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ORIGINAL RESEARCH

Prediction of hypotension with baseline perfusion index following spinal anaesthesia in patients undergoing lower segment caesarean section: An observational study

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Abstract

Background: This study was conducted to determine whether a baseline perfusion index (>3.5) predicts the development of hypotension following spinal anesthesia in lower segment caesarean section.

Materials and Methods: This observational study was conducted in a tertiary care hospital in the patients who were undergoing lower segment caesarean section (LSCS). Patients were divided into two groups of 30 each according to perfusion index value.

Results: Perfusion index values showed a statistically significant difference during 2nd (p value = <0.001), 4th (p value =<0.001), 6th (p value =0.001), 30th (p value = 0.049), 35th (p value= 0.028) and 40th minutes (p value = 0.011). During intraoperative period SBP demonstrated statistically significant lower values during the 2nd, 4th, 6th, 8th, 10th minutes in group B than group A. During intraoperative period DBP showed statistically significant difference during 2nd , 4th , 6th and 8th minutes with values being lower in group B than group A.

Conclusions: Perfusion index (PI) can be used as a tool for predicting hypotension in healthy parturients undergoing elective caesarean section under subarachnoid block. Parturients with baseline PI >3.5 were at higher risk of developing hypotension following subarachnoid block compared to those with baseline PI <3.5

Keywords:
Perfusion Index, Hypotension in LSCS, Spinal Anaesthesia

Introduction

Caesarean section is commonly performed under spinal anaesthesia, because it has many advantages over general anaesthesia.

Spinal anaesthesia induced hypotension during caesarean delivery is because of decreased vascular resistance, sympathetic blockade and decreased peripheral vascular tone in parturients at term. [1] Decreased peripheral vascular tone results in pooling of blood volume in the lower extremities even before spinal anaesthesia and the sympathetic blockade with spinal anaesthesia would further increase the blood pooling. Pregnant women are more sensitive to local anaesthetic drugs, less responsive to vasopressors and have lower mean arterial pressure (MAP) at term. Hence parturients can develop profound hypotension following central neuraxial blockade.[2]

The PI can be used to assess peripheral perfusion dynamics due to changes in peripheral vascular tone. Baseline PI in parturient correlates with the degree of hypotension during spinal anaesthesia for caesarean delivery.[2,3]

The peripheral perfusion index (PPI), derived from the photoelectric plethysmographic signal of the pulse oximeter is able to monitor vascular reactivity in critically ill patients. Additionally, the PPI has been suggested to be a useful noninvasive method for the assessment of peripheral vasomotor tone in healthy volunteers, neonates and critically ill patients. This index is calculated as the ratio between the pulsatile component (arterial compartment) and the nonpulsatile component (venous and capillary blood and other tissues) of the light reaching the detector of the pulse oximeter. Therefore, peripheral vasoconstriction mainly reduces the pulsatile component and directly affects the ratio, thus decreases the PPI.[4]

Hence, we decided to conduct a study to evaluate baseline perfusion index as a predictor of hypotension following spinal anaesthesia in patients undergoing lower segment caesarean section with primary objective – To determine the difference in proportion of patients developing hypotension between two study groups (baseline Perfusion index value <3.5 v/s baseline perfusion index value >3.5).

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Materials and Methods

Sample size calculated was minimum 12 cases of lower segment caesarean section in each group at 95% confidence interval and 80% power and alpha error of 0.05 to verify the expected proportion of incidence of hypotension in both groups (group A perfusion index <3.5 and group B perfusion index >3.5). For the study purpose total 60 cases of lower segment caesarean section 30 in each group were taken.

This observational study was conducted in a tertiary care centre in southern Rajasthan after obtaining institutional ethical committee approval and written informed consent from all patients.

ASA Grade I pregnant women aged 20-35 years & having > 145 cm of height, undergoing LSCS were included in the study. Pregnant women with placenta previa, pre-eclampsia, cardiovascular or cerebrovascular disease, gestational diabetes, body mass index > 40 and gestational age <36 or >41 weeks were excluded from the study.

The patients who were undergoing lower segment caesarean section were divided into two groups of 30 each according to perfusion index value as below -

- Group A (n=30): Patients perfusion index value <3.5.
- Group B (n=30): Patients perfusion index value >3.5

First of all patients satisfying inclusive criteria were selected. After PAC & written informed consent patients were taken in OT. Baseline perfusion index value was noted before surgery. An 18 G I.V. line was secured in upper left limb and patient preloading with 500 ml Ringer Lactate. All routine monitors were attached and pre operative vitals (Perfusion index, blood pressure, pulse rate, spo2) were recorded. Patients were positioned in left lateral decubitus position for spinal anaesthesia. Under all aseptic precautions spinal anaesthesia was given at L3-L4 space with 2 ml of 0.5% hyperbaric bupivacaine. Immediately after spinal anaesthesia injection patients positioned in supine position at 15 degree left lateral tilt. Patients were oxygenation by face mask at 4L/min during the procedure. After the desired level of effect achieved surgery was initiated. Intraoperative parameters were recorded as per the Proforma. After extraction of baby 10U oxytocin was given intramuscular in gluteal region. After surgery post operative vitals were recorded and patient was shifted to recovery room.

Statistical analysis was done using the Statistical Package for Social Science (SPSS 25.0 Evaluation version). To calculate the sample size, a power analysis of α=0.05 and α=0.90, showed that 30 patients per study group were needed. Data are expressed as either mean and standard deviation or numbers and percentages. Students T test & Chi Square tests were applied where deemed appropriate. P<0.05 was considered statistically significant.

Results

Table 1: Age Distribution (in years)

	Group A (N=30)	Group B (N=30)	P Value
Weight (kg)	62.70 ± 5.88	60.37 ± 5.01	0.103
Height (cm)	155.57 ± 4.30	155.40 ± 4.32	0.881

Table 2: Height & Weight Distribution (in years)

The patients in both the groups were comparable with regards to age, weight & height.

	Group A (N=30)	Group B (N=30)	P value
Baseline	2.28 ± 0.94	5.63 ± 0.38	0.001
After spinal anaesthesia (1 min.)	3.48 ± 1.49	5.88 ± 1.20	0.001
2min.	3.70 ± 1.68	6.07 ± 1.39	0.001
4min.	4.45 ± 1.90	6.59 ± 1.75	0.001
6min.	4.69 ± 2.13	6.52 ± 2.10	0.001
8min.	4.91 ± 2.04	5.53 ± 2.31	0.274
10min.	5.58 ± 2.18	5.63 ± 2.19	0.934
12min.	5.31 ± 1.97	5.26 ± 1.41	0.910
14 min	5.46 ± 1.80	5.61 ± 1.55	0.725
16min.	5.70 ± 1.87	5.84 ± 2.01	0.790
18min.	5.43 ± 1.97	5.75 ± 2.03	0.538
20min.	5.18 ± 1.80	5.59 ± 2.21	0.433
25min.	5.13 ± 1.78	5.51 ± 2.38	0.494
30min.	4.56 ± 1.29	5.57 ± 2.45	0.049
35min.	4.21 ± 1.56	5.42 ± 2.51	0.028
40min.	3.97 ± 1.50	5.30 ± 2.35	0.011

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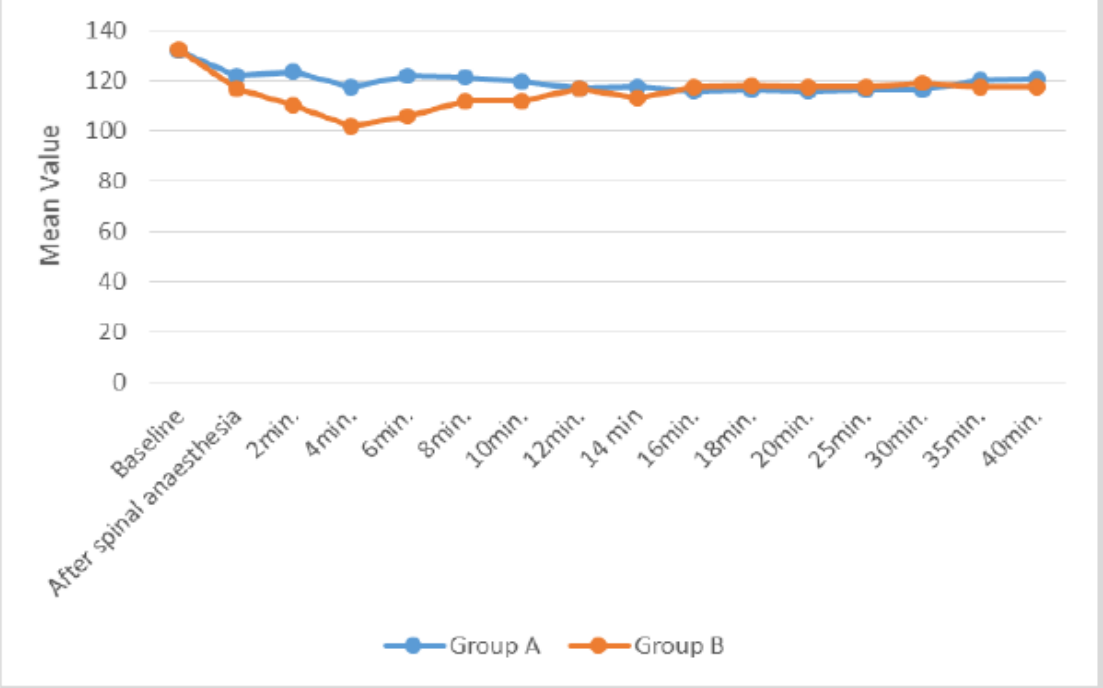
Table 3: Comparison of Intraoperative Mean Perfusion Index (%) among Study Groups.

	Group A (N=30)		Group B (N=30)	
	No.	%	No.	%
<25	13	43.33	10	33.33
>25	17	56.66	20	66.66
Mean ± SD	26.93	3.25	28.27	4.09
P value			0.167	

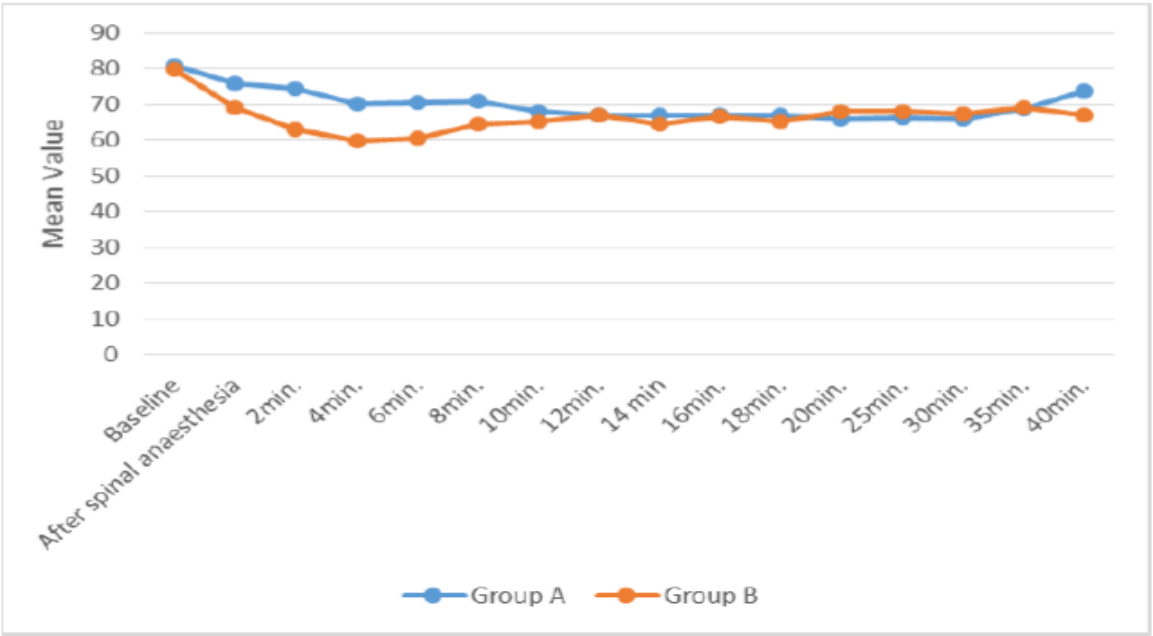
Perfusion index values showed a statistically significant difference during 2nd (p value = <0.001), 4th (p value =<0.001), 6th (p value =0.001), 30th (p value = 0.049), 35th (p value= 0.028) and 40th minutes (p value = 0.011).

Figure 1: Comparision of intra-operative mean systolic blood pressure (mmHg)



During intraoperative period SBP demonstrated statistically significant lower values during the 2nd, 4th, 6th, 8th, 10th minutes in Group B than Group A.

Figure 2: Comparision of intra-operative mean diastolic blood pressure (mmHg)



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During intraoperative period DBP showed statistically significant difference during 2nd , 4th, 6th and 8th minutes with values being lower in group B than group A.

Discussion

Caesarean section surgery is commonly performed in countries around the world. Spinal anaesthesia is preferred technique for performing caesarean section because it has many advantages over general anaesthesia but hypotension following central neuraxial block is common side effect which in turn results in nausea, vomiting, dizziness and umbilical arterial acidosis in newborn. Pregnant women are more sensitive to local anaesthetic drugs, less responsive to vasopressors and have lower mean arterial pressure (MAP) at term. Hence they can develop profound hypotension following spinal anaesthesia for lower segment caesarean section.

Non-invasive blood pressure (NIBP) measurement is the standard method of monitoring intraoperative haemodynamics. However, beat to beat variation in perfusion dynamics cannot be assessed by it. Perfusion index derived from pulse oximeter is able to reflect vasomotor tone. It is ratio between the pulsatile blood flow and the non-pulsatile blood flow in the peripheral vascular tissue, can be easily measured by the light reaching the detector of the pulse oximeter, a peripheral perfusion index (PI) can be calculated. Hence, perfusion index can be used to assess perfusion dynamics and considered to be useful non-invasive tool to predict development of hypotension following spinal anaesthesia. Various studies have been done, which advocates use of perfusion index to assess haemodynamic variables. [4,5]

Michel E et al reported that perfusion index is an early marker of peripheral vasoconstriction induced by changes in circulatory volume. [4] **Ginosar et al** reported that perfusion index was earlier, clearer and more sensitive indicator of sympathectomy following epidural anaesthesia.[5]

However, there is paucity of data regarding its use for predicting hypotension following spinal anaesthesia.

Parturients with high baseline perfusion index will have lower peripheral vascular tone and will be prone to develop hypotension following central neuraxial block. Cut off value of baseline perfusion index for prediction of hypotension following spinal anaesthesia was chosen as 3.5 based on a study conducted by **Toyoma S. et al** & **Duggappa DR et al**. [2,3] In this study, the incidence and severity of hypotension was more in parturients with baseline perfusion index (>3.5).

Normal physiological changes during pregnancy include decrease in systemic vascular resistance, increased blood volume and cardiac output. This decrease in vasculsar tone will corresponds to higher perfusion index due to increase in pulsatile component due to vasodilatation. Administration of spinal anaesthesia results in further decrease in peripheral vascular resistance along with hypotension and increased peripheral pooling of blood.

In the present study there was more decrease in systolic blood pressure in group B as compared to group A after subarachnoid block. The difference was statistically significant at different time interval (2nd, 4th, 6th, 8th, 10th minutes) till 10 minutes after subarachnoid block. Our observations are also in accordance with the observations of the study done by **Duggappa DR et al (2017) and S. Toyoma et al (2013).** Our study was similar to the study done by **Dr Joseph et al (2019).** They also reported that there was significant fall in systolic blood pressure in patients who had perfusion index more than 3.6.

After subarachnoid block decrease in diastolic blood pressure was more in group B (PI>3.5) as compared to group A (PI<3.5). The difference in fall in diastolic blood pressure was statistically significant at different time interval (2nd, 4th, 6th, 8th minutes) till 8 minutes. Our observations are similar to the findings of **Duggappa DR et al (2017)** and **S. Toyoma et al (2013)**. Similar finding was observed by **George J et al (2019).** [6] They also found that there was less fall in diastolic blood pressure in patients who had perfusion index <3.6.

Conclusion

We concluded that perfusion index (PI) can be used as a tool for predicting hypotension in healthy parturients undergoing elective caesarean section under subarachnoid block . Parturients with baseline PI >3.5 were at higher risk of developing hypotension following subarachnoid block compared to those with baseline PI <3.5.

Source of Support

Nil

Conflict of Interest

No

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