Journal of Cardiovascular Disease Research

ISSN:0975-3583,0976-2833 VOL14,ISSUE01,2023

Perfusion Index as an Early Predictor of Hypotension during Spinal Anaesthesia for Cesarean Delivery

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Received Date: 01/01/2023 Acceptance Date: 30/01/2023

Abstract

Background: Spinal anaesthesia has become the choice of neuraxial anaesthesia for cesarean delivery. Hypotension, the most common side effect of spinal anaesthesia is more in parturients. Perfusion index (PI) is one of the newest methods, used nonivasively for the prediction of hypotension post spinal anaesthesia, evaluation of regional block success, and a tool for pain assessment. In our study we used PI for predicting the occurrence of hypotension post subarachnoid block in elective lower segment cesarean section. **Materials and Methods**: In this prospect double observational study, 126 parturients were divided into two groups on the basis of baseline PI. Group 1 included parturients with PI of <3.5 and Group 2 parturients with PI value >3.5. Spinal anaesthesia performed was performed with 10mg of Inj.Bupivacaine 0.5% (hyperbaric) at L3-L4 interspace. Hypotension was defined as SBP >20% from baseline. Statistical analysis was performed using Chi-square test and independent sample t-test. Receiver operating characteristic curve (ROC) was plotted for PI and occurrence of hypotension. **Results**: The incidence of hypotension in Group 1 was 10.5% compared to 71.42% in Group 2 ($p<0.001$). There was significant correlation between perfusion index >3.5 and number of episodes of hypotension and total dose of ephedrine. The sensitivity and specificity of baseline PI of 3.5 to predict hypotension was 69.84% and 89.29% respectively. **Conclusion**: Parturients with baseline PI >3.5 are at higher risk of developing hypotension following SAB compared to those with baselin PI ≤3.5.

Key words: Pregnancy, spinal anaesthesia, hypotension, perfusion index.

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Introduction

Spinal anaesthesia is the preferred method of choice for a LSCS as it avoids the risk of maternal aspiration an provides good postoperative analgesia. Hypotension following spinal anasthesia results from the sympathetic blockade and decreased cardiac output. Perfusion index(PI) is defined as the ratio of pulsatile to non-pulsatile blood flow in peripheral vascular tissue, measured using a pulse oximeter based on the amount of infrared light absorbed. We conducted this study to determine whether a baseline PI>3.5 predicts the development of hypotension after spinal anaesthesia in parturients.

Methods

After approval by the institutional Ethical committee, this prospective study was conducted over six months. Parturients were divided into two groups based on baseline PI as a group A ≤3.5 and group B >3.5. Each parturient were prehydrated with Ringer Lactate at the rate of 10ml/kg/hr. Spinal anaesthesia was provided in a sitting position using 25G Quincke's needle at L3-L4 interspace with 10mg of 0.5% hyperbaric bupivacaine under strict aseptic precaution. The parturient returned to the supine position with a left lateral tilt of 15º to facilitate left uterine displacement. Oxygen was given through face mask at 4L/min. The level of sensory block was checked 5 mins after the spinal injection. If a T6 block was not achieved, they were excluded from the study. Maximum cephalad spread was checked 20 mins after SAB.NIBP, HR, RR, SpO2 and PI were recorded at 2min intervals after the SAB upto 20 min and then at 5 min intervals till the end of surgery. Hypotension was defined as a decrease in SBP >20% from the baseline.It treated with IV bolus of 6mg Inj.Ephedrine and 100ml of Ringer Lactate. Bradycardia was defined as HR <55 beats/min and treated with Inj.Atropine 0.6mg IV bolus.

Inclusion Criteria

ISSN:0975-3583,0976-2833 VOL14,ISSUE01,2023

- Parturients posted for elective lscs
- Age between 20 and 35 years

Exclusion Criteria
- Emergency LSCS
- Gestational age <36 or >41 weeks
- Gestational diabetes mellitus
- Pregnancy induced hypertension
- Pre-eclampsia
- Placenta Previa
- Cardiovascular disease
- Cerebrovascular disease

Results

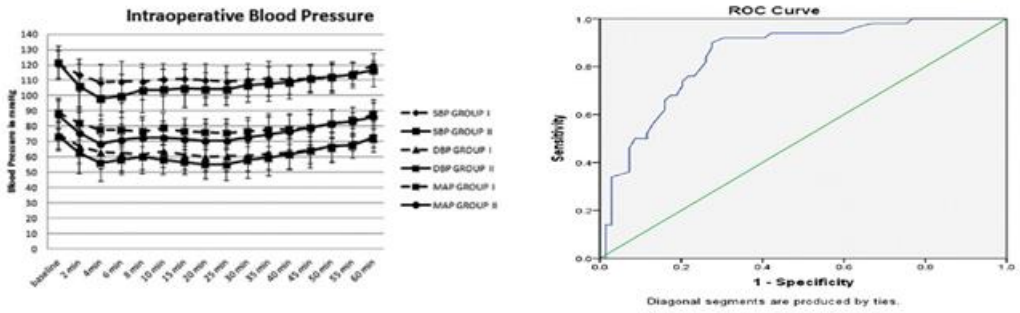

Figure 1

Table 1: Area under the curve

Test Result Variable(s): PI baseline				
Area	**Std. Error**	**P**	**Asymptotic 95% Condidence Interval**	
			Lower Bound	**Upper Bound**
0.848	0.036	<0.001	0.779	0.918

Table 2

Parameter	**Group I(*n*=57) PI≤3.5**	**Group II(*n*=63) PI>3.5**	**P**
Dose of ephedrine in mg. median (IQR, minimum-maximum)	0.00(0-0,0-18)	6.0(0.12,0-24)	<0.001
Fluid requirement in mL, median (IQR) episodes of hypotension	1000(900-1100)	1100(1000-1150)	<0.001
0	51	18	<0.001
1	4	24	
2	1	16	
3	1	4	
4	0	1	

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Table 3

Demographic parameter	Group I(*n*=57) PI≤3.5	Group II(*n*=63) PI>3.5
Age in year, median (IQR range)	24(21-27.5)	25(22-28)
Height in cm, median (IQR range)	156(154-157)	157(156-158)
Weight in kg, median (IQR range)	68.0(64.5-70)	67.0(62.5-70)

2 patients excluded from the study due to inadequate spinal blockade and 4 patients excluded due to requirement of additional oxytocin, as the drugs administered could influence the HR and BP of the patients.57 patients were in Group I and 63 patients were in Group II for final analysis. The median level of cephalad spread of sensory block achieved in both groups was T6. (IQR T4-T6). Median PI in Group I was 2.45(IQR 1.8-2.8), and in Group II was 5.4 (4.25-7.1). The PI values in both groups showed skewed distribution to the right around the PI value of 3.5, was observed when baseline PI values of both groups were combined and assessed for normal distribution. Intraoperatively, the HR was comparable between the two groups. The difference between the 2 groups with respect to SBP, DBP and MAP was statistically significant for first 25 mins.All these values are lower in Group II than Group I. The ROC curve yielded 3.85 as a more appropriate cut-off with a well balanced 76% sensitivity and specificity. The area under the ROC curve (AUC) was 0.848. The incidence of Hypotension in Group I was 10.5% (6/57) compared to 71.42% (45/63) in Group II ($p < 0.001$, odds ratio-0.07). Median ephedrine usage in Group I was 0 mg (IQR 0-0mg) and 6 mg (IQR 6-12 mg) in Group II ($p<0.001$). The amount of IV fluids required in Group I was also lower than Group II ($p<0.001$). The sensitivity and specificity of baseline PI with a cut-off of 3.5 was 69.84% and 89.29% respectively. The RR and SpO2 were comparable and the incidence of nausea and vomiting was similar in both groups (4/57 in group I, 7/63 in group II).

Discussion

The principle of SpO2 is depending on 2 light sources with different wavelengths 660nm and 940nm. It has pulsatile component, which represents fluctuations in the volume of the arterial blood between the source and the detector. The non-pulsatile component is from connective tissue, bone, venous compartment. The decrease in systemic vascular resistance in pregnancy will correspond to higher perfusion index due to an increase in pulsatile component due to vasodilatation. Induction of sympathectomy by spinal anaesthesia will cause a further decrease peripheral vascular tone and increase pooling and hypotension. PI can be a useful tool to early predict the hypotension. In this study, the incidence of hypotension was higher in parturients with baseline PI value >3.5.

George et.al also concluded a significant correlation between PI and decrease in systemic arterial pressure, but they had derived a baseline PI of 3.6 as their cutoff value with a sensitivity of 80% and specificity of 60%. arghese conducted a similar study and concluded the correlation result with an area under the curve of 0.911 and with the same baseline PI of 3.5 having a sensitivity of 86.6% and specificity of 93.3%.

Conclusion

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

Declaration of patient consent

The authors certify that they have obtained all Appropriate patient consent forms. In the form, the Patient(s) has/have given his/her/their consent for His/her/their images and other clinical information to Be reported in the journal. The patients understand That their names and initials will not be published and Due efforts will be made to conceal their identity, but Anonymity cannot be guaranteed.

Financial support and sponsorship Nil.

Conflicts of interest -There are no conflicts of interest.

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ISSN:0975-3583,0976-2833 VOL14,ISSUE01,2023

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