Section: Anesthesiology

Original Research Article

PREOPERATIVE BASELINE PERIPHERAL PERFUSION INDEX AS AN EARLY PREDICTOR OF THE INCIDENCE OF HYPOTENSION FOLLOWING SPINAL ANAESTHESIA IN ELECTIVE CAESAREAN SECTION.

Simi. P. Babu[1], Ashwini. B[2], Balasandhiya. P[3]

[1]Assistant Professor, Department of Anesthesiology, Madha Medical College and Research Institute, Kundrathur Road, Kovur, Chennai-600128, India.
[2]Assistant Professor, Department of Anesthesiology, Madha Medical College and Research Institute, Kundrathur Road, Kovur, Chennai -600128., India.
[3]Assistant Professor, Department of Anesthesiology, Madha Medical College and Research Institute, Kundrathur Road, Kovur, Chennai -600128, India.

Received : *05/01/2024*
Received in revised form : *02/03/2024*
Accepted : *19/03/2024*

Keywords:
Pregnancy, Hypotension, spinal anesthesia, Perfusion index.

Corresponding Author:
Dr. Simi.P.Babu,
Email: dr.simibabu@gmail.com.

DOI: 10.47009/jamp.2024.6.2.72

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 346-349

Abstract

Background: The new parameter, the perfusion index, is used for predicting hypotension, followed by spinal anaesthesia for the elective caesarean section. Predicting hypotension early allows for appropriate prophylactic interventions, ensuring better maternal care and neonatal outcomes. The aim of the study is to find out whether the baseline peripheral perfusion index can be used to predict hypotension following spinal anaesthesia in an elective caesarean section. **Material and Methods**: The study was conducted among the Parturients undergoing elective lower segment cesarean section in Madha medical college and Research Institute by the Department of Anesthesiology, for a period of one year from August 2022 to July 2023.Based on inclusion and exclusion criteria the study participants were recruited. The final sample size was 150.Routine investigations and preanesthetic fitness were obtained**.** The baseline Peripheral perfusion index[PI] was recorded every 10 seconds. Spinal anaesthesia was administered as per institutional protocol. Intra operative reading of heart rate, blood pressure are recorded. The data collected will be entered in Excel Sheet and analysis will be done by SPSS 23. P value <0.05 is considered as statistically significant. **Results**: Group A (PI <3.5) consist of 55 study participants and Group B (PI >3.5). consist of 95 study participants. The demographic profile of both the groups were compared between the two groups and was found to be not statistically significant. The mean blood pressure of Group A was found to be more 82.95±3.79 compared to Group B 71.11±4.4 and the difference was found to be statistically significant($p<0.05$). None of the parturient used Ephedrine or Atropine in Group A. The association between the blood pressure of the study participants and baseline perfusion index was found to be statistically significant and inversely correlated. **Conclusion**: Parturients having baseline of PI >3.5 has more risk of developing post spinal hypotension than those with baseline PI < 3.5.

INTRODUCTION

Spinal Anesthesia is merged as the preferred anesthesia for the lower segment Cesarean section due to the disadvantages faced with the general anesthesia like risk of aspiration and difficult airway. Spinal anesthesia also avoids the drug induced neonatal respiratory depression and provides a good postoperative analgesia without the use of intra venous opioids.[1] Though spinal block has its own advantages, the most common risk associated with it is post spinal hypotension.[2] This hypotension results due to the sympathetic blockade and decreased cardiac output.[3]

Healthy pregnancy is characterized by the decrease in systemic vascular resistance which is due to decrease in vascular tone.[4-6] At term the pregnant women have lower mean arterial pressure,they are more sensitive to local anaesthetics and less responsive to vasopressors.[7] This is the reason for the parturients to develop profound hypotension following the central neuraxial blockade for the lower segment caesarean section (LSCS).[8]

In order to prevent the hypotension many strategies have been used. According to some studies, co-loading with crytalloids and colloids is more effective than preloading.[8]. The incidence of hypotension is found to be reduced following the administration of vasopressors like phenylephrine and Nonepinephrine in some studies. Yet each of these methods have its own side effects.

Perfusion index assess perfusion dynamics, it is defined as the ratio of pulsatile blood flow to non-pulsatile blood flow in the peripheral vascular tissue, measured using a pulse oximeter based on the amount of infra red light absorbed.[9] It is a non-invasive method to detect the likelihood of development of hypotension following sub arachnoid block.

Parturients with a lower peripheral vascular tone are expected to have a high baseline perfusion index. Spinal anaesthesia given for the caesaren section will further decrease peripheral vascular tone in these parturients and make them more prone for intraoperative hypotension.

Aim of the Study

To find out whether baseline peripheral Perfusion index can be used to predict hypotension following spinal anaesthesia for the elective caesarean section.

Objectives of The Study

- To evaluate preoperative baseline peripheral perfusion index can predict the incidence of hypotension after spinal anaesthesia for parturients undergoing LSCS.

- To correlate peripheral perfusion index values with intra operative blood pressure measurements.

MATERIALS AND METHODS

Study Setting

This study was conducted among the Parturients undergoing elective lower segment cesarean section in Madha medical college and Research Institute Hospital by the Department of Anesthesiology. The study was done for a period from August 2022 to July 2023.

Study Design

Analytical cross-sectional study.

Sample Size

The study participants fulfilling the inclusion and the exclusion criteria were included in the study throughout the study period. The final attained sample is 150. The study participants were grouped into two based on

Inclusion Criteria

- Study participants with ASA Grade 1 and 2
- Age group of the study participants 20-35 years
- Pregnant mothers with singleton fetus
- Elective LSCS

Exclusion Criteria

- Emergency cases
- Body mass index >40
- Paturients with placenta previa,
- Cardio and Cerebro vascular disease
- Pregnancy with other medical conditions
- Preeclampsia and Eclampsia patients
- Peripheral vascular disease

Data Collection Method

After obtaining the Institutional Ethical Committee clearance, the study was started after obtaining patients informed consent. The study participants recruited during the study period is 150 will undergo the routine investigations and then the preanesthetic fitness. The baseline Peripheral perfusion Index was recorded every 10 seconds for one minute in a left lateral position on the right index finger at room temperature by anesthesiologist in the pre-operative room. Spinal anaesthesia was administered as per institutional protocol.

Intra operative reading of Heart rate, Blood Pressure, are recorded. Perfusion Index are recorded at an interval of two minute intervals after sub arachnoid block up to 20 min &then at 5 min intervals. The parameters like Heart rate, Systolic & diastolic blood pressure, Perfusion index are monitored till the end of surgery. Total doses of vasopressors (Ephedrine) and atropine given was noted.

Operational Definitions

Hypotension: Hypotension was defined as a decrease in MAP< 65 mm of Hg or 20% decrease from baseline.

Bradycardia: Bradycardia was defined as HR < 60 beats /mt.

RESULTS

The study participants were divided into two groups based on their Perfusion index. Group A (PI <3.5) and Group B (PI >3.5). Group A consist of 55 study participants and Group B consist of 95 study participants. The demographic profile of both the groups were compared between the two groups in Table 1. The mean age, mean height and mean weight of the two groups showed difference but the difference was found to be not statistically significant.

The mean heart rate of Group A was found to be 79.13±7.74 and that of Group B was found to be 77.89±7.95. There was a difference and it was found to be not statistically significant. The mean blood pressure of Group A was found to be more 82.95±3.79 compared to Group B 71.11±4.4. There was difference between the groups and it was found to be statistically significant. [Table 2]

The ephedrine usage was found to be more in Group B 80(84.2%). The atropine usage was also found to be more 5(5.3%) in Group B. Whereas in Group A none of the parturients used Ephedrine or Atropine. Both the groups was found to be statistically significant. [Table 3]

The association between the blood pressure of the study participants and baseline perfusion index was

ISSN (O): 2687-5365; ISSN (P): 2753-6556

found to be statistically significant and inversely correlated.

Table 1: Baseline characteristics of the study participants in both groups

Baseline characteristics	Group A (PI<3.5) (N=55)	Group B (PI>3.5) (N=95)	P value
Mean Age	25.05±2.6	25.45±3.1	0.42
Mean Height	166.8±4.7	166.13±4.1	0.34
Mean Weight	75.8±8.08	74.24±6.6	0.20

Table 2: Mean Heart rate and Blood pressure among the study participants

Variables	Group A (PI<3.5) (N=55)	Group B (PI>3.5) (N=95)	P value
Mean Heart rate	79.13±7.74	77.89±7.951	0.35
Mean Blood pressure	82.95±3.79	71.11±4.4	<0.001

Tables 3: Usage of Ephedrine and Atrophine in both groups

Variables	Group A (PI<3.5) (N=55)	Group B (PI>3.5) (N=95)
Ephedrine usage Yes No	 0(0%) 55(100%)	 80(84.2%) 15(15.8%)
Atrophine usage Yes No	 0(0%) 55(100%)	 5(5.3%) 90(94.7%)

Table 4: Correlation between the Perfusion index and Blood pressure of the study participants

		Blood Pressure	Baseline perfusion index
Baseline mean	Pearson Correlation Sig N	1 150	-.765 .000 150
Baseline perfusion index	Pearson Correlation Sig N	-.765 .000 150	1 150

Table 5: Area under curve

Parameters	PI
Area under the ROC curve (AUC)	0.909
Standard Error [a]	0.028
95% Confidence interval [b]	0.855 to 0.976
Significance level P (Area=0.5)	<0.0001

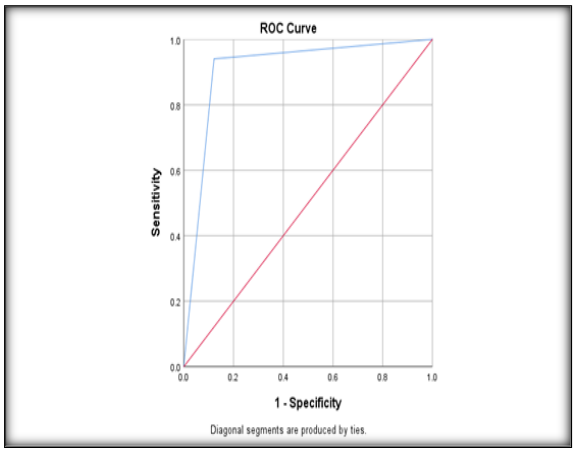

Figure 1: ROC Curve depicting Baseline PI against incidence of hypotension

The ROC curve analysis was created by plotting the true positive against false positive.

The sensitivity and specificity of the baseline PI with the cut off 3.5 was found to be 87.84% and 94.3%.

DISCUSSION

It is well known that sub arachnoid block is the most common method of administering anaesthesia in lower segment caesarean section. Development of hypotension following spinal anaesthesia administration among caesarean section delivery is quite common.[8] No monitoring systems has been developed specifically to predict the risk of hypotension. Toyama S et al,[9] has did a study to assess the usefulness of perfusion index in predicting the hypotension among women undergoing caesarean section under spinal anaesthesia.

Decrease in systemic vascular resistance, increased total blood volume and cardiac output is seen in healthy pregnant women.[10] Various factors are responsible for the reduction of systemic vascular resistance and it variations.[11-14] This decrease in tone

ISSN (O): 2687-5365; ISSN (P): 2753-6556

corresponds to the higher perfusion index values due to the increased pulsatile component due to vaso dilatation.

In our study parturients having baseline PI (>=3.5) is associated with increased incidence of hypotension and increased vasopressors requirement. Similar results was also observed in Toyama et al.[9] The ROC curve has showed us that the baseline PI was the most suitable parameter in detecting parturient at risk of developing post spinal hypotension during LSCS. It differentiate the parturients who developed the post spinal hypotension from those who did not. The baseline PI value of 3.5 gives us sensitivity of 87.84% and specificity of 94.3%. In Toyama et al study.[9] sensitivity was found to be 81% and specificity 86% for the cut off 3.5.In Dugappa et al,[15] study the specificity was comparable 89.29% whereas the sensitivity was lower 69.84%.

In contrast to our studies Yokose et al[16] had observed that no predictive values for hypotension in the parturients undergoing LSCS following Sub arachnoid block. This may be due to the difference in methodology like hypotension, co-loading with colloids and baseline PI method of calculation.

The main drawback of the PI is that it depends on the vessel's vascular tone. The vascular tone of vessels during pregnancy can be impacted by a variety of causes, including diseases. A lot more study needs to be done on the use of PI to predict post-spinal hypotension.

CONCLUSION

PI can be used in parturients undergoing caesarean section under spinal anaesthesia to predict hypotension 3.5 is the ideal cutoff to find the overall incidence of hypotension. Parturients having baseline of PI >3.5 has more risk of developing post spinal hypotension than those with baseline PI < 3.5.

Funding:
None of the authors received funding for this study

Competing Interest
There is no competing interest

Authors Contribution
All authors in our study contributed to the data collection of the patients

Acknowledgement
The authors like to thank the Dean of the Medical College, Head of the Department Anesthesiology, Madha Medical College, Chenna, Tamilnadu

REFERENCES

1. Paez L JJ,Navarro JR:Regional versus general anesthesia for caesarean section delivery.Rev Colomb Anestesiol.2012,40:203-206
2. Bajwa SJ,Bajwa SK.Anaesthetic challenges and management during pregnancy:Strategies revisited.Anesth Essays Res.2013;7:160-7
3. Hans R,Bein B,Ledowki T,Lehmkuhl M,Ohnesorge H,Scherkl W.Heart rate variability predicts severe hypotension after spinal anesthesia for elective caesarean delivery..Anesthesiology 2005;102:1086-93
4. Bowyer L,Brown MA,Jones M:Forearm blood flow in pre-eclampsia.Int J Obstet Gynec.2003;110:383-391
5. Sakai K,Imaizumi T,<Maeda H,Nagata H,Tsukimori k,Takeshita A,Nakano H:Venous distensibility during pregnancy .Comparison between normal pregnancy and preeclampsia.Hypertension.1994,24:461-466
6. Ajne G,Ahborg G,Wolff K,Nisell H:Contribution of endogenous endothelin-1 to basal vascular tone during normal pregnancy and preeclampsia.Am J Obstet Gynecol.2005,193:234-240
7. Gaiser R.Physiological changes of pregnancy:In :Chestnut DH,editor.Chestnut's Obstetric Anesthesia:Principles and practice.5th ed.Philadelphia:Mosby Elsevier Publishing:2014.15-38
8. Park GE,Hauch MA,Curlin F,Dutta S,Bader AM.The effects of varying volumes of crytalloid administration before Cesarean delivery on maternal hemodynamics and colloid osmotic pressure.Anesth Analg 1996:83:299-303
9. Toyama S, Kakumoto M.Morioka M,Matsuoka K,Omatsu H,Tagaito Y.Perfusion index derived from a pulse oximeter can predict the incidence of hypotension during spinal anaesthesia for caesarean delivery.Br J Anaesth 2013:111:235-41
10. Ajne G,Ahlborg G,Wolff K,Nisell H.Contribution of endogenous endothelin-1 to basal vascular tone during normal pregnancy and preeclampsia.Am J Obstet Gynecol.2005;193:234-40
11. Clapp JF 3rd,Capeless E.Cardiovascular function before,during and after the first and subsequent pregnancies.Am j Cardiol 1997;80:1469-73
12. Sakai K,Imaizumi T,Maeda H,Nagata H,Tsukimori K,Takeshita A.Venous distensibility during pregnancy.Comparisons between normal pregnancy and preeclampsia.Hypertension 1994;24:461-6
13. Barwin BN,Roddie IC.Venous distensibility during pregnancy determined by graded venous congestion.Am J Obstet Gynecol.1976;125:921-3
14. Bowyer L,Brown MA,Jones M.Forearm blood flow in pre-eclampsia .BJOG.2003;110:383-91
15. Perfusion index as a predictor of hypotension following spinal anaesthesia in lower segment caesarean section Devika Rani Duggappa, MPS Lokesh, Aanchal Dixit, Rinita Paul, RS Raghavendra Rao, P Prabha IJA 2017, IP: 157.50.12.24
16. Yokose M, Mihara T, Sugawara Y, Goto T The predictive ability of non-invasive haemodynamic parameters for hypotension during caesarean section:A prospective observational study. Anaesth Obstet 2015;25:345-9.

ISSN (O): 2687-5365; ISSN (P): 2753-6556