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Original Article

Prediction of Hypotension during Caesarean Section with Positional Changes in the Blood Pressure and Heart Rate

Ragi Jain[1*], Aditya Agarwal[2], Seema Yadav[2]

[1*]Associate Professor, [2]Post graduate students,

Department of anaesthesia, Santosh Medical College, Ghaziabad, UP, India.

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***Correspondence to:**
Dr Ragi Jain
Department of anaesthesia
Santosh Medical College, Ghaziabad
ragijain5@gmail.com

ABSTRACT

Background: Hypotension is the most the most common adverse effect of neuraxial anaesthesia in caesarean section. It results in deleterious effects on mother as well as fetus. Hence early recognition and management becomes necessary. We designed this observational study to predict the incidence of hypotension with degree of positional change in blood pressure and heart rate from supine to lateral and sitting positions.

Aim: To predict the incidence of hypotension with degree of positional change in blood pressure and heart rate from supine to lateral and sitting positions.

Methods: 70 ASA grade I and II parturients were selected for this prospective observational study. Preoperative haemodynamic parameters recorded included changes in systolic, diastolic and mean blood pressure and heart rate in sitting and lateral positions from supine position. Intraoperatively, incidence of hypotension was noted. Statistical soft-ware used was Epi-Info 7 and Microsoft excel.

Results: With hypotension as the dependent variable, there was a significant moderate degree of correlation with mean changes in diastolic and mean blood pressure from supine to lateral position (p= <0.0001 and 0.0005 respectively). However, changes in haemodynamic variable from supine to sitting position had weak correlation.

Conclusion: There was moderate degree of correlation for changes in diastolic and mean blood pressure between supine and lateral positions with occurrence of hypotension. However, correlation of difference between sitting from the supine position showed only mild association.

KEYWORDS: Caesarean section, Hypotension, Haemodynamics, Positional changes, Neuraxial anaesthesia,

INTRODUCTION

Caesarean sections are commonly performed under spinal anaesthesia and hypotension is the common intraoperative event associated with surgery and anaesthesia.[1] Hypotension following spinal anaesthesia is the result of rapid onset sympathatic blockade.[2] This hypotension, if severe can adversely affect mother and fetus. Therefore, timely recognition and management of hypotension becomes paramount during anaesthesia. Increased sympathetic drive before spinal anaesthesia is associated with intraoperative hypotension during caesarean section.[3] The change in blood pressure in supine and sitting reflects adequacy of autonomic system functioning. The positional change in blood pressure can be taken as the assessment of degree of sympathetic activity and hence can predict intraoperative hypotension under spinal anaesthesia. The increase in blood pressure after the change of position reflects increased sympathetic activity of blood vessels.[4,5]

We designed this observational study to predict the incidence of hypotension with degree of positional change in blood pressure and heart rate from supine to lateral and sitting position.

MATERIALS & METHODS

After taking institutional ethical clearance and informed consent, 70 American Society of Anesthesiologists Grade I and II patients undergoing elective caesarean section under spinal anaesthesia were selected for this observational study. Patients with history of hypertension, pre-eclampsia, diabetes or any other major systemic or pregnancy related complication were excluded from the study.

On the day of surgery, patients were given tablet ranitidine 150mg with sips of water 3 hours prior to surgery. At the time of surgery after the patient had been wheeled into the operation theater, intravenous line was started using ringer lactate (500ml) with the aim of finishing it within 20-30 minutes. Monitoring included non-invasive blood pressure (NIBP), pulse oximetry, heart rate and electrocardiogram.

After taking baseline parameters in supine position, patients were positioned in lateral position and blood pressure and heart rate were noted. Then the patients were positioned in sitting position for administration of spinal anaesthesia with 2.5 ml of 0.5% hyperbaric bupivacaine at L3-4 or L4-5 intervertebral space using 25 gauze Quincke needle. Before administering spinal anaesthesia, hemodynamic parameters were again noted in this sitting position. Surgery was allowed to commence when good quality block till the level of T4 was demonstrated. After the delivery of baby, injection oxytocin 15units was given in drip. Patients were monitored for systolic and diastolic blood pressure every 3 minutes till the delivery of baby and every 5 minutes thereafter. Heart rate and oxygen saturation were monitored throughout the study interval. Postoperatively patients were given injection diclofenac 75mg 8 hourly, with first dose given after the patient was shifted to ICU. Oxygen was given via face mask at rate of till the delivery of baby and thereafter if needed, to keep the pulse oximetry values above 95%.

Blood pressure (systolic, diastolic and mean) and heart rate were recorded twice in supine, lateral and then in sitting positions immediately on assumption of the position and then three minutes later. The average values were noted for evaluation. Heart rate was recorded in the similar manner. Episodes of intraoperative hypotension and bradycardia were recorded throughout the study interval. Hypotension was defined as systolic blood pressure less than 100 mmHg or less than 20% of the baseline supine values. Injection ephedrine 5 mg boluses were given to treat hypotension. Bradycardia was defined as heart rate less than 60 beats per minute. It was treated with injection atropine 0.6mg. The total amount of ephedrine and atropine given was recorded. Peak sensory block levels were noted. The study period lasted till the patient was shifted out of operation theater.

Statistical analysis was done using software Epi-info7 and Microsoft Excel. The sample size is determined using the correlation between positional change in blood pressure and degree of hypotension during the study period. For correlation co-efficient of 0.35 and significance at 5%, with power of 80%, 62 patients were needed.[2] To compensate for the drop-outs, we increased the sample size to 70 patients. Blood pressure and heart rate changes were analyzed using repeated measures one way analysis of variant (ANOVA). Spearman's or Pearson' correlation coefficient was used to measure the association between postural change in blood pressure and heart rate with the incidence of hypotension.

One way analysis of variance was done using linear regression. Linear regression was done using hypotension as dependent variable. Independent variables were changes in blood pressure and heart rate on sitting and on left lateral position from supine position. Changes in blood pressure that were evaluated included systolic, diastolic and mean blood pressures. Multiple linear regression was also done, regressing hypotension on postural changes in systolic, diastolic and mean blood pressures and heart rate on assuming sitting and lateral positions from supine blood pressure. P less than 0.05 was taken as significant.

RESULTS

Out of 70 patients selected, 6 patients had to be dropped from the study. 3 patients had to be converted to general anaesthesia due to failure of spinal anaesthesia or inadequate block.

One patient was very apprehensive for spinal anaesthesia and was given general anaesthesia. In remaining two patients, data was misplaced.

Demographic profile of parturient is displayed in table 1.

Table 1: Demographic characteristics.

Characteristics	n=64
Age(yr)	29.55±4.95
Weight(kg)	65.66±9.19
Gravida	1(1-4)

ANOVA statistic revealed that for hypotension, there was a moderate degree of correlation with mean changes in blood pressure from supine to lateral position and this association was significant for changes in diastolic and mean blood pressure (table2). However, when multiple regression of all these independent variable was done on hypotension, there was only mild correlation of hypotension with changes in diastolic and mean blood pressure, while rest of the parameters had no significant correlation with hypotension (table 3).

Table 2: Correlation of individual variables with hypotension as dependent variable. (variables are mean changes in blood pressure from supine to lateral position)

Variable	Correlation coefficient	P value
ΔSBP	0.32	0.01
ΔDBP	0.49	<0.0001
ΔMBP	0.42	0.0005
ΔHR	0.06	0.65

SBP- systolic blood pressure, DBP- diastolic blood pressure, MBP- mean blood pressure, HR- heart rate.

Table 3: Multiple regression values with hypotension as dependent variable. (independent variables were haemodynamic changes from supine to lateral position)

Variable	Coefficient	P value
ΔSBP	-0.028	0.25
ΔDBP	-0.10	0.02
ΔMBP	0.13	0.03
ΔHR	-0.04	0.002

SBP- systolic blood pressure, DBP- diastolic blood pressure, MBP- mean blood pressure, HR- heart rate.

When ANOVA statistics for correlation of hypotension was done with changes in blood pressure and heart rate from supine to sitting position, there was a significantly weak correlation. (table 4). When multiple regression of all the independent variable was done on hypotension, none of the parameters had significant correlation with hypotension. (table 5)

Table 4: Correlation of individual variables with hypotension as dependent variable. (variables are mean changes in blood pressure from supine to sitting position)

Variable	Correlation coefficient	P value
ΔSBP	0.22	0.08
ΔDBP	0.30	0.01
ΔMBP	0.33	0.008
ΔHR	0.23	0.06

SBP- systolic blood pressure, DBP- diastolic blood pressure, MBP- mean blood pressure, HR- heart rate.

Table 5. Multiple regression values with hypotension as dependent variable. (Independent variables were haemodynamic changes from supine to sitting position)

Variable	Coefficient	P value
ΔSBP	0.006	0.85
ΔDBP	0.03	0.68
ΔMBP	0.008	0.93
ΔHR	-0.02	0.06

SBP- systolic blood pressure, DBP- diastolic blood pressure, MBP- mean blood pressure, HR- heart rate.

DISCUSSION

Neuraxial anaesthesia remains the preferred choice for cesarean section across the world. Hypotension is the physiological consequence of spinal anaesthesia and can have a potentially deleterious maternal and fetal impact.[2,6-8] The sympathectomy resulting from neuraxial blockade is exaggerated by physiological changes of pregnancy and puerperium, leading to hypotension in as much as 55%-90% of mothers receiving spinal anaesthesia for cesarean section.[1,6]

Blood pressure measurements have been used to predict various cardiac related adverse events. Infect predictability of blood pressure measurement to coronary artery disease is improved by considering pressure response to certain stressful stimuli encountered during the day. [9] One standardized stress stimulus is postural change, particularly the assumption of standing position to predict coronary artery disease.[9]

We hence designed this study to know the predictability of postural changes in blood pressure on incidence of hypotension during spinal anaesthesia. Since during caesarean section in operation theater, it is very distressing to the patient to assume standing position from supine, we measured the postural variability in blood pressure in sitting and lateral positions from supine position.

Our study reveals that changes in diastolic and mean blood pressure between supine and lateral position are moderately associated with the occurrence of hypotension. Changes in blood pressure between supine and sitting are only mildly associated with hypotension. However multiple regression analysis revealed only mild association of blood pressure and heart rate changes with occurrence of hypotension in these positions.

In contrast, another study showed that parturients with greater positional blood pressure change required more ephedrine and blood pressure decreased more after spinal anaesthesia. They showed significant association between positional blood pressure change and hypotention after spinal anaesthesia. They had taken mean arterial pressure (MAP) less than 80% from the baseline value to predict hypotension.[2]

Again, the absolute change in systolic blood pressure after spinal anaesthesia was significantly affected by anxiety. Also, though not significant, there appeared to be a trend to increased vasopressor use with increasing anxiety.[1] It was speculated that this is associated with an anxiety mediated increase in baseline sympathetic activation. As hypotension induced by spinal anaesthesia is mediated by sympatholysis, it seems plausible that the higher the baseline sympathetic activation, the more dramatic will be the hemodynamic effect of spinal anaesthesia.[1]

Hypotension after spinal anaesthesia is primarily due to decrease in systemic vascular resistance secondary to vasodilatation with the blockade of preganglionic sympathetic fibers. Increased sympathetic drive before spinal anesthesia was associated with hypotension during neuraxial anaesthesia for cesarean delivery. The increase in blood pressure after changing position reflects increased sympathetic activity to blood vessels.[2] Patients with higher baseline sympathetic activation have been shown to have more marked hypotension after spinal anaesthesia. Infect preoperative anxiety causing greater sympathetic stimulation had been shown to be associated with greater hypotension after spinal anaesthesia.[1]

Blood pressure variability during positional changes is a characteristic feature of hypertension in elderly. The afferent fiber of this baroreflex arises from the aortic arch and carotid artery bifurcations and, therefore, in

patients with arteriosclerosis, the afferent signal of the baroreflex may be decreased owing to low compliance of the arteriosclerotic vascular walls.[10] Greater the postural blood pressure change, especially the diastolic blood pressure, on assumption of standing position, greater risk of myocardial infarction.[9] Orthostatic systolic blood pressure and diastolic blood pressure are associated with increased incidence of thrombotic and cardioembolic strokes in the linear fashion.[11] Postural change has been defined as the most important trigger for ischemic stroke out of seven predefined emotional, behavioral and environmental stimuli. It is also found that non-lacunar ischemic stroke incidence was associated with an orthostatic decrease of systolic and diastolic blood pressure, whereas lacunar stroke incidence was possibly associated with both orthostatic increases and decreases in systolic blood pressure.[11]

Though positional blood pressure variability has been used to predict the adverse events, it has been seen that the amount with which blood pressure rises or falls with the change in position varies considerably among individuals.[11,12] The physiological mechanism leading to an increase in blood pressure response on standing are different from those leading to a decrease in blood pressure response on standing, genetic influence on blood pressure response to postural stressors may be heterogenous. Infect authors have found suggestive evidence for genetic linkage that regulate systolic blood pressure during the physiological recovery period after a postural stressor.[12]

It is to be noted that not just hypotension; even cardiac arrest has been reported intraopartively during caesarean section. Vasovagal syncope is hard to predict.[13] A careful history taking regarding fainting or syncope, and proper preoperative evaluations is necessary. Term pregnant women present significant decrease in systemic vascular resistance (25%) by the development of low vascular bed in placenta and vasodilatation caused by prostacyclin, estrogens and progesterons. Not only increase in plasma volume (50%), but also compensatory sympathetic activation maintains hemodynamic stability. However, this compensatory sympathetic activity is blocked during neuraxial anaesthesia.[13-15]

Moreover, neonates born by cesarean delivery under spinal anesthesia are more acidaemic when compared to those delivered after epidural or general anaesthesia; while this may be, in part, the direct consequence of maternal hypotension, current evidence suggests that this is largely a consequence of the vasopressors used to treat to prevent it.[1]

In this present study, instead of percentage change, we had used absolute values for changes in blood pressure and heart rate. Though it would have been better to use percentage change, using absolute values seemed convenient and more practical in a busy anaesthesia suite to predict the incidence of hypotension.

CONCLUSION

Our study showed a moderate degree of co-relation for changes in diastolic and mean blood pressure between supine and lateral positions with occurrence of hypotension. This correlation is mild when changes between supine and sitting blood pressure measurements are compared with occurrence of hypotension.

REFERENCES

1. Orbach-Zinger S, Ginosar Y, Elliston J, Fadon C, Abu-Lil M, Raz A, et al. Influence of preoperative anxiety on hypotension after spinal anaesthesia in women undergoing caesarean section. Br J Anaesth 2012; 109: 943-49.

2. Jeon YT, Hwang JW, Kim MH, Oh AY, Park KH, Park HP, et al. Positional blood pressure change and the risk of hypotension during spinal anesthesia for cesarean delivery: An observational study. Anesth Analg 2010; 111: 712-15.

3. Hanss R, Bein B, Ledowski T, Lehmkuhl M, Ohnesorge H, Scherkl W, et al. Heart rate variability predicts severe hypotension after spinal anesthesia for elective cesarean delivery. Anesthesiology 2005; 102: 1086-93.

4. Hanss R, Ohnesorge H, Kaufmann M, Gaupp R, Ledowski T, Steinfath M, et al. Changes in heart rate variability may reflect sympatholysis during spinal anaesthesia. Acta Anaesthesiol Scand 2007; 51: 1297-307.

5. O'Leary DD, Kimmerly DS, Cechetto AD, Shoemaker JK. Differential effect of head-up tilt on cardiovagal and sympathetic baroreflex sensitivity in humans. Exp Physiol 2003; 88: 769-74.

6. Kee WDN, Khaw KS. Vasopressors in obstetrics: what should we be using? Current opinion Anaesthesiol 2006; 19: 238-43.

7. Villar J, Carroli G, Zavaleta N, Donner A, Wojdyla D, Faundes A,et al. Maternal and neonatal risks and benefits associated with caesarean delivery; multicenter prospective study. BMJ 2007 17; 335(7628):1025.

8. Gori F, Corradetti F, Cerotto V, Peduto VA. Influence of positioning on plain levobupivacaine spinal anesthesia in cesarean section. Anesthesiol Res Pract. 2010; 2010: 212696.

9. Sparrow D, Tifft CP, Rosner B, Weiss ST. Postural changes in diastolic blood pressure and the risk of myocardial infarction. The Normotensive aging srudy. Circulation 1984; 70: 533-537.

10. Eto M, Toba K, Akishita M, Kozaki K, Watanabe T, Kim S, et al. Impact of blood pressure on cardiovascular events in elderly patients with hypertension. Hypertens Res Vol 2005; 28: 1-7.

11. Yatsuya H, Folsom AR, Alonso A, Gottesman RF, Rose KM. Postural changes in blood pressure and incidence of ischemic stroke subtype: The ARIC study. Hypertension 2011; 57: 167-73.

12. Pankow JS, Rose KM, Oberman A, Hunt SC, Atwood LD, Djousse L, et al. Possible locus on chromosome 18q influencing postural systolic blood pressure changes. Hypertension 2000; 36: 471-76.
13. Jang YE, Do SH, Song IA. Vasovagal cardiac arrest during spinal anesthesia for cesarean section- a case report. Korean J Anesthesiol 2013; 64: 77-81.
14. Kimpinski K, Iodice V, Sandroni P, Low PA. Effect of pregnancy on postural tachycardia syndrome. Mayo Clin Proc. 2010; 85: 639-44.
15. Taylor JY, Chambers AN, Funnell B, Wu CY. Effect of parity on blood pressure among African-American women. J Natl Black Nurses Assoc 2008; 19: 12-19.

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