

Minimizing Post Spinal Hypotension by Delayed Supine Positioning Following Spinal Anaesthesia for Cesarean Delivery

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Abstract:

One common and potentially fatal side effect following an intrathecal block for a caesarean section is hypotension of the mother. The mothers' hemodynamic profile improves when non-pharmacological techniques, such as delayed supine positioning, are combined with pharmacological techniques, including the use of injectable phenylephrine. To avoid hypotension, the current study assessed the benefits and drawbacks of combining pharmaceutical and non-pharmacological approaches. Positioning is combined with pharmacological techniques, such as the use of injectable phenylephrine or ephedrine. Following Institutional Ethical Committee approval, from April to June 2024, this study was carried out at the obstetric theatre at Meenakshi Medical College Hospital and Research Institute. Ninety pregnant women were separated into two groups for the study. Group 2 was positioned supine immediately after the intrathecal block, while Group 1 was left seated for two minutes following the injection. Prophylactic intravenous phenylephrine (20 mcg) and an ondansetron 4mg IV bolus were administered to both groups right after intrathecal administration of local anaesthetic. Systolic blood pressure data for the patients were recorded from the time of intrathecal injection until the foetus was delivered. A total of 85 pregnant women were recruited (42 in the sitting group and 43 controls). Intraoperative monitoring of SBP levels shows the mean value of the intervention group was frequently higher than controls. Furthermore, the intervention group exhibited a lower incidence of hypotension, and the occurrence of bradycardia was similar in both groups.

Keywords: Caesarean section, intrathecal blockade, supine position, vasopressor.

INTRODUCTION

The most widely used method of anaesthesia for pregnant women undergoing caesarean section is spinal anaesthesia. The usually witnessed side effect of spinal anaesthetic is maternal hypotension, which can have detrimental consequences for the foetus and the mother [1,2]. Sympathetic nerve inhibition, which causes blood vessels to dilate and less blood to return to the heart, is the main reason for the drop in blood pressure. These adverse effects may include nausea, dizziness, and, in more severe cases, decreased placental blood flow and the unborn child's suffering [3]. Aspiration, changed mental status, and nausea and vomiting are all made more likely by hypotension, which is still a common side effect of spinal anaesthetics [4]. It appears that adopting a delayed supine positioning strategy can be a beneficial and feasible approach in mitigating anaesthesia-induced hypotension [5]. Several strategies, including fluid administration, pharmacological medications, or patient posture, can be used to prevent maternal hypotension [6]. However, each of these approaches has its own set of drawbacks and differing degrees of efficacy. Consequently, there is a continuous quest for innovative ways to enhance patient comfort and safety [1].

Vasopressors are more often recognized as an efficient way to lower post-spinal hypotension than fluid loading. Because of its quicker onset, lower risk of

foetal acidosis, and reduced placental transit, phenylephrine is the recommended vasopressor in the prevention and treatment of post-spinal anaesthesia hypotension [1,6]. The suppression of sympathetic nerves, which causes blood vessels to expand and less blood to return to the heart, is the primary reason for the drop in blood pressure [2].

To avoid post-spinal hypotension, keeping the patient seated following a subarachnoid block is also essential to stop the injected hyperbaric local anaesthetic from spreading to the higher thoracic dermatomal levels. The compression of the dural sac in the supine position, along with the factor of gravity, quickly pushes the local anaesthetic solution and cerebrospinal fluid (CSF) toward the direction of the skull. Additionally, this posture causes acute epidural venous plexus engorgement and vena cava obstruction, which raises block levels [7].

Objectives

Primarily to ascertain the alteration in systolic blood pressure in pregnant individuals in the position as per the group allocated. The other objectives involve assessing the proportion of individuals whose systolic blood pressure was less than 80% of their baseline value after intrathecal blockade, adequacy and duration of sensory block achieved, incidence of nausea and vomiting intraoperatively, vasopressor requirements

and monitoring of parameters such as blood loss, intravenous fluids given, the time taken from incision to delivery of the baby and finally the fetal outcomes via the APGAR scores at 1 minute and 5 minutes following delivery of the baby.

MATERIAL AND METHODS

It is a prospective, observational study. Approval from the institutional ethical committee was acquired. Research population involves pregnant patients aged 18 to 35 who are carrying a full-term (greater than 37 weeks of gestation) single live foetus posted for elective caesarean section under spinal anaesthesia at our labour operation room in Meenakshi Medical College Hospital and Research Institute, Tamil Nadu. Using convenient sampling, a total of 90 samples were analysed with 45 members in each group, and excluding failed spinal anaesthesia, Group 1 with 42 samples and Group 2 with 43 samples were finally analysed. Patients between the ages of 18 and 35 who are pregnant with full full-term (more than 37 weeks of gestation) single live foetus who are planned for elective caesarean sections under spinal anaesthesia were included. Individuals with ultrasound showing fetal abnormalities, those with pregnancy-induced hypertension, presence of cardiac arrhythmias, obese patients with BMI >35kg/m², valvular heart lesions, and maternal 2D-Echo showing left ventricular ejection fraction <45% were excluded from the research population.

Subjects fulfilling the inclusion and exclusion criteria were recruited. Additionally, each participant's signed informed consent was acquired following an explanation of the goals and methodology.

A statistician performed randomization using computer-generated random numbers. A resident who was not involved in patient care randomized the patients into the control group and intervention group. Three successive blood pressure readings taken at an interval of 2 minutes each were recorded, and the mean calculated and noted down as the baseline systolic blood pressure (SBP) while the subject was in the

supine position. Intravenous ondansetron (4 mg) and metoclopramide (10mg) were given after the insertion of an 18-gauge IV cannula. In the sitting position, spinal anesthesia was given with 0.5% Bupivacaine heavy 2.2ml (11mg) intrathecally in the L3-L4 intervertebral space after clear aspiration of CSF.

After the injection, Group 1 (sitting) remained seated for two minutes, while the second (control) group lay down right away. Left lateral tilt was given with a wedge placed below the right side pelvis, and co-loading with crystalloids was administered. Totally up to 1.5 liters of intravenous lactated Ringer's solution was administered till the end of the procedure. Inj. Phenylephrine 20mcg administration was done soon after the injection of intrathecal local anesthetic. After clamping the umbilical cord, 0.5 IU Oxytocin was given intravenously as a bolus over 5 seconds, followed by a 2.5 IU/h infusion of oxytocin.

A nasal catheter was used to add 5L/min of oxygen to the inspired air till delivery. The efficacy of the spinal anaesthetic was assessed using a pinprick test or feeling in addition to a motor block. Post spinal hypotension (described as a drop in systolic blood pressure to less than 80% of the starting point between the foetus's delivery and the intrathecal injection) was treated with 20 mcg of intravenous phenylephrine as treatment. Severe hypotension, explained as a drop in systolic blood pressure <60% of baseline value, was corrected with intravenous ephedrine (6 mg).

After the data was put into an Excel sheet, data analysis was done using Microsoft SPSS 28.0 software. Categorical data were presented as frequencies (%) and evaluated using the Chi-square test. To ascertain if the continuous data were normally distributed, the Shapiro-Wilk test was employed, and the findings were presented as the median (interquartile range) and mean (standard deviation), respectively. Continuous data was analysed using the Mann-Whitney test or the unpaired t-test.

RESULTS AND OBSERVATIONS:

Table 1 displays baseline statistics and demographic information for study participants. The two groups were comparable.

The two groups differed significantly in several important hemodynamic measures, as shown in Table 2. With a p-value of 0.002, the occurrence of episodes of hypotension was substantially lower in Group 1 (26%) than in Group 2 (56%). This suggests that there was noticeably less hypotension among the mothers in Group 1.

Table. 1: Demography and Baseline Hemodynamic Parameters

Variable	Group 1 (n=42) (Sitting)	Group 2 (n=43) (Control)	p-value
Mean Age (years)	29.30±6.48	27.82±6.67	0.110
Mean Weight (kg)	73±13.17	77±14.6	0.107
Mean Time from spinal anesthesia until delivery (min)	29.2±5.30	29.8±6.2	0.804
Mean Time from incision until delivery (min)	22±4.82	23±6.0	0.618
Mean Baseline systolic blood pressure (mmHg)	122.8±12.75	126.7±13.01	0.570
Mean Baseline heart rate (bpm)	97.4±13.3	92±12.6	0.110

Table. 2: Maternal Intraoperative Haemodynamic Parameters

Variables	Group1 (n=42)	Group 2 (n=43)	p-value
Incidence of hypotension SBP <100	11(26.2%)	24 (55.8%)	0.001 *
Hypotensive episodes per mother	0.33±.09	.67±.141	<0.001*
Incidence of severe hypotension	0	4	0.012 *
Incidence of post-delivery Hypotension	5 (11.9%)	23 (53.5%)	0.002*
Mean Post-delivery hypotension episodes	0.26±.190	0.72±.28	<0.001*
Incidence of bradycardia	0 (0%)	1 (2.3%)	0.320

Comparison of Systolic Blood Pressure Between Groups

Throughout the intraoperative phase, the systolic blood pressure values of the intervention group appear to be higher and more consistent than those of Group 2, suggesting that the intervention in Group 1—likely a specific technique or positioning—may be effective in preventing declines in SBP, a common adverse outcome of intrathecal anaesthesia. Figure. Figure 1 shows the trends in SBP over time for the group.

Compared to the control group, the sitting group's blood pressure was noticeably higher ($p = 0.001$). Compared to the controls, the intraoperative systolic blood pressure of Group 1 was greater.

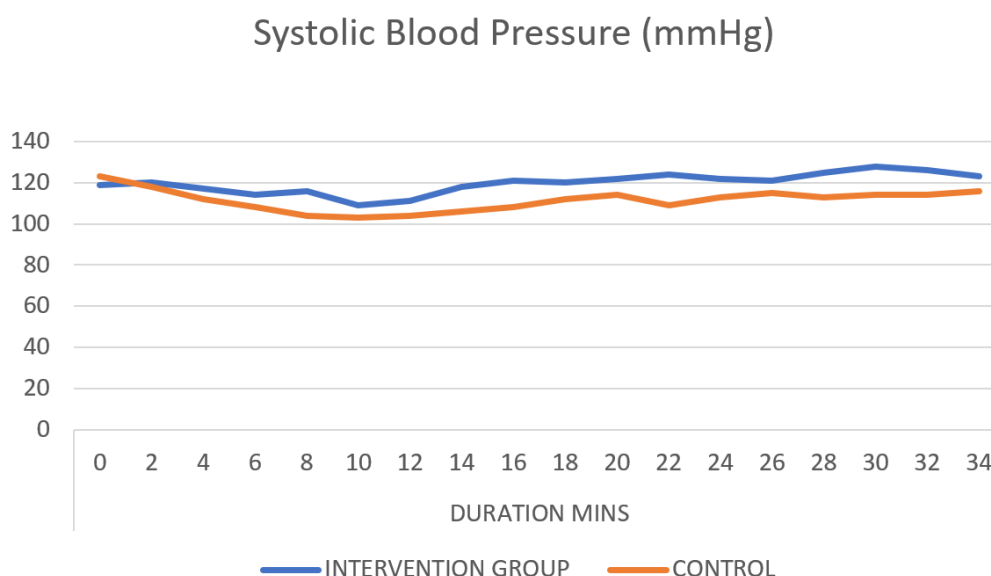


Figure. 1 Comparison of Systolic Blood Pressure Between Groups

In comparison to the baseline reading, systolic blood pressure was mostly sustained in the patients who were positioned supine after a period of sitting. Compared to controls, patients in the sitting group also experienced severe hypotension less frequently and consumed ephedrine at a lower rate. The rates of bradycardia were similar in both groups. Group 1 experienced a lower occurrence of episodes of vomiting and nausea than those of Group 2. The analgesia in Group 1 was less prolonged than in the control group, as shown in Table 3. Urine production and blood loss were similar in both groups, as were other maternal outcomes. At 1 and 5 minutes, the Group 1 outperformed the control group in terms of newborn APGAR scores, as shown in Table 3.

Table. 3: Maternal and Foetal Results

Maternal outcomes	Group 1 (n=42)	Group 2 (n=43)	p-value
Mean Duration of analgesia (min)	124.6±18.3	119.8±16.91	0.070
Blood loss (mL)	742.8±89.4	738.5±79.6	0.171
Incidence of nausea	4	16	0.010*
Incidence of vomiting	3	13	0.032*
Foetal outcomes			
APGAR 1 min	7.6	7.8	0.210
APGAR 5 min	9.5	9.7	0.167

DISCUSSION

Our result shows that, compared to the control group, the Group 1 average systolic blood pressure was noticeably higher. It was found that sitting for five minutes following an intrathecal block consumed less ephedrine and fluids without drastically influencing systolic blood pressure by El-Hakeem et al. [8], which is consistent with our findings.

In terms of hemodynamic parameters, unlike our investigation, Kohler et al. contrasted the recumbent positioning immediately following the subarachnoid block with a scenario where patients remained seated for 3 minutes before lying down [9]. The percentage of patients who needed ephedrine to treat hypotension and the total dose of ephedrine did not differ. The outcomes could be partially explained by the higher dosage of hyperbaric bupivacaine that was given and the moderate lateral tilt employed, which is associated with aortocaval compression.

Moore et al. discovered that after two minutes of sitting, better maternal hemodynamic profiles were seen, and that the longer the seated time, the higher the bupivacaine dosage must be administered [7]. Vagal reflexes are more common in the patient in the sitting position during the performance of a subarachnoid block than in the lateral position. Additionally, in the lateral decubitus position, uterine perfusion pressure is higher, and because of the decreased hydrostatic pressure, puncturing the venous plexus in the epidural space is less likely in the lateral position [8]. The disadvantages of the lateral position far outweigh any theoretical advantages. The advantages of the sitting position include the technical ease of insertion, superior patient comfort, possible improved analgesia for combined spinal epidural (CSE), and decreased aortocaval compression [10].

The advantage of giving an intrathecal block with the patient seated as opposed to the lateral decubitus position is that it provides better hemodynamic

parameters and a decreased need for vasopressors to maintain the mean arterial pressure [11].

The adverse effects and usage of vasopressor drugs can be reduced by combining the use of non-pharmacological techniques with vasopressor prophylaxis [12]. Additionally, our approach allows for a delayed hemodynamic adjustment by delaying this repositioning, giving the body enough time to respond to the changes brought on by the anaesthesia. While there is a preference for fluid loading over non-loading techniques following caesarean deliveries, not all fluid-loading regimens significantly reduce the incidence of post-spinal hypotension [13].

Utilizing a variety of methods, including leg warping, sequential compression devices, tilting or flexing the operating table to encourage venous return, head-up and head-down postures, reverse aortocaval compression, and mechanical wedges or displacers [14].

To avoid post-spinal hypotension, it is important for patients to maintain their sitting posture after a subarachnoid block. This helps to stop local anaesthetic drugs from spreading to the upper thoracic dermatomes [15].

In pregnant individuals, the dural sac's rapid compression and gravity pull the local anaesthetic and CSF (cerebrospinal fluid) in the direction of the skull while the patient is supine. The supine position causes aortocaval compression and swelling of the venous plexus in the epidural space, resulting in abnormally high block levels [16]. Regarding the impact of the multimodal approach for preventing maternal hypotension concerning sitting posture, not much

information has been acquired from previous literature studies.

The induction of spinal anaesthesia using hyperbaric bupivacaine with the parturient in the right lateral position and 10° head-up tilt is an effective method [17]. The approach to positioning the patient in supine after a period of sitting allows for a sufficient time for hemodynamic adaptation by giving the body enough time to respond to the changes brought on by the intrathecal anaesthesia.

Prophylactic norepinephrine infusion effectively lowers the incidence of post-spinal anaesthesia hypotension. A prophylactic dose of 0.05 or 0.075 µg/kg/min norepinephrine prevents post-spinal anaesthesia hypotension in patients undergoing caesarean section [18]. A prophylactic norepinephrine bolus of 5.35 µg, administered with a crystalloid co-load, effectively prevents hypotension following the spinal anaesthesia in caesarean delivery patients [19].

The approach to positioning the patient in supine after a period of sitting allows for a sufficient time for hemodynamic adaptation by giving the body enough time to respond to the changes brought on by the intrathecal anaesthesia. The results of this experiment demonstrate how well delayed supine positioning works to lower the risk of hypotension following subarachnoid block in caesarean births. The limitations of this study include the limited sample size and that only pregnant individuals from one centre were involved. The group, having received the intervention, displayed a considerable reduction in the need for vasopressors, highlighting the potential of this simple intervention to enhance patient safety and lessen the burden on healthcare resources [20].

CONCLUSION

In mothers having a scheduled caesarean surgery, combining pharmacological (vasopressors) and mechanical (sitting position) strategies to minimize post-spinal hypotension will improve maternal hemodynamic parameters, vasopressor intake, nausea and vomiting, and foetal outcomes. To confirm that these results of the effects of delayed positioning of the patient in supine position after intrathecal blockade for caesarean section in terms of hemodynamic stability and on other pertinent outcomes are of immense importance, more studies are needed in a variety of contexts with larger populations. Confirming these results in bigger and more varied populations and examining the intervention's broader implications in resolving spinal anaesthesia-related problems should be the main goals of future studies. This method has the prospect to significantly improve overall outcomes and maternal safety in addition to being simple to adopt and apply.

Conflict of interest

Nil conflict of interest.

Authorship Contribution Statement

Vigneshwaran K: Experimentation and Writing-original draft, Namasivayam S.A.: Review and editing, Chandru E: Review and editing, Vishak M: Review, Thej Kiran N: Formal analysis, Sivatharshini. P*: Conceptualization and supervision.

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