Original Research Paper

Volume-9 | Issue-9 | September - 2019 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

A PROSPECTIVE STUDY IN PREDICTING POST-SPINAL HYPOTENSION IN PATIENTS UNDERGOING A CAESAREAN SECTION THROUGH PREOPERATIVE BASELINE HEART RATE

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ABSTRACT **Introduction:** Spinal anesthesia for caesarean section has several advantages over general anaesthesia , the most common complication of spinal anesthesia in pregnant patient is hypotension. Preoperative determination of the autonomic tone might provide an opportunity to detect patients at risk of developing severe hemodynamic impairment following spinal anaesthesia. There are several methods to determine autonomic tone. Of these, a convenient, handy and non-invasive method of measuring activity of ANS is analysis of heart rate.

Method: This is a Prospective, randomized, double blinded study done over a period of 5 months, data will be collected from 100 ASA-I and ASA-II fit patients scheduled for elective caesarean delivery under subarachnoid block. The patients will be divided into two groups of 50 each, first group will be the patients with preoperative HR below 90bpm and the second group will be patients with HR above 90bpm. Written informed consent was taken from all the patients. Blood pressure measurement will be recorded immediately after spinal at regular intervals till end of surgery.

Results: There was no statistical difference between the two groups in terms of age, weight, height and duration of surgery. In the group with HR greater then 90bpm, 27 patients developed hypotension where as in the group with HR lower than 90bpm 11 patients developed hypotension. This difference is statistically significant ($p<0.05$).

Conclusion: Patients with a higher preoperative HR are more likely to develop post-spinal hypotension than patients with lower HR, thus pre-operative Heart rate can predict post-spinal hypotension in patients of caesarean section who have been given spinal anesthesia.

KEYWORDS : spinal anaesthesia, hypotension, heart rate, autonomic nervous system, pregnency, ephedrine, caesarean section.

INTRODUCTION

Spinal anaesthesia is the most commonly used method of anesthesia for caesarean section. The most common complication of spinal anaesthesia in pregnant patient is hypotension.[1] Intra operative hypotension induced by spinal anaesthesia during C-section is still a challenge for many anesthetists. Many complications are associated with intra- operative hypotension like reduced uteroplacental blood flow and fetal acidosis in neonates or nausea, vomiting and decreased consciousness in parturient.[2]

Spinal anaesthesia for caesarean section has several advantages over general anaesthesia like decreased risk of failed intubation, decreased risk of pulmonary aspiration of gastric contents, avoidance of the depressant effects of general anaesthetics on neonate etc. Single shot spinal is most commonly performed because it is simple, quicker, has faster onset with superior quality of block and infrequent failure, lesser risk of systemic toxicity due to local anaesthetic agent and lesser transfer to foetus as lower doses are used and because of its cost effectiveness. However, single shot spinal anaesthesia has its own bag of adverse effects. The most common adverse effect is hypotension, primarily because of chemical sympathectomy associated with the lumbosacral block. The incidence of hypotension during spinal anaesthesia is as high as 75-85%.[3]

Commonly used methods to prevent or treat such hypotension include preloading with fluids, avoidance of aortocaval compression and the administration of vasopressor drugs. For the management of hypotension, many pharmacological and non-pharmacological methods have been used, with no single method adequate or conclusively superior. Amongst the vasopressors used like ephedrine, phenylephrine and mephentermine, none of them is conclusively better over the other.[4]

Ephedrine, a sympathomimetic amine, acts on part of the sympathetic nervous system (SNS). The principle mechanism of action relies on its indirect stimulation of the adrenergic receptor system by increasing the activity of noradrenaline at the postsynaptic α- and β-receptors.[5]

Ephedrine is the drug of choice as vasopressor agents in obstetric anaesthesia. Vasopressor drugs used as prophylaxis is a reasonable option to prevent spinal anaesthesia induced hypotension. Ephedrine can be administered via both intramuscular and intravenous route.[6] Systemic hypotension are modulated by autonomic nervous system (ANS).[7]

Preoperative determination of the autonomic tone might provide an opportunity to detect patients at risk of developing severe haemodynamic impairment following spinal anaesthesia. There are several methods to determine autonomic tone. Of these, a convenient, handy and non-invasive method of measuring activity of ANS is analysis of heart rate.[8]

AIM

The aim of present study is designed to identify the subset of pregnant patients at higher risk of developing post-spinal hypotension based on baseline heart rate prior to administration of anaesthesia.

OBJECTIVES

- To study the effect of autonomic nervous system through preoperative heart rate.
- Monitoring of heart rate, blood pressure and saturation intraoperative
- Subject risk of developing post spinal hypotension.

INCLUSION CRITERIA

1. ASA grade I and ASA grade II fit patients.
2. Singleton full term pregnant patients posted for elective caesarean sections.

3. Haemodynamically stable patients with all routine investigations within normal limits and without any other co morbidities.
4. Availability of informed consent and willingness of the patient to be a part of the study.

EXCLUSION CRITERIA

1. Patients with ASA physical status III or more.
2. Patients having resting blood pressure more than 140/90 mm Hg, history of hypertension, pre-eclampsia or eclampsia. Also patients having hyperthyroidism, and coexisting neurologic, cerebrovascular, cardiovascular disorder (asymmetric septal hypertrophy, angina, etc), renal, metabolic, psychiatric disorder, glaucoma or occlusive vascular disorder were excluded.
3. Those patients having history of hypersensitivity to local anaesthetic and any contraindications to spinal anaesthesia or having known foetal abnormalities were also excluded.

MATERIALS AND METHODS

Institutional ethics committee approval was taken prior to the commencement of the study. 100 patients undergoing elective caesarean section under spinal anaesthesia was selected randomly after applying already mentioned stringent inclusion and exclusion criteria. The patients were divided into two groups of 50 each.

- **Group A:** Patient with preoperative baseline heart rate below 90bpm.
- **Group B:** Patient with preoperative baseline heart rate above 90bpm.

Source of data was collected from 100 ASA-I and ASA-II fit patients scheduled for elective C-section under subarachnoid block. Written informed consent was taken from all.

METHOD:

Type of study: Prospective, randomized, double blinded study.
Period of study: July 2018 to December 2018.
Period required for data collection: 5 months
Period required for data analysis and reporting: 1 month
Sample size: 100 cases
Place of Study: Tertiary health care centre.

MATERIALS REQUIRED

1. Standard anaesthesia machine (Boyle's apparatus)
2. Intravenous cannula 20 G
3. Intravenous fluids – Crystalloids and colloids
4. Monitoring equipment's such as pulse oximeter, ECG monitor, non-invasive blood pressure apparatus.
5. 26 G Quincke's spinal needle
6. Disposable syringe
7. Drugs for spinal anaesthesia: 0.5% hyperbaric Bupivacaine hydrochloride , 2% Plain Lignocaine
8. All preparations that is drugs and equipment's necessary for resuscitation &/or GA will be kept ready.

PROCEDURE AND CONDUCT OF THE STUDY

Pre-operative visit was conducted on the previous day of surgery and detailed history and complaints were noted in case of elective surgeries. General and systemic examination of cardiovascular, respiratory and central nervous system was done. Patients were kept nil by mouth from midnight prior to surgery. Informed consent was taken.

Before spinal anaesthesia, all the patients were preloaded with 500ml of lactated Ringer's solution 15 minutes prior to spinal anaesthesia. No anticholinergics was given as pre-medication. Basal heart rate was predetermined with pulse oximeter by taking average of five independent recordings every minute in sequence. Baseline blood pressure was recorded by taking average of five independent recordings, every minute in sequence with the help of non-invasive blood pressure monitor. Patient's peripheral oxygen saturation, surface temperature and electrocardiogram were monitored. Basal values were recorded.

We divided subjects into two groups based on their baseline heart rate. The patient having a heart rate of 90 bpm or less were included in Group A, while those having heart rate of 91 bpm or more were included in group B.

Spinal anesthesia was administered in the sitting position with due aseptic precautions. After painting and draping of the lumbar area, a subarachnoid placement of bupivacaine (2.5 mL of 0.5% bupivacaine) through the L3-L4 interspinous spaces using 26 G Quinke's spinal needle and patient were made to lie down with a wedge placed under the right buttock. Blood pressure measurement was recorded immediately after subarachnoid block and repeated every 3 min in first 30 min and cycled to 5 min till end of surgery. Dermatomal level of anaesthesia was assessed. The target block height was equal to or above T6 and the surgeons were asked to proceed. Oxygen was administered at a rate of $3Lmin^{-1}$ by a face mask to all the patients until the umbilical cord was clamped.

Patient's developing more than 20% drop in their mean arterial pressure (MAP) were noted and treated with parenteral ephedrine 3 mg bolus. Ephedrine was repeated as indicated upto maximum 30mg throughout the surgery. The amount of ephedrine administered was used to calculate ephedrine requirements.

STATISTICAL ANALYSIS

Data was collected, compiled and tabulated.

Chi Square t test was used to compare incidence of hypotension and Unpaired t test was used to compare ephedrine requirements for both the groups.

$P < 0.05$ was considered statistically significant.

RESULTS

100 singleton pregnant patients of ASA grade I and II scheduled for elective caesarean section under spinal anaesthesia were enrolled for this study. Patients were divided into two groups on the basis of their baseline heart rate. In group A, patients having H.R. < 90 bpm and in group B, patients having H.R. > 90 bpm were included (50 patients in each group). No statistical difference between two groups in age, weight, height and duration of surgery was present.

Thirty four patients out of hundred developed hypotension(34%), of whom twenty four were in group B(70.58%) and ten were in group A(29.41%). Incidence of hypotension was statistically significant between two groups (*P= 0.003)*. It was found that, in group B, the requirement of ephedrine was greater than group A (mean 3.0 ± 0.0 Vs 4.38 ± 1.53, *P=0.008*).

Table 1:

Variables	Group 1 (Baseline HR <90bpm) (n=50)	Group 2 (Baseline HR ≥90bpm) (n=50)	P value*
Age (years) (mean ± sd)	26.4 ± 5.1	27.25 ± 3.31	0.597
Height (cm) (mean ± sd)	156.3 ± 9.1	154.0 ± 7.6	0.173
Weight (kg) (mean ± sd)	63.9 ± 7.7	66.2 ± 6.8	0.117
Surgical time (min) (mean ± sd)	83 ± 26	77 ± 24	0.233

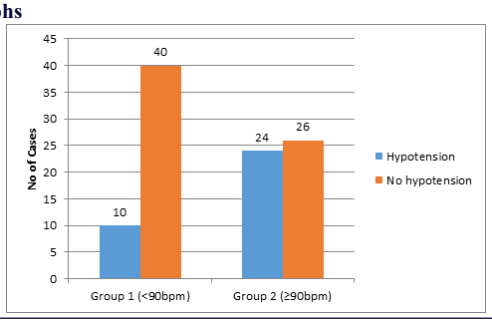
*p value calculated using unpaired t test,
p value <0.05 indicate statistical significance

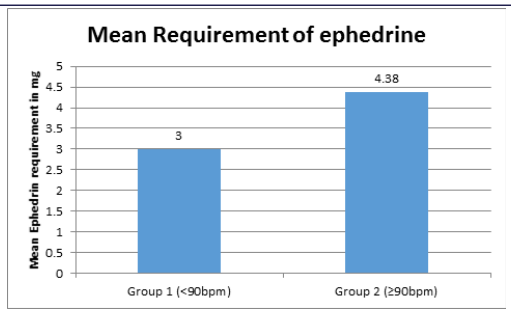
Table 2:

Variables	Group 1 (Baseline HR <90bpm) (n=50)	Group 2 (Baseline HR ≥90bpm) (n=50)	P value
Hypotension			
Present	10	24	0.003*
Absent	40	26	
Use of ephedrine (mean ± sd)	3.0 ± 0.0 (n=10)	4.38 ± 1.53 (n=24)	0.008#

*p value calculated using chi square test, df 1
#p value calculated using unpaired t test
p value <0.05 indicate statistical significance

Graphs





DISCUSSION

For obstetric patients coming for caesarean section, spinal anaesthesia is a commonly performed technique. The increase use of spinal anaesthesia for lower segment C-section is because of higher risk of maternal complications associated with general anaesthesia. Spinal anaesthesia is well tolerated but most common side effect associated with it is hypotension, which can have serious adverse effects for both mother and foetus. In order to prevent hypotension post spinal anaesthesia, there are various methods like preloading, pelvic tilt, prophylactic ephedrine, but no single method is entirely satisfactory and applicable for all patients.

Systemic haemodynamics are modulated my autonomic nervous system. Determination of autonomic tone pre operatively might provide an opportunity to detect patients at risk of developing severe haemodynamic impairment following spinal anaesthesia. To determine autonomic tone, several methods exists. Of this, a convenient, handy and non-invasive method of measuring activity of ANS is analysis of heart rate. Therefore, preoperatively analysed H.R. may predict hypotension following spinal anaesthesia and identify at risk patients. Thus, to prevent hypotension in at risk patients this can prove beneficial.

Present study demonstrated that higher the baseline heart rate, higher is the risk of developing hypotension post spinal anaesthesia. The cut-off values of H.R. were based on previous studies.

The main limitation of our study is the small sample size. But, we can use this evidence for future research to better establish the relation between preoperative heart rate and post spinal hypotension.

CONCLUSION

In obstetric patients undergoing C-section, there is significant association between preoperative heart rate and post spinal hypotension.

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