receive smaller doses of spinal local anesthetic than nonpregnant patients due to their smaller CSF volume, the cephalad movement of hyperbaric local anesthetic in the supine pregnant patient and greater sensitivity of nerve fibers to the local anesthetic during pregnancy.[8]

Conclusion

We conclude that the sitting position or the left

lateral decubitus position in the performance of spinal anesthesia for cesarean section does not influence either the onset time of anesthesia or the incidence of hypotension.

It was found that the sitting position facilitated the procedure of spinal anesthesia on the part of the anesthesiologist. The lateral position was found to be more comfortable for patients. Hence, the choice of posture for the performance of spinal anesthesia for elective cesarean section could be granted to the anesthetist's preference or the patient's option.

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