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EFFICACY OF USING DELAYED SUPINE POSITIONING IN THE PREVENTION OF POST-SPINAL ANESTHESIA HYPOTENSION IN FEMALES UNDERGOING CAESAREAN DELIVERIES

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ABSTRACT

Background: After a subarachnoid block is administered after a caesarean section delivery, maternal hypotension is a risky and frequent consequence. Maternal hemodynamic profiles are better affected when different pharmaceutical techniques—such as ondansetron and norepinephrine—are used in conjunction with non-pharmacological techniques during delayed supine positioning.

Aim: The current study set out to evaluate the risks and advantages of using both pharmaceutical and non-pharmacological approaches in the prophylaxis of hypotension.

Methods: 170 subjects were randomly split into two groups and tested for the study. Group II (control) patients were forced to lie down in a supine position as soon as the subarachnoid block was administered, while Group I subjects were remained seated for two minutes following injection. Prophylactic intravenous infusion of norepinephrine and ondansetron bolus prior to surgery was administered to both groups. Systolic blood pressure was measured in each patient starting with the intrathecal injection and continuing until delivery.

Results: Systolic blood pressure in the sitting group (Group I) was 122±16 mmHg till delivery, which was substantially higher than in the control group (114±12 mmHg; p=0.003). The intraoperative systolic blood pressure in the sitting group was higher than in the control group. In addition, there was a decreased occurrence of hypotension and ephedrine use in comparison to the control group. The two research groups had similar rates of bradycardia.

Conclusion: The current study suggests that improved outcomes for the fetus, nausea and vomiting, vasopressor intake, and maternal hypotension are obtained when pharmacological and non-pharmacological techniques are used in conjunction during caesarean births.

Keywords: supine position, subarachnoid block, hypotension, ondansetron, caesarean section

INTRODUCTION

One of the frequent and unfavorable effects of a subarachnoid block used for caesarean section deliveries is maternal hypotension, which can potentially lead to serious problems for both the mother and the fetus. Several strategies, including patient posture, the use of pharmaceutical agents, and fluid administration, can be used to prevent maternal hypotension. 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.1. Administering vasopressor drugs like ephedrine and phenylephrine can cause a number of adverse consequences, including fetal acidosis and reflex bradycardia.

Thus, the adverse effects and usage of vasopressor drugs can be reduced by combining the use of non-pharmacological techniques with vasopressor prophylaxis.2 One medication that is thought to be safe, effective, and to prevent post-spinal hypotension with little side effects is ondansetron. 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.3

In order to postpone the commencement of the subarachnoid block, it is also important to arrange the subjects such that they remain seated for a while after the block is administered. It is thought that the body can adjust to the sympathetic blockade and provide a better hemodynamic profile when the neuraxial block starts slowly. In order to avoid post-spinal hypotension, it is important for patients to maintain their sitting posture after subarachnoid block. This helps to stop local anesthetic drugs from spreading to the upper thoracic dermatomes.4

The dural sac's rapid compression and gravity pull the local anesthetic and CSF (cerebrospinal fluid) in the direction of the skull while the patient is supine. This position causes the vena cava to get blocked and the epidural venous plexus to swell, resulting in abnormally high block levels. There is a dearth of material available to assess the effects of delayed supine placement on the hemodynamics of mothers after subarachnoid block anesthesia.5

Few data from earlier literature studies have been gathered about the effects of the multimodal strategy for preventing maternal hypotension with regard to sitting posture. In order to evaluate the advantages and disadvantages of using both pharmaceutical and non-pharmacological approaches in the prophylaxis of maternal hypotension, a clinical trial was conducted.

MATERIALS AND METHODS

The goal of the current randomized controlled clinical trial was to evaluate the risks and advantages of using both pharmaceutical and non-pharmacological approaches in the prophylaxis of maternal hypotension. The study was conducted between... and.., after approval from the relevant institutional ethical committee. The research participants were drawn from the institute's Department of Obstetrics and Gynaecology. Prior to study participation, informed consent was obtained from all subjects, both verbally and in writing.

170 female participants undergoing caesarean delivery at the Institute were evaluated for the study. Subjects who were between the ages of 18 and 35, had singleton pregnancies, were undergoing elective caesarean birth at the institute under subarachnoid block anaesthesia, and were at full term gestation or more than 37 weeks were the inclusion criteria for the study. Subjects with pre-existing hypertension, contraindication to spinal anaesthesia, pregnancy-induced hypertensive disorders, peripartum bleeding, valvular heart lesions, obese subjects with BMI >35 kg/m2, cardiac arrhythmias with rhythm other than normal sinus rhythm and sinus tachycardia, and fetal anomalies were among those excluded from the study.

The 170 subjects that were included were split into two groups at random. Group II (control) patients were forced to lie down in a supine position as soon as the subarachnoid block was administered, while Group I subjects were remained seated for two minutes following injection. Baseline systolic blood pressure in both groups was measured in the supine position as the average of three successive measures taken at intervals of two minutes. Prior to the intravenous line (IV) insertion and premedication, all evaluations were recorded. The trial individuals received intravenous administration of 50 mg ranitidine and 4 mg ondansetron following the insertion and securing of the IV line. A subarachnoid block was administered in the sitting posture in the L4-L5 or L3-L4 interspace using aseptic and sterile procedures. 25µg of fentanyl and 11 mg of 0.5% bupivacaine were then administered. Subjects in Group II (control group) were forced to lie down right after injection, while those in Group I (sitting group)

were left sat for two minutes after the injection. Ringer's lactate solution was used to accomplish co-hydration while all of the participants in both groups were positioned in a left lateral tilt supine position.

Norepinephrine was continued intravenously in both groups after an initial 0.05 µg/kg/min infusion and a 5µg IV bolus combined with a subarachnoid block anesthetic agent. Following delivery, the patient received an oxytocin bolus (0.5 IU over 5 seconds) and then 2.5 IU/hour. 3L/min of oxygen was used as inspired air supplementation up until delivery. When a fetus is born and receives an intrathecal injection, post-spinal hypotension is defined as a drop in systolic blood pressure to less than 805 of the baseline value. This condition is treated with 9 mg of IV ephedrine.

Subsequently, post-spinal hypotension—defined as a drop in systolic blood pressure to less than 60% of the baseline value—was treated with 15 mg of IV ephedrine. Additionally, when the blood pressure did not respond to the initial dose within two minutes, a vasopressor bolus was administered. Intraoperative hypertension was controlled with a >120% increase of the baseline levels when the norepinephrine infusion was stopped. Once the subject's blood pressure stabilized, the infusion was resumed. In order to treat intraoperative bradycardia, which was defined as a heart rate of less than 55 beats per minute without hypotension between fetal delivery and intrathecal injection, vasopressor infusion was stopped. Subjects who had both bradycardia and hypotension were administered 9 mg of IV ephedrine.

A 0.5 mg IV atropine bolus was administered if the bradycardia persisted after the previously mentioned therapy or if the hypotension did not coexist. The study data did not include patients who experienced intraoperative blood loss above 1000 milliliters, did not have a successful subarachnoid block with a sensory level below T4, and had high spinal block individuals whose spinal denervation extended to the second or third dermatome during the subarachnoid block. The main result evaluated was a shift in the subject's systolic blood pressure based on the group to which they were assigned, in addition to the preoperative IV ondansetron and IV norepinephrine infusions.

. Hemodynamic data, including heart rate, mean pulse pressure, and diastolic blood pressure, were evaluated as secondary outcomes. The percentage of participants with a decreased SBP of less than 80% of the baseline value from intrathecal injection until fetus delivery was used to calculate the incidence of post-spinal hypotension. The percentage of patients whose systolic blood pressure was less than 60% of baseline values was used to measure severe post-spinal hypotension. The research also evaluated post-delivery hypotension, which is defined as the proportion of participants whose systolic blood pressure was less than 80% of the pre-delivery and oxytocin beginning blood pressure. Systolic blood pressure more than 80% of baseline levels is a sign of reactive hypotension, which is diagnosed within two hours.

The degree and duration of subarachnoid block analgesia, the need for ephedrine and norepinephrine intraoperatively, and nausea and vomiting during the procedure were among the other factors evaluated.
The time between the skin incision and the birth of the fetus, the volume of blood loss during surgery, and the duration from the subarachnoid block to the delivery were all evaluated as additional data. The umbilical blood gases potential of hydrogen (pH), partial pressure of carbon dioxide (pCO_2), pressure of oxygen (pO_2), and bicarbonate (HCO_3), as well as the newborns' APGAR (appearance, pulse, grimace, activity, and respiration) scores, were measured one and five minutes after birth.

The unpaired t-test and SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) were used for the statistical analysis of the collected data. The statistics were presented as percentage, frequency, mean, and standard deviation. An acceptable p-value for statistical significance was <0.05. Repeated measures and ANOVA (analysis of variance) were employed to assess the change in parameters of any group before and after surgery.

RESULTS

The goal of the current randomized controlled clinical trial was to evaluate the risks and advantages of using both pharmaceutical and non-pharmacological approaches in the prophylaxis of maternal hypotension. 170 participants in the study were split into two groups at random.

Group II (control) patients were forced to lie down in a supine position as soon as the subarachnoid block was administered, while Group I subjects were remained seated for two minutes following injection. In the sitting and control postures, the study subjects' mean age was 28.2±2.6 and 28.4±5.2 years, respectively, with a p-value of 0.62. The groups in the sitting and control positions had mean BMIs of 21.3±3.2 and 22.4±4.4 kg/m2, respectively, with a non-significant difference (p=0.87). With a p-value of 0.67, the mean weight for Groups I and II was 78.6±11.2 and 77.4±10.2 kg, respectively. Groups I and II had baseline heart rates of 97.3±13.22 and 92.5±14.2 bpm, respectively, with p=0.12.

Groups I and II had similar baseline systolic blood pressure (p=0.63). Table 1 illustrates that there were no significant differences between Groups I and II in terms of the time from spinal anesthesia to delivery or the time from incision to delivery (p=0.82 and 0.73, respectively).

The study's findings demonstrated that, when comparing the intraoperative maternal hemodynamics in the two study groups, 1.16% (n=1) of the individuals in Group II displayed a non-significant difference (p=0.34), while no participants in Group I had bradycardia. Not a single female from either group experienced a hypotension episode per mother. In females from Groups I and II, the incidence of hypotension was observed in 26.19% (n = 22) and 4.65% (n = 4), respectively, with significant differences observed (p = 0.007).

In Groups I and II, norepinephrine infusion was 205.22±47.2 µg and 202.12±38.2 µg, respectively. This was non-significant, with a p-value of 0.43. As shown in Table 2, the mean total ephedrine dose given to research participants in Groups I and II was 0±0.7 and 32±0.43 mg, respectively. This was considerably greater in the control group with p<0.001.

In terms of maternal hemodynamics, it was seen that post-delivery hypotension episodes occurred in 21.42% (n=18) of the seated participants in Group I and in 53.48% (n=46) of the Group II subjects. The control group had a considerably higher rate of post-delivery hypotension episodes (p<0.001). The incidence of post-delivery hypotension was seen in 21.42% (n=18) of Group I patients and 53.48% (n=46) of Group II subjects; the control group had a considerably greater incidence of post-delivery hypotension (p=0.001).

There was no incidence of severe hypotension observed in any of the participants in Group I, but 13.95% (n=12) of the subjects in Group II showed a substantially greater incidence (p=0.01). Groups I and II had mean hypotension episodes per mother of 0±0.3 and 1±0.5, respectively, with significant differences (p<0.001). As shown in Table 2, the incidence of hypotension was observed in 28.57% (n=24) of the patients in Group I and 62.79% (n=54) of the participants in Group II. This was substantially greater in the control group with p=0.001.

When the maternal and fetal outcomes of the two study groups were examined, it was observed that the incidence of vomiting was considerably lower in Group I (7.14%; n = 6) than in Group II (30.23%; n = 26; p = 0.007) among the maternal outcomes. With 32 participants in Group II compared to 8 subjects in Group I, the incidence of nausea was considerably higher (p=0.004). In Groups I and II, the urine production was 300±14.23 and 200±13.88 mL, respectively, showing non-significant differences (p=0.15). With p=0.29, blood loss was similar in Groups I and II. The duration of analgesia in Groups I and II was 120.22±6.24 and 120.22±5.98 minutes, respectively, with p=0.06 indicating non-significant differences.

In terms of fetal outcomes, Groups I and II's APGAR 1 min scores were 7±2.2 and 7±1.8, respectively, indicating significant differences (p=0.02). At five minutes, Group I's APGAR scores were significantly higher (p<0.001) at 9±2.1 and 8±1.6. Table 3 illustrates the non-significant difference in umbilical artery blood gas parameters for HCO3, pO2, and pCO2 (p-values of 0.16, 0.95, and 0.13), while Group I had significantly higher pH (7.26±1.6) than Group II (7.22±0.8), which was significantly higher for Group I (p=0.01).

DISCUSSION

In this study, 170 participants were split into two groups at random. Group II (control) patients were forced to lie down in a supine position as soon as the subarachnoid block was administered, while Group I subjects were remained seated for two minutes following injection. In the sitting and control postures, the study subjects' mean age was 28.2±2.6 and 28.4±5.2 years, respectively, with a p-value of 0.62. The groups in the sitting and control positions had mean BMIs of 21.3±3.2 and 22.4±4.4 kg/m2, respectively, with a non-significant difference (p=0.87). With a p-value of 0.67, the mean weight of Groups I and II was 78.6±11.2 and 77.4±10.2 kg, respectively.

Groups I and II had baseline heart rates of 97.3±13.22 and 92.5±14.2 bpm, respectively, with p=0.12. Groups I and II had similar baseline systolic blood pressure (p=0.63). In Groups I and II, the times from spinal anesthesia to delivery and from incision to delivery showed non-significant differences (p=0.82 and 0.73, respectively). These results were in line with research conducted in 2017 by Butwick AJ et al6 and Hasanin A et al7, in which the authors evaluated participants whose demographic information was similar to that of the current study.

When the intraoperative maternal hemodynamics in the two study groups were compared, it was observed that 1.16% (n=1) of the individuals from Group II had a non-significant difference with p=0.34, while no subject from Group I had

bradycardia. Not a single female from either group experienced a hypotension episode per mother. Hypotension was observed in 26.19% (n=22) and 4.65% (n=4) of the female participants in Group I and II, respectively. This difference was statistically significant at p=0.007. In Groups I and II, norepinephrine infusion was 205.22±47.2 µg and 202.12±38.2 µg, respectively. This was non-significant, with a p-value of 0.43. The control group received considerably higher amounts of total ephedrine (p<0.001) than the study individuals from Groups I and II, with mean doses of 0±0.7 and 32±0.43 mg, respectively.

These results showed correlations with the maternal hemodynamics reported by the authors in their 2013 study and their 2016 study by Haseen M et al., where the results were similar to those of the current investigation. According to the study's findings, when comparing maternal hemodynamics, post-delivery hypotension episodes were observed in 21.42% (n=18) of the seated participants in Group I and 53.48% (n=46) of the group II patients. This difference was statistically significant and occurred in the control group with a p-value of less than 0.001. The incidence of post-delivery hypotension was seen in 21.42% (n=18) of Group I patients and 53.48% (n=46) of Group II subjects; the control group had a considerably greater incidence of post-delivery hypotension (p=0.001).

There was no incidence of severe hypotension observed in any of the participants in Group I, but 13.95% (n=12) of the subjects in Group II showed a substantially greater incidence (p=0.01). Groups I and II had mean hypotension episodes per mother of 0±0.3 and 1±0.5, respectively, with significant differences (p<0.001). The incidence of hypotension was seen in 28.57% (n=24) of Group I patients and 62.79% (n=54) of Group II subjects; the control group had a considerably greater incidence of hypotension (p=0.001). These outcomes were in line with those of El-Hakeem et al. (2010) and Kehler F et al. (2002), whose investigations revealed similar hypotension parameters to those of the current investigation.

In relation to the comparison of the fetal and maternal outcomes in the two study subject groups, the incidence of vomiting was observed in 7.14% (n=6) of the subjects in Group I, which was substantially lower than the 30.23% (n=26) of the individuals in Group II (p=0.007). With 32 participants in Group II compared to 8 subjects in Group I, the incidence of nausea was considerably higher (p=0.004). In Groups I and II, the urine production was 300±14.23 and 200±13.88 mL, respectively, showing non-significant differences (p=0.15).

With p=0.29, blood loss was similar in Groups I and II. The duration of analgesia in Groups I and II was 120.22±6.24 and 120.22±5.98 minutes, respectively, with p=0.06 indicating non-significant differences. These results were consistent with investigations by Patel M et al. (1993) and Inglis A et al. (1995), which found similar maternal outcomes following subarachnoid block to those of the current investigation. The APGAR 1 minute scores for the fetal outcomes were seen to be 7±2.2 and 7±1.8 in Groups I and II, respectively, indicating significant differences with p=0.02. At five minutes, Group I's APGAR scores were significantly higher (p<0.001) at 9±2.1 and 8±1.6.

The umbilical artery blood gas measurements revealed that there was no significant difference in HCO3, pO2, and pCO2 (p-values of 0.16, 0.95, and 0.13, respectively). However, Group I had significantly higher pH (7.26±1.6) than Group II (7.22±0.8), which was significantly higher for Group I (p=0.01). These findings were consistent with those published by Polley LS et al. (2008) and Moore A et al. (2014), who reported similar fetal outcomes and umbilical artery blood gas values.

CONCLUSIONS

Considering its limitations, the present study concludes that the combined use of pharmacological and non-pharmacological methods during caesarean deliveries results in better outcomes concerning the fetus, nausea and vomiting, vasopressor consumption, and maternal hypotension. Further longitudinal studies with larger sample sizes and longer monitoring intervals can help with further clarification of the issue.

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TABLES

Characteristics	Group I (sitting)	Group II (control)	p-value
Mean age (years)	28.2±2.6	28.4±5.2	0.62
BMI (kg/m2)	21.3±3.2	22.4±4.4	0.87
Weight (kg)	78.6±11.2	77.4±10.2	0.67
Baseline heart rate (bpm)	97.3±13.22	92.5±14.2	0.12
Baseline systolic BP (mmHg)	125±10.2	126.2±10.4	0.63
Time from spinal anesthesia to delivery (min)	29.5±5.2	29.1±8.3	0.82
Time from incision to delivery (min)	21.2±4.4	21.6±6.1	0.73

Table 1: Baseline demographic data and hemodynamic data in the two groups of study subjects

Parameter	**Group I (sitting)**		**Group II (control)**		**p-value**
	n=84	**%**	**n=86**	**%**	
Bradycardia incidence	0	0	1	1.16	0.34
Hypotension episode per mother	0	0	0	0	0.006
Hypotension incidence	22	26.19	4	4.65	0.007
Norepinephrine infusion (µg)	205.22±47.2		202.12±38.2		0.43
Total ephedrine (mg)	0±0.7		32±0.43		**<0.001**
Post-delivery hypotension episode	0±0.3		1±0.5		**<0.001**

Post-delivery hypotension incidence	18	21.42	46	53.48	**0.001**
Severe hypotension incidence	0	0	12	13.95	**0.01**
Hypotension episode per mother	0±0.3		1±0.5		**<0.001**
Hypotension incidence	24	28.57	54	62.79	**0.001**

Table 2: Comparison of intraoperative maternal hemodynamics in two study groups

Parameter	**Group I (sitting) n=84**	**Group II (control) n=86**	**p-value**
Maternal outcomes			
Vomiting incidence	6	26	0.007
Nausea incidence	8	32	**0.004**
Urine output (mL)	300±14.23	200±13.88	0.15
Blood loss (mL)	750±50.86	700±48.33	0.29
Analgesia duration (min)	120.22±6.24	120.22±5.98	0.06
Fetal outcomes			
APGAR 1 min	7±2.2	7±1.8	**0.02**
APGAR 5 min	9±2.1	8±1.6	**<0.001**
Umbilical artery blood gas parameters			
HCO3	20±1.4	18±0.8	0.16
pO2	23±0.6	23±0.4	0.95
pCO2	42±0.2	45±0.1	0.13
pH	7.26±1.6	7.22±0.8	**0.01**

Table 3: Comparison of maternal and fetal outcomes in two groups of study subjects