Comparison of Severity of Hypotension between Different Positions during Spinal Anaesthesia for Elective Caesarean Section

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ABSTRACT

BACKGROUND

Elective caesarean section can be performed via the spinal, epidural or the combined spinal-epidural route. Although each of these techniques come with their own pros and cons, a single shot spinal anaesthesia is the preferred and most widely accepted technique with reliable and predictable degree of anaesthesia. Though, a subarachnoid block is easy to perform, it is associated with a greater extent of hypotension, which, if severe enough can have a telling effect on both the mother and the neonate. The purpose of this study was to investigate, if the maternal position while administering spinal anaesthesia can play a role in minimizing the extent of hypotension. Subsequent requirement of vasopressor (Phenylephrine) was also noted.

METHODS

This was a prospective study and was carried out at R.G. Kar Medical College, Kolkata, over a period of 1 year. 150 ASA 2 patients aged 18 years and above, undergoing elective caesarean section, were divided into 5 groups. Women in each group were placed in a particular position for administering spinal anaesthesia with 12.5 mg of intrathecal 0.5% hyperbaric bupivacaine. Noninvasive blood pressure, heart rate and vasopressor requirement were measured at intervals of 5 minutes for a period of 15 minutes, for women in each group.

RESULTS

It was observed that women who were kept in the sitting position for 5 minutes after administration of spinal anaesthesia and gradually placed in the supine position (Group 5) experienced the least incidence of hypotension and changes in heart rate. Consequently, the requirement of vasopressor (Phenylephrine) was also low in them compared to the other groups.

CONCLUSIONS

The study showed that the extent of hypotension following spinal anaesthesia can be minimized by altering the position of the parturients.

KEY WORDS

Hypotension, Patient Positioning, Caesarean Section, Subarachnoid Block, Vasopressor (Phenylephrine)

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BACKGROUND

Over the past few decades, there has been a tremendous increase in the number of Caesarean deliveries performed in most countries.[1,2] A significant number of these is elective Caesarean sections. The method of anaesthesia for such Caesarean section deliveries can be either regional or general. However, neuraxial anaesthesia remains the preferred choice for Caesarean deliveries across the world.

Regional anaesthesia has gained in popularity over the years and is the preferred technique because general anaesthesia has been associated with a greater risk of maternal morbidity and mortality. Regional anaesthesia can be performed via the spinal, epidural or the combined spinal – epidural route. Although each technique comes with its own pros and cons, and in spite of numerous studies in the past comparing these techniques, a single shot spinal anaesthesia is the preferred and most widely accepted technique.[2,3,4]

A sub arachnoid block, is easier to perform, has a faster onset of action and is less time consuming compared to placing an epidural catheter. But, at the same time, a spinal block can be associated with a greater extent of hypotension as compared to an epidural or a combined spinal-epidural technique.[2,3,5] It is this feature of a spinal block that forms the basis of this study. One such method to reduce the incidence of post spinal hypotension, is to alter the position of the patient while placing the neuraxial block, in such a way, that the rise of the local anesthetic agent in the spinal column can be slowed down.

In our protocol, we hypothesized that by slowing the rise of the intrathecally administered hyperbaric bupivacaine, severity of hypotension might be reduced. Therefore, this study was aimed to analyze the effects of patient positioning while delivering spinal anaesthesia. Subsequent changes of other hemodynamic variables (heart rate) were also compared between the groups, as was the requirement of vasopressors (Phenylephrine in this study) to counter the resultant hypotension.

METHODS

This prospective study was carried out at R.G. Kar Medical College and Hospital, Kolkata, from October 2015 to September 2016, after approval by the Institutional Ethics Committee. A total of 150 ASA 2 patients of 18 years and above undergoing Elective Caesarean Section for term singleton pregnancy (≥ 37 weeks' gestation), were enrolled for the study on first come basis. Patients with co-morbidities (Hypertension, diabetes mellitus, cardiovascular or cerebrovascular disease and a history of coagulation disorders, contraindication to spinal anaesthesia) were excluded from the study. Purposive sampling was done. A total of 150 subjects with a minimum Systolic Blood Pressure SBP of 90 mmHg and a minimum Diastolic Blood Pressure (DBP) of 60 mmHg were selected. These 150 subjects who fulfilled the inclusion criteria were further divided into the following 5 groups for the purpose of this study. Group 1 (n=30): Patients placed in the lateral position with no head tilt (Lateral + flat table), for administering spinal anaesthesia, then subsequently supine; Group 2 (n=30): Patients placed in the lateral position with 10-15 degrees head up tilt (lateral + slanted table) for administering spinal anaesthesia, then supine; Group 3 (n=30): Patients placed in the sitting position for administering spinal anaesthesia, then placed immediately supine; Group 4 (n=30): Patients placed in the sitting position for administering spinal anaesthesia. After spinal was placed, the patients were turned to a 30 degrees upper body tilt, followed by a slow recline to supine position over 5 minutes; Group 5 (n=30): Patient placed in the sitting position for administering spinal anaesthesia administration. After spinal is placed, the patient is maintained in sitting posture for 5 minutes, and then placed supine. When ultimately made supine for surgery, a left uterine displacement with a right sided wedge was maintained. No control was applied for this observation, and all the groups were studied independently. All patients were kept fasting for 6 hours before Caesarean section. Standard monitors included non-invasive blood pressure, electrocardiography and pulse-oximetry. After IV access was secured, the patients were positioned accordingly for administering spinal injection. Spinal anaesthesia was administered with 2.5 ml (12.5 mg) 0.5% hyperbaric bupivacaine at L3-L4 interspace using 27-gauge Quincke's spinal needle. I litre of Ringer's Lactate Solution was infused (10 ml/kg of body weight). The extent of neuraxial blockade was assessed by pin prick and surgical incision was allowed when a sensory level of at least T_6 was attained. The systolic and diastolic blood pressures were noted at 5 minutes, 10 minutes, and 15 minutes. Incidence of hypotension was also noted. Total IV vasopressor (Phenylephrine), requirements were also noted. Hypotension was treated with an IV bolus of Phenylephrine 100 μg (1 ml) as per protocol. The primary outcome variable was the incidence of maternal hypotension. Secondary outcome was percentage of patients requiring Phenylephrine and variations of heart rate.

Statistical Analysis

Data collected was entered in MS- Excel Sheet and was analyzed by using statistical software SPSS Version 17.0. Descriptive statistics was presented by mean and standard deviation for continuous variables and counts with their percentage for categorical variables. Comparison among the groups was done by applying one-way analysis of variance, followed by an appropriate post hoc Bonferroni test. A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean age of the patients has been represented in Table 1. Group 1 had the patients with lowest mean age of 23.43+/- 3.11 years, whereas Group 4 had the highest mean age at 24.36 +/- 3.6 years. Blood pressure recording was done for all the patients, in all the 5 groups at 0 minutes, i.e. before administering spinal block, at 5 minutes after administering spinal block, at 10 minutes and at 15 minutes respectively. At baseline (Table 1), all the groups were comparable in their Blood Pressure measurements with Group 2 having the highest baseline mean SBP at 132.97 (+/- 11.79) mmHg, and Group 5 having the least mean SBP of 122.97(+/- 9.44) mmHg.

The Diastolic Blood Pressure was also comparable between the groups with Group 1 having the highest mean DBP of 82.37 (+/- 9.70) mmHg, while the minimum mean DBP was noted in Group 5, which stood at 74.63 (+/-5.95) mmHg. At 5 minutes past administering the Spinal Block, hypotension was noted in all the groups, and amongst the 5 groups Group 3 (i.e. sitting position while giving spinal block, then immediately supine) recorded the maximum fall in mean Systolic BP at 5 minutes, with the difference being 13.94 mmHg. However, the lowest mean systolic BP was recorded for Group 5 at 111.06 (+/-11.33) mm Hg. Group 3 however recorded the maximum fall in mean diastolic BP at 5 minutes, with the difference being 9.45 mmHg, and also had the maximum number of women who experienced hypotension of >20/10 mmHg at 5 minutes with 8 out of 30 patients (26.66%) experiencing significant hypotension (Table 3). Tachycardia (>100 bpm) was also seen in 7 out of 30 women (23.33%) in Group 3 (Table 4), more than any other group at this stage.

The lowest mean SBP and DBP at 10 minutes after the delivery of the local anesthetic drug was seen in Group 5, the value being 105.70 (+/- 8.59) mm Hg, and 65.30 (+/-6.05) mmHg respectively. Group 4 recorded a maximum drop in mean SBP from baseline, of 19.30 mm Hg and a significant drop in mean DBP of 14.21 mmHg. (>10 mmHg from baseline). Overall, significant hypotension, i.e. a drop in BP of >20/10 mm Hg from baseline values were maximally reported in Group 3 and Group 4 with 10 out 30 women in each group (33.33%) reporting the same (Table 3). The maximum difference from the baseline mean heart rate was shown by Group 4, which observed an increase of 9.74 bpm from its corresponding baseline mean value. However, it was in Group 3, which had the maximum number of women (10 out of 30; (33.33%) who experienced tachycardia (>100 bpm) at this stage (Table 4).

The scenario at 15 minutes also reflected the observations at 10 minutes from the start of the spinal block, with Group 5 reporting the lowest mean SBP and mean DBP at 102.67 (+/- 6.23) mmHg and 62.86 (+/- 5.06) mmHg respectively. The highest drop in mean SBP was for Group 4 (21.80 mm Hg), followed by Group 3 (21.57 mm Hg), whereas the decline in mean DBP being observed in Group 3 (13.90 mm Hg) and in Group 4 (15 mm Hg) (Table 1). Group 3 and Group 4 also had the maximum no. of women in them who reported a drop in Blood Pressure of >20/10 mmHg from the baseline values: 14 out of 30 women in Group 3 (46.66%), and 12 out of 30 women in Group 4 (40%) (Table 3). 16 out of 30 women in Group 3 (53.33%), also experienced an accompanying Heart Rate of >100 bpm, which was more than all the other groups. (Table 4)

Regarding the requirement of Phenylephrine (used in a dose of 100 mcg IV bolus each time), it was observed that Group 3 had most women requiring it with 17 out 30 (56.66%) women having reported the need for Phenylephrine at some point or the other within the first 15 minutes after giving spinal anaesthesia. This was closely followed by Group 4, where 13 out 30 women (43.33%) required Phenylephrine to treat hypotension whereas 8 out of 30 women (26.66%) in both group 1 and Group 2 required the drug for maintaining their BP. (Fig. 1)

Variable	Group 1	Group 2	Group 3	Group 4	Group 5	F- Value	p-Value
Age	24.06± 3.59	23.43± 3.11	24.13± 3.72	24.36± 3.6	23.6± 3.1	0.40	0.80
SBP Baseline	126.34± 13.67	132.97± 11.79	128.17± 11.17	125.90± 11.43	122.97± 9.44	-	-
SBP_5 minutes	120.82± 10.32	125.05± 12.94	114.23± 14.29	114.06± 8.98	111.06± 11.33	6.75	<0.0001*
SBP_10 minutes	114.62± 12.53	118.43± 13.92	110.10± 11.84	106.6± 9.14	105.7± 8.59	6.72	<0.0001*
SBP_15 minutes	108.1± 12.02	114.8± 12.01	106.6± 9.06	104.1± 7.55	102.66± 6.23	7.17	<0.0001*
DBP Baseline	82.37± 9.7	77.83± 6.2	76.86± 7.5	78.13± 6.6	74.63± 5.9	-	-
DBP_5 minutes	77.62± 9.1	72.63± 6.5	70.23± 8.72	70.53± 6.0	68.13± 7.4	6.48	<0.0001**
DBP_10 minutes	72.79± 9.49	69.03± 5.88	65.46± 7.07	65.3± 5.89	65.3± 6.05	6.62	<0.0001**
DBP_15 minutes	69.17± 8.56	66.03± 5.79	62.96± 6.59	63.13± 5.30	62.86± 5.06	5.51	<0.0001**
HR Baseline	83.58± 8.14	84.06± 11.29	84.0± 7.12	83.23± 9.0	84.76± 7.16	-	-
HR_5 minutes	87.31± 10.35	87.36± 10.37	89.76± 11.46	87.9± 11.01	88.2± 9.61	0.27	0.90$
HR_10 minutes	89.62± 9.57	91.46± 11.47	92.2± 11.88	92.96± 11.45	92.06± 8.49	0.41	0.80$
HR_15 minutes	93.93± 10.35	95.53± 13.19	95.96± 13.15	95.76± 12.72	94.36± 6.87	0.18	0.94$

Table 1. Comparison Table Among the Groups with Different Characteristics Under Study

*- SBP (Systolic Blood Pressure) statistically significant at 5 % level of significance. **- DBP (Diastolic Blood Pressure) statistically significant at 5 % level of significance. $- HR (Heart Rate) statistically non- significant at 5 % level of significance.

Variables Under Study	Pair-Wise Comparison	p-Value (Bonferroni)
SBP_5 minutes (Systolic Blood Pressure)	Gr-1 Vs Gr.5	0.03
	Gr.2 Vs Gr.3	0.005
	Gr.2 Vs Gr.4	0.004
	Gr.2 Vs Gr.5	0.001
DBP_5 minutes (Diastolic Blood Pressure)	Gr-1 Vs Gr.3	0.003
	Gr-1 Vs Gr.4	0.005
	Gr-1 Vs Gr.5	<0.0001
SBP_10 minutes (Systolic Blood Pressure)	Gr-1 Vs Gr.5	0.03
	Gr.2 Vs Gr.3	0.005
	Gr.2 Vs Gr.4	<0.0001
	Gr.2 Vs Gr.5	<0.0001
DBP_10 minutes (Diastolic Blood Pressure)	Gr-1 Vs Gr.3	0.001
	Gr-1 Vs Gr.4	0.001
	Gr-1 Vs Gr.5	0.001
SBP_15 minutes (Systolic Blood Pressure)	Gr-1 Vs Gr.5	0.03
	Gr.2 Vs Gr.3	0.01
	Gr.2 Vs Gr.4	<0.0001
	Gr.2 Vs Gr.5	<0.0001
DBP_15 minutes (Diastolic Blood Pressure)	Gr-1 Vs Gr.3	0.003
	Gr-1 Vs Gr.4	0.004
	Gr-1 Vs Gr.5	0.002

Table 2. Post-hoc Comparison Table between the Groups with Statistically Significant Characteristics at 5 % Level of Significance

Group	At 5 min	At 10 min	At 15 min
1	16.66	20	30
2	16.66	23.33	33.33
3	26.66	33.33	46.66
4	20	33.33	40
5	13.33	16.66	26.66

Table 3. Pregnant Patients Percentage (%) Experiencing Significant Hypotension

Group	At 5 min	At 10 min	At 15 min
1	10	17	20
2	6.66	20	36.66
3	23.33	33.33	53.33
4	10	23	37
5	10	17	20

Table 4. Pregnant Patients Percentage (%) Experiencing Tachycardia (>100 bpm)

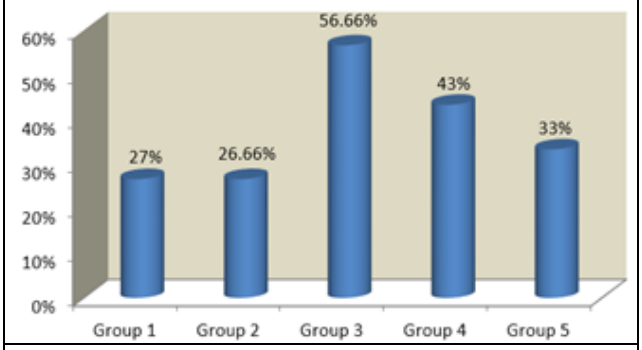

Figure 1. Percentage of Pregnant Patients Requiring Phenylephrine in each Group

DISCUSSION

The results in our study showed that patients in Group 5, i.e. in whom after giving the spinal in sitting position, they were kept sitting for 5 minutes and then made gradually supine; the overall incidence of hypotension was less.

At an interval of 5 minutes, only 13.3% of women in Group 5 faced significant hypotension (i.e. a fall in BP by >20/10 mm Hg), compared to 26.6% in Group 3 (Sitting then immediately supine), followed by 20% in Group 4(upper body tilt, then supine over 5 minutes), and 16.6% each in Group 1 and 2. The variation in Heart rate also followed the same pattern, with Group 3 showing the maximum increase in mean heart rate.

After 10 minutes of the spinal block Group 3 recorded a drop in mean Diastolic blood pressure of 11.40 (+/- 0.46) mm Hg from the baseline. The fall in SBP was also high at 18.07 (+/- 0.67) mm Hg, which was behind only Group 4, which recorded a fall in BP of 19.30 (+/- 2.29) mm Hg. Also, Group 3 and Group 4 had the highest number of women who experienced significant hypotension (>20/10 mm Hg), at 33.3% each, followed by Group 2 (23.3%) and group 1 (20%). Group 5, had the least number of women with hypotension of >20/10 mmHg at 16.6%. %. Regarding variation in heart rate, as high as 10 out 30 women in Group 3 (33.33%) experienced tachycardia, owing to hypotension, which was the highest amongst all the 5 groups.

A similar picture was observed at 15 minutes, where, amongst all the 5 groups. Group 3 had the maximum women who experienced significant hypotension and Group 5, reported the least. As for the variation in heart rate at 15 minutes was concerned, our study showed that in Group 3, as many as 16 out of 30 women (53.3%) experienced tachycardia, while the value was least in case of Group 5. Group 5 also had the minimum requirement of the vasopressor Phenylephrine (mcg), which further mirrors the lower incidence of hypotension in the group.

The results from our study, matched that of many similar studies in the past. For example, Kohler et al,[6,7,8] tested the hypothesis that the incidence of hypotension during spinal anaesthesia for Caesarean section is less in parturients who remain in the sitting position for 3 min compared with parturients who are placed in the modified supine position immediately after induction of spinal anaesthesia. In our study also, the patients in Group 5 who remained in the sitting position for 5 minutes following the spinal block experienced the minimum hypotension amongst the 5 groups. Also, in their study, the requirement of vasopressor (Ephedrine) was lower in the sitting group, which is also similar to the results of our study. Obasuyi BI; Fyneface-Ogan S & Mato CN,[9,10,11] compared the hemodynamic effects of lateral and sitting positions during induction of spinal anaesthesia for Caesarean section. In their study, they found that hypotension occurred less frequently when spinal anaesthesia for Caesarean sections was induced with patients in the lateral position compared with the sitting position. This, also, matched our findings where we see that Group 1 and Group 2, where patients were given spinal in the lateral position experienced hypotension to a lesser extent than in Group 3, where spinal block was given in the sitting position. Similarly, Gori et al,[12,13,14] studied the influence of patient positioning on spinal anaesthesia in Caesarean Section using plain levobupivacaine in 46 women divided into 2 groups: those in the first group were placed in the supine position immediately after the injection, while those in the second group were asked to remain seated for 2 minutes before assuming the supine position. They showed that although there was no significant difference in block height, but the time required to achieve the same was slower in the seated group, owing to a slower rise of the anesthetic drug in the spinal column. This was also shown in our study, where patients in Group 5 experienced minimal changes in hemodynamics because of the tardy rise of the local anesthetic agent. Stoneham & Associates,[15,16,17] also set out to prove that hemodynamic instability was less in the "Oxford" or the head up position compared to the sitting position. They were able to successfully prove that hypotension and the requirement of vasopressor (Ephedrine) was indeed less in the head up position compared to the sitting position, which further strengthens the findings of this study.

A few studies showed results, different from the observations made in our study. For example, For example, Loke GP; Chan EH & Sia AT,[18,19,20] in their study comparing a 10 degree head up tilt to the right lateral position, found the former position to be better in terms of the overall effect on hemodynamics. In our study, we found that the patients in lateral position while administering spinal anaesthesia had in fact a lesser incidence of hypotension as compared to the 10-15 degrees head up tilt group. Similarly, Inglis A; Daniel M & McGrady E,[21,22,23] compared two groups with the women placed either in the right lateral or the sitting positions for administering spinal anaesthesia. They found that the mothers in the lateral group achieved a faster onset of block height, and thereby experienced more hemodynamic instability with more requirement of vasopressor. Another study in this regard was done by Lee et al (2015),[24,25] wherein they hypothesized that head elevation in Spinal-Epidural Anaesthesia provides improved hemodynamics and appropriate sensory block height in patients undergoing elective Caesarean section. Their results matched their hypothesis and they concluded that that the incidence of hypotension and the required dose of ephedrine were greater in group Lateral compared to the group with head elevation. Patel et al in their study also found that the incidence of hypotension and the subsequent requirement of vasopressor were more in the group in whom spinal was placed in the lateral position as compared to the group in which received

spinal in the sitting position. The results from this study were in direct contrast to the results from our study.

Most of these studies, in spite of their similarities or differences with this study, were able to prove to a large extent that the incidence of post spinal hypotension was largely associated with the rate of the rise of local anaesthetic agent in the spinal column, so if the rate of rise of the drug can be slowed by altering the maternal position while administering spinal anaesthesia, it was possible to limit the adverse effects as well. The results from this study also follow this hypothesis. We have seen that in our study, patients in Group 5, who were made to sit for 5 minutes after placing the spinal, experienced significantly lesser degree of hypotension and required lesser doses of vasopressor in addition to an overall more stable haemodynamics.

CONCLUSIONS

The study showed that the extent of hypotension following spinal anaesthesia can be minimized by altering the position of parturients.

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