

## Comparison Of The Hemodynamic Parameters During And After Caesarean Delivery

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### ABSTRACT

**Background:** Spinal anaesthesia for caesarean section induces hypotension, which may cause severe adverse effects. Our goal was to determine whether hypotension could be predicted by pulse oximetry parameters, such as the perfusion index and pleth variability index, heart rate, ratio of low-frequency to high-frequency components of heart rate variability, and entropy of heart rate variability, measured before the induction of anaesthesia.

**Aim and Objective:** To compare of the hemodynamic parameters during and after caesarean delivery

**Methodology:** The Institutional Research Committee gave its approval before the current study could be carried out in the Department of Anesthesiology at Santosh Medical College and Hospital. The current research was done from August 2016 to July 2017. Three groups of 30 patients each were randomly selected from a sample size of 90 individuals.

**Result:** We measured the baseline mean heart rate. In groups B, BF1, and BF2, it was  $81.4 \pm 2.17$ ,  $80 \pm 2.81$ , and  $80.067 \pm 3.62$  respectively. In all three groups, the heart rate decreased, with group B

experiencing the greatest decrease. When compared to baseline data, Group B's heart rate dropped to  $59.77 \pm 2.4$  at its greatest point after 15 minutes.

**Conclusion:** Our study was to investigate whether the PI, PVI, heart rate, LF-to-HF ratio, and entropy measured before the induction of spinal anaesthesia could predict hypotension during caesarean section.

**Keywords:** Spinal anaesthesia, hypotension, caesarean, vasomotor, umbilical, arterial, acidosis.

## INTRODUCTION

Caesarean section is commonly performed under spinal anaesthesia, because it has many advantages over general anaesthesia. However, spinal anaesthesia can result in hypotension, which may cause severe adverse effects in mothers, such as nausea, vomiting and dizziness, and may cause umbilical arterial acidosis in infants. An ability to identify those who would suffer from hypotension following spinal anaesthesia would give clinicians an opportunity to take preventative measures. Baseline peripheral vasomotor tone [1], volume status [2] and sympathetic activity [3] are known to affect the degree of hypotension after spinal anaesthesia in parturients undergoing caesarean section. We therefore hypothesised that the perfusion index (PI), pleth variability index (PVI), heart rate, and parameters of heart rate variability (HRV) may predict hypotension.

Spinal anaesthesia is the preferred means for caesarean delivery. It carries high efficiency, minimal neonatal depression, awake mother and lesser incidence of aspiration pneumonia.[4,5] Spinal anaesthesia is very popular for caesarean sections and currently both hyperbaric and plain (hypobaric) solution of bupivacaine along with opioids are used. Difference in baricity can affect the intrathecal distribution of bupivacaine.[6,7]

Post caesarean delivery patients are at higher risk for thromboembolic events which may also be precipitated by immobility from inadequate pain control [6,7] or excessive sedation from opioids. Fortunately, the absolute risk of developing clinically important venous thromboembolism during pregnancy or postpartum is low. Despite the low incidence, however pulmonary embolism is leading cause of maternal death after childbirth with approximately 1 clinically recognized pulmonary embolism per 1000 births and 1 fatal pulmonary embolism per 100000 births [7,8]. The greatest risk occurs during the postpartum period. The risk of venous thromboembolism in pregnant women is increased by smoking, prior venous thromboembolism, and inherited thrombophilias.[9]

Heart rate and HRV reflect sympathetic activity. Spectral analysis included in a linear analysis of HRV is used to estimate autonomic nervous activity, by calculating the ratio of the low-frequency (LF) component (indicator of parasympathetic and sympathetic nervous activity) to the high-frequency (HF) component (indicator of parasympathetic nervous activity) (LF-to-HF ratio). On the other hand, entropy, which is calculated by a non-linear analysis of HRV, provides insight into the overall structure of the heart rate regulatory system [12].

Patients experiencing pain due to cancer may self-administer this opioid to the extent necessary to produce a desirable level of analgesia. Each transdermal patch contains a depot of fentanyl that provides adequate drug to produce stable plasma fentanyl concentrations for 3 consecutive days. Transdermal fentanyl systems applied before the induction of anesthesia and left in place for 24 hours decrease the amount of parenteral opioid required for postoperative analgesia.[13] Acute toxic delirium has been observed in patients with chronic pain due to cancer being treated with transdermal fentanyl for prolonged periods of time.[14]

## **METHODS AND MATERIALS**

The Institutional Research Committee gave its approval before the current study could be carried out in the Department of Anesthesiology at Santosh Medical College and Hospital. The current research was done from August 2016 to July 2017. During the trial period, patients undergoing elective caesarean section birth surgery were sedated using spinal anaesthesia. Three groups of 30 patients each were randomly selected from a sample size of 90 individuals.

All the patients will be given premedication Tablet Alprazolam 0.25mg and tablet rantac 150 mg per orally on the night before surgery. None of the patients were given anything orally for at least 8 hours prior to surgery. NPO for 8 hrs prior to surgery and Pre-medication was given in routine. Under aseptic precautions lumbar puncture was performed in L3-4 / L 4-5 interspace with 25 guage quincke lumbar puncture needle. Drug was injected as per group allocation after free flow of CSF. Timing of intrathecal injection was noted after which the patient was placed supine.

The data of the study was analyzed using the software SPSS 11.5 for windows. Appropriate univariate and bivariate analysis will be carried out using the Student t test for the continuous variable (age) and two-tailed Fisher exact test or chi-square ( $\chi^2$ ) test for categorical variables. All means will be expressed as mean  $\pm$  standard deviation. The critical levels of significance of the results will be considered at 0.05 levels i.e.  $P < 0.05$  will be considered significant.

## RESULTS

Table 1: Demographic data distribution of study subject.

Demographic Distribution		Number (Percentage)		
		Group B	Group BF1	Group BF2
Age Groups	20-22 Years	8	8	7
	23-24 Years	5	3	1
	25-26 Years	9	11	9
	27-28 Years	4	4	7
	29-30 Years	4	4	6
Age	Mean±SD	24.93±2.59	25.03±2.56	25.83±2.60
Weight	Mean±SD	64.90±6.773	65.50±6.261	69.20±5.952

In Table 1, Distribution of sample among age groups shows maximum subjects belonged to 25-26 Years age group. P value 0.078, indicates the difference in the mean age of the patients in the three groups was not significant and all the age groups were comparable. The mean age of the group B was 24.93 while the mean age in group BF1 and group BF2 was 25.03 and 25.83 respectively. P value 0.76, indicates the difference in the mean age of the patients in the three groups was not significant and all the three groups are comparable. Similarly, weight of patients has been maximum in group BF2 is 69.2 and least in Group B is 64.9. There was no significant difference in mean weight in the three groups and all the three groups are comparable.

Table 2: Comparison of mean heart rate, mean respiratory rate, mean SP O<sub>2</sub> and blood pressure among study subjects

	Time Intervals	Group B	Group BF1	Group BF2	p value
Mean Heart Rate	Baseline	81.4±2.17	80±2.81	80.067±3.62	0.201
	0 Minute	77.3±2.27	78±2.81	77.47±3.72	0.078
	30 Minutes	65.97±2.22	73.37±3.81	73.2±4.83	0.000
	60 Minutes	70.17±1.34	73.4±4.68	73.5±4.72	0.001

	120 Minutes	69.93±1.4	73.367±3.84	73.53±4.62	0.000
	180 Minutes	69.27±1.015	80±2.81	72.73±4.49	0.000
<b>Systolic Blood Pressure</b>	Baseline	119.97±3.81	120.53±3.481	120.30±3.67	0.901
	0 Min	118.03±3.84	117.83±3.96	117.80±3.99	0.966
	30 Min	104.83±4.914	107.07±4.76	106.01±4.51	0.883
	60 Min	107.73±3.930	108.40±4.01	108.34±5.12	0.972
	120 Min	108.57±3.971	107.21±3.72	107.95±3.92	0.742
	180 Min	108.37±4.021	108.30±3.96	108.21±3.96	0.921
<b>Diastolic Blood Pressure</b>	Baseline	77.83±5.908	78±5.94	77.97±5.89	0.992
	0 Min	76.53±6.776	76±6.63	76±6.63	0.939
	30 Min	74.07±5.564	74.07±5.56	74.07±5.56	0.998
	60 Min	75.93±7.474	75.93±7.47	75.93±7.47	0.997
	120 Min	75.63±6.531	75.63±6.53	75.63±6.531	1.000
	180 Min	75.73±7.032	75.73±7.03	75.73±7.032	1.000
<b>Mean Arterial Pressure</b>	Baseline	91.83±3.95	92.27±4.07	92.1±4.01	0.996
	0 Min	90.43±4.52	89.97±4.45	89.97±4.45	0.990
	30 Min	84.27±4.16	84.97±4.21	84.97±4.21	0.959
	60 Min	86.6±4.91	86.77±4.9	86.77±4.9	0.981
	120 Min	86.67±4.33	86.37±4.44	86.37±4.44	0.995
	180 Min	86.63±4.7	86.63±4.7	86.63±4.7	0.979
<b>Mean Respiratory Rate</b>	Baseline	15.9±1.24	15.43±1.19	15.1±1.16	0.071
	0 Minute	15.77±1.3	15.7±1.37	15.63±1.2	0.213
	30 Minutes	15.77±1.19	15.63±1.26	15.57±1.38	0.000
	60 Minutes	15.93±1.31	15.85±1.06	15.77±1.13	0.731
	120 Minutes	15.53±1.17	15.4±1.1	15.33±1.15	0.386
	180 Minutes	15.93±1.28	15.7±1.26	15.63±1.26	0.067
<b>Mean SP O<sub>2</sub></b>	Baseline	99.5±0.51	99.3±0.47	99.67±0.48	0.557
	0 Minute	99.67±0.48	99.2±0.55	99.43±0.5	0.316

	30 Minutes	99.6±0.5	99.27±0.58	99.33±0.48	0.026
	60 Minutes	99.63±0.49	99.3±0.6	99.1±0.55	0.472
	120 Minutes	99.37±0.61	99.4±0.56	99.4±0.56	0.264
	180 Minutes	99.53±0.51	99.33±0.55	99.07±0.58	0.575

In Table 2 , The mean heart rate at baseline was assessed. It was 81.4±2.17 in group B, 80±2.81 in group BF1 and 80.067±3.62 in group BF2. There was a fall in heart rate in all three groups, but the drop being maximum in group B. The maximum fall in heart rate in Group B was at 15 minutes with respect to baseline values to 59.77±2.4. The mean of SBP in the three groups was analyzed. The baseline SBP in group B, group BF1 and group BF2 was 119.97±3.81, 120.53±3.481 and 120.30±3.67 respectively. Though there was a fall in SBP in all three groups intra operatively but the maximum fall was noted at 20 minutes to 101.33±4.482 mmHg in group B. The mean of DBP in the three groups was analyzed. The baseline DBP in group B was 77.83±5.908 while in group BF1 was 78±5.94 and in group BF2 was 77.97±5.89 mm of Hg. Though there was a fall in DBP in all three groups intra operatively but the maximum fall was noted in group B, at 15 minutes. The mean of MAP in the three groups was analyzed. The baseline MAP in group B was 91.83±3.95 while in group BF1 was 92.27±4.07 and in group BF2 was 92.1±4.01 mm of Hg. Though there was a fall in MAP in all three groups intra-operatively but the maximum fall was noted in group B at 20 minutes to 79.37±3.31. The mean respiratory rate at baseline was assessed. It was 15.9±1.24 in group B, 15.43±1.19 in group BF1 and 15.1±1.16 in group BF2. The baseline values were comparable with was no significant alteration in respiratory rate throughout the procedure. The mean respiratory rate at baseline was assessed. It was 99.5±0.51 in group B, 99.3±0.47 in group BF1 and 99.67±0.48 in group BF2. The baseline values were comparable. There was no significant alteration in oxygen saturation throughout the procedure.

**Table 3: Side Effects in Group B, BF1 and BF2 groups.**

Side Effects	Group B	Group BF1	Group BF2	P value
<b>Hypotension</b>	03 (10%)	04 (13.33%)	04 (13.33%)	0.231
<b>Brady cardiac</b>	09 (30%)	04 (13.33%)	01 (3.33%)	0.001
	03 (10%)	00 (0%)	01 (3.33%)	0.001

<b>Shivering</b>				
<b>Nausea</b>	03 (10%)	01 (3.33%)	02 (6.67%)	0.001
<b>Vomiting</b>	04 (13.33%)	01 (3.33%)	01 (3.33%)	0.001
<b>Other Effects</b>	01 (3.33%)	02 (6.67%)	04 (13%)	0.001

This table compared the side effects in 3 groups. Hypotension developed in group 10% subjects in group B, while 13.33% subjects in group BF1 and BF2 had hypotension. 9 out of 30 patients in group B had bradycardia while 4 patients in group BF1 and 1 patients in group BF2 had bradycardia. None in either groups had respiratory depression. Nausea and vomiting was significantly seen in group B patients when compared to the other two groups. 3 out of 30 patients in group B developed shivering while no instance of shivering was noted in BF1 however 1 patient reported with shivering in BF2 group.

## DISCUSSION

The practice of regional anaesthesia for caesarean section is common place today in our country. It involves the use of epidural or spinal anaesthesia, which allows consciousness during the operation. . Spinal anaesthesia is very popular for caesarean sections and is preferred over epidural anaesthesia for elective caesarean and emergency caesarean procedures, due to the relative ease of administration, reduced systemic toxicity, faster onset of action and start of the operation. Spinal anaesthesia has also been shown to be effective for caesarean section with a moderate degree of maternal satisfaction due to early skin to-skin-contact. It is also associated with a faster onset of action, ease of administration and reduced systemic toxicity due to lower dose requirements, however, the likelihood of maternal hypotension is higher relative to epidural anaesthesia. The choice of spinal anaesthetic drug may influence the occurrence and degree of severity of these events

Drugs used for spinal anaesthesia in caesarean section are mainly local anaesthetics of either the amide or ester class, based on the link existent between the amine and aromatic arms. The local anesthetics have a relatively short duration of action, thereby limiting the technique for comparatively long duration surgery and increasing the requirement of analgesics in the early post-operative period. Furthermore, even the

conventional recommended doses of the local anesthetic are unable to completely abolish visceral pain produced by the manipulation of the uterus and peritoneum, leading to intraoperative pain and nausea vomiting necessitating an increase in doses of the local anesthetic, which is associated with a higher incidence of maternal and neonatal morbidity.

Fentanyl is a lipophilic opioid that is typically used in combination with local anaesthetics at doses of 10 to 25 mcg for spinal anaesthesia. It acts quickly, lasts only briefly, and requires less analgesia after the procedure. The efficacy and effectiveness of bupivacaine and bupivacaine combined with two different dosages of fentanyl for analgesic effect are therefore compared in the current study. The study assesses the effects of the study medicines being administered as a spinal anaesthetic agent on individuals having elective caesarean sections on their hemodynamics.

## CONCLUSION

From the present study it can be concluded that intrathecal Fentanyl in the dose of 20 µg with bupivacaine results as follows-Decreases the mean onset time of sensory, motor blockade and time to reach peak sensory level.It produces higher level of sensory blockade.It produces prolonged duration of sensory and motor blockade.It prolongs the duration of effective analgesia .It has no significant hemodynamic changes.It also produces lesser adverse effects Fentanyl used as an adjunct intrathecally along with bupivacaine prolongs the duration of effective analgesia in the immediate post-operative period with effective hemodynamic stability and without any significant adverse effects amongst the three groups compared. Hence it can be an attractive intrathecal adjuvant for prolonging the effect of bupivacaine.

In conclusion, we have demonstrated that pre-anaesthetic heart rate is a predictor of hypotension after spinal anaesthesia for caesarean section in healthy women. In particular, we demonstrated that heart rates of < 71 bpm, and more than 89 bpm, are clinically useful prognostic values to help predict the development of hypotension, while those in the range between have relatively weak prognostic value. Unlike some previous studies, we showed that pre-anaesthetic PVI, PI, LF-to-HF ratio and entropy of HRV are not useful indices to predict hypotension in this patient group.

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