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Original Research Article

RELATIONSHIP BETWEEN BASELINE HEART RATE AND POST SPINAL SUBARACHNOID BLOCK HYPOTENSION IN PATIENTS UNDERGOING CESAREAN SECTION – A RANDOMIZED DOUBLE BLIND STUDY

Najeeb K.E¹, Manju B.K², Vinodhini³, Renju Ninan⁴, Vivek. S⁵

¹Assistant Professor, Department of Anesthesia, Al-Azhar Medical College, Thodupuzha, Kerala, India
²Consultant, Department of Anesthesia, Aster Hospital, Qatar
³Assistant Professor, Department of Obstetrics and Gynecology, Al-Azhar Medical College, Thodupuzha, Kerala, India
⁴Associate Professor, Department of Anesthesia, Al-Azhar Medical College, Thodupuzha, Kerala, India.
⁵Professor, Department of Community Medicine, Al-Azhar Medical College, Thodupuzha, Kerala, India.

Abstract

Background: To study the relationship between baseline heart rate and post spinal subarachnoid block hypotension in patients undergoing cesarean section. **Materials and Methods:** After obtaining approval from the ethics committee of Sri Ramachandra Medical College, 30 pregnant patients were selected for the study. The patients were divided into three groups based on the average baseline heart rate. Group I with baseline heart rate < 80 beats/min. Patients with baseline heart rate between 80 – 90 beats/min and > 90 beats/min were grouped into Group II and Group III respectively. **Result:** All the 30 patients completed the study. Among them 12 patients belonged to Group I (heart rate < 80beats/min). Group II (heart rate 80- 90beats/min) and Group III (heart rate > 90beats/min) had 10 patients and 8 patients respectively. Frequency of distribution of the number of patients is shown in the table (Table I). Group I had 40% of patients. Group II had 33.3% and Group III had 26.7% of patients. Fig I shows the distribution of patients in the three groups. **Conclusion:** From our study, we conclude that baseline heart rate can be used as a predictor of hypotension in cases of post spinal subarachnoid block in parturients. As the baseline heart rate increases, chances of hypotension also increase proportionately requiring more ephedrine to treat it. It does not depend upon the age, weight and height of the patients.

INTRODUCTION

Regional anaesthesia is the most commonly administered anesthesia technique in obstetrics. Among them spinal anesthesia is the commonest. The term 'Spinal Anesthesia' was coined by Leonard Coming in 1885. Cocaine was the first local anesthetic. It was first introduced into practice in eye surgeries by Carl Koller in 1884. It was used in surgery as a spinal anesthetic by August Bier in 1899.

Main advantages of spinal anesthesia for cesarean delivery are its simplicity, speed, reliability and minimal fetal exposure to depressant drugs2. Mother remains awake during the surgery. Risk of aspiration is reduced. Non-behavioral assessment of neonates is better with spinal anesthesia than general anesthesia. A denser sacral nerve root blockade, more motor blockade and less shivering are the other features of spinal anesthesia when compared to epidural anesthesia.

T4 level block is the target for spinal anesthesia in cesarean delivery. Lidocaine 60-75mg or bupivacaine 10-15mg can be introduced into subarachnoid space at L3-L4 or L2-L3 interspace. Fentanyl 10-20 micrograms may be added to augment the sensory blockade. Prolongation of the blockade may be brought into effect by epinephrine. Disadvantages include hypotension, intrapartum nausea and vomiting, possibility of post dural puncture headache and limited duration of action3. Maternal hypotension for more than 2 minutes may adversely affect the Apgar scores. Prehydration with lactated Ringer's solution, maintaining left uterine displacement during anesthesia and prophylactic administration of ephedrine can decrease the incidence of hypotension.

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The level of anesthesia for cesarean delivery results in the vagal predominance in the upper gastro intestinal tract. Visceral pain from traction of abdominal structures stimulates the vagus to trigger the vomiting center. Inadequate conduction blockade may worsen this condition. Metaclopramide , droperidol and scopalamine patches can be used to prevent nausea and vomiting prophylactically. A T4 block results in loss of thoracic proprioception and the patient may not appreciate her chest movements and may become restless or dyspnoeic. Rarely this may require rapid sequence induction and endotracheal intubation for securing the airway.

Spinal cord and its nerve roots lie within central bony canal of vertebral column. Vertebral column consists of 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal vertebrae4. Spinal canal is bounded anteriorly by vertebral bodies, laterally by pedicles and posteriorly by lamina. Spinal column forms a double "C"; convex anteriorly in cervical and lumbar regions. Ligamentous structures provide support.

Ventrally vertebral bodies and intervertebral discs are connected and supported by anterior and posterior longitudinal ligaments. Dorsally, ligamentum flavum, interspinous ligament and supraspinous ligaments provide stability. Spinal cord extends from foramen magnum to the level of L1 in adults and L3 in children. Therefore, lumbar puncture in adults is performed below L1 and in children below L3 to avoid trauma to the spinal cord.

MATERIALS AND METHODS

After obtaining approval from the ethics committee of Sri Ramachandra Medical College, 30 pregnant patients were selected for the study.
Inclusion Criteria
- ASA I pregnant patients
- Term pregnancies
- Elective cesarean section

Exclusion Criteria
- Pre-term and post-term pregnant patients
- Emergency cesarean section
- Pregnancy induced hypertension
- Chronic hypertension
- Diabetes Mellitus
- Cardiac diseases
- Body Mass Index (BMI) > 30 kg/m^2

On the day before surgery an informed written consent was obtained from the patients. Patients were premedicated with l50mg of T.Ranitidine orally on the night before surgery and on the morning of surgery. On the day of surgery, patients were shifted to the holding area of the operating room (OR) and blood pressure and heart rate were measured.
In the left lateral position five readings of baseline blood pressure (BP), mean arterial pressure (MAP)

and heart rate (HR) were taken at 2 minute intervals. Then the patients were given a head end elevation position of 30°. Again five readings of systolic and diastolic blood pressure, mean arterial pressure and heart rate were taken in this position. Average of the mean arterial pressure and heart rate readings were calculated and recorded. Anesthesiologist who recorded the baseline readings in holding area was not aware of the proceedings in the operating room.
The patients were shifted to the operating room by another anesthesiologist. They were placed m the supine position. Electrocardiogram, noninvasive blood pressure and pulse oxymetry monitors were connected and baseline values noted. Intravenous line was secured with wide bore 18 gauge cannula. Preloading was done with 15ml/kg body weight of Lactated Ringer's (RL) solution in 10 minutes.
After preloading, patients were made to sit up. The back was cleaned with three coats of povidone iodine 5% solution and allowed to dry up for 2 minutes. The remaining solution was then wiped off with sterile gauze. After informing the patients, L3-L4 interspace was infiltrated with 2% lignocaine local anesthetic solution. After a minute, a 25 gauge Quincke's spinal needle was introduced through the L3-L4 interspace. Subarachnoid space placement of the needle was confirmed with free flowing cerebrospinal fluid through the needle. l2mg of 0.5% bupivacaine heavy was injected in 15 seconds. Then the syringe was taken out along with the needle and the patients were placed supine after placing a wedge below the right flank.
Blood pressure and mean arterial pressure readings were then recorded every two minutes for the next thirty minutes. Mild hypotension with mean arterial pressure values less than 20% to 30% from the baseline mean arterial pressure was treated with 6mg of ephedrine intravenously. Marked hypotension with decrease in mean arterial pressure more than 30% from the baseline was treated with l2mg of ephedrine. If needed ephedrine was repeated every two minutes. The total dose of ephedrine given till the end of 30 minutes was taken as the ephedrine requirement.
The patients were divided into three groups based on the average baseline heart rate. Group I with baseline heart rate < 80 beats/min. Patients with baseline heart rate between 80 – 90 beats/min and > 90 beats/min were grouped into Group II and Group III respectively.
Statistical Analysis
Mean arterial pressure, heart rate, age, weight, height, body mass index and ephedrine requirement were the variables included in the analysis. The results were analyzed using Student's T test, Anova and Pearson Correlations. p values < 0.05 were considered to be significant.

RESULTS

All the 30 patients completed the study. Among them 12 patients belonged to Group I (heart rate < 80beats/min). Group II (heart rate 80- 90beats/min) and Group III (heart rate > 90beats/min) had 10 patients and 8 patients respectively. Frequency of distribution of the number of patients is shown in the table (Table I). Group I had 40% of patients. Group II had 33.3% and Group III had 26.7% of patients. Fig I shows the distribution of patients in the three groups.

Table I: Frequency of Distribution of The Number of Patients.

Group	Heart Rate (beats/minute)	Frequency (number of patients)	Percentage
I	< 80	12	40.00
II	80 – 90	10	33.30
III	> 90	8	26.70
	Total	30	100.0

We have compared the age, weight, height and body mass index of the 30 patients (N = 30) included in our study (Table II). Mean age was 25.93 years, weight 64.8 kg, height l58.03 cm and body mass index 25.827 kg/m 2. Analyzing these variables with heart rate using Pearson correlation, we found that there is no significant correlation between these variables. It indicates that the heart rate did not depend on the changes in age, weight, height and body mass index of the patients included in our study. This is shown in Figure II.

Table II: Descriptive Statistical Analysis Comparing Age, Weight, Height

	Minimum	Maximum	Mean	Std. Deviation
AGE(years)	20	35	25.93	3.28
WEIGHT(kg)	55	80	64.80	6.59
HEIGHT(cms)	144	170	158.03	6.38
BMI(kg/m2)	22.1	28.3	25.827	1.452

And Body Mass Index of Patients
(N = 30)

The study also showed that there is not much correlation between age and average heart rate (Table III). Age ranged from 20 to 35 years in all the groups. The p value obtained on comparing average heart rate and age is 0.466. (p value < 0.05 is considered to be statistically significant). Comparing weight and heart rate with Pearson correlation, we found that there is no significance as the p value obtained was 0.641.Weight ranged from 55 to 80 kg in all the groups. Comparing average heart rate and ephedrine requirement with Pearson correlations, we found that there is a significant correlation between these two variables. p value obtained is 0.007 confirming its significance. Pearson correlation value of 0.631 shows a positive correlation which means that as the baseline heart rate increases, ephedrine requirement also increases positively indicating increasing incidences of hypotension. This substantiates our findings.

Table III: Comparison of Average Age, Weight, Heart Rate and Ephedrine Requirement Using Pearson Correlations

	Pearson Correlation	p value
Age and heart rate	0.138	0.466
Weight and heart rate	0.125	0.641
Heart rate and ephedrine Requirement	0.631	0.007**

**99% significant

(p value 0.000 to 0.001 - 99.9% significant; 0.002 to 0.01 - 99% significant; 0.02 to 0.05 - 95% significant).

Table IV: Comparison between pre spinal and post spinal mean arterial pressures and ephedrine requirement in the three groups

Group	Heart Rate (beats/minute)	Mean Ephedrine requirement	Pre spinal MAP	Post Spinal MAP
I	< 80	0	85.88	83.50
II	80 – 90	8	86.75	80.10
III	> 90	15.75	87.81	83.00

We analyzed the relationship between pre spinal and post spinal mean arterial pressures and ephedrine requirement (Table IV & Figure III) in the three groups. Group with baseline heart rate less than 80 beats/minute represents Group I, 80-90 beats/minute represents Group II and more than 90 beats/minute represents Group III. The mean ephedrine requirement was nil in Group I. The mean ephedrine requirement was 8 mg in Group II while it was 15.75 mg in Group III. Mean of pre spinal mean arterial pressures was 85.88 in Group I, 86.75 in Group II and 87.81 in Group III. Mean of post spinal mean arterial pressures was 83.50, 80.1 and 83 in Group I, Group II and Group III respectively. There is a significant increase in the mean ephedrine requirement in Group II and Group III. Group III had more ephedrine requirement than Group II. This indicates that as the baseline heart rate increased there was a significant increase in the ephedrine requirement.

As we have calculated previously, Group I had no ephedrine requirement. Group II and Group III required ephedrine post spinal subarachnoid block. Mean ephedrine requirement in Group II was 8 mg and that in Group III was 15.75 mg. This indicates that Group III with the baseline heart rate more than 90 beats/minute had more incidences of hypotension than Group II with baseline heart rate 80- 90beats/minute. As a consequence, more ephedrine was required by Group III than Group II. This proves that as baseline heart rate increases, incidences of hypotension also increase.

DISCUSSION

Hypotension is one of the major concerns in obstetric anaesthesia19. Hypotension occurring after spinal subarachnoid block is a major threat to the mother and fetus. It compromises the uteroplacental circulation, the fetal well-being and neonatal outcome if not treated promptly. Treatment of hypotension can be carried out with ephedrine, pelvic tilt and intravenous fluids. Ephedrine is the most preferred drug used in obstetric anesthesia to treat hypotension20. But it carries the risk of reactive hypertension and cardiac arrhythmias. Pulmonary edema may also result from excessive intravenous fluid administration.

Michael.A.Frolich and Donald Caton14 in their study with 40 healthy pregnant patients demonstrated that heart rate is a major factor with which one can predict hypotension after spinal subarachnoid block. They proved in their study that incidence of hypotension increases with increase in baseline heart rate and so the ephedrine requirement increases. In our study, we also obtained similar results where all 12 patients with baseline heart rate <80 beats/min did not require ephedrine doses as they did not develop hypotension. All 9 patients in Group II (80-90 beats/min) and 8 patients in Group III (>90 beats/min) required ephedrine. Mean value of ephedrine required is about 15.75 mg in Group III when compared to 8.0 mg in Group II. This indicates an increasing tendency to develop hypotension along with increase in baseline heart rate.

CONCLUSION

From our study, we conclude that baseline heart rate can be used as a predictor of hypotension in cases of post spinal subarachnoid block in parturients. As the baseline heart rate increases, chances of hypotension also increase proportionately requiring more ephedrine to treat it. It does not depend upon the age, weight and height of the patients.

REFERENCES

1. Paul G. Barash, Bruce F.Cullen, Robert K.Stoelting. Clinical Anesthesia 5th edition, Lippincot Williams and Wilkins 2006.
2. Chesnut DH. Obtetric anesthesia, Principles and practice 211d edition. St.Louis, Mosby Inc.1999.
3. Greene.N.M. Physiology of spinal anesthesia, 3rd edition Baltimore/London, Williams and Wilkins 1981.
4. Wylie and Churchill-Davidsons, A Practice of Anesthesia 7th addition, Arnold 2003.
5. Robert K. Stoelting. Pharmacology and Physiology in anesthetic practice, 3rd edition. Lippincott-Raven 1999.
6. Wylie and Churchill-Davidsons, A Practice of Anesthesia 7th addition, Arnold 2003.
7. Birnbach DJ, Gatt sp, Datta s (editors). Text book of Obstetric anesthesia, Philadelphia, Churchill Livingstone 2000.
8. Critchley CRA, Stuart JC, Conway F, Short TG. Hypotension during subarachnoid anesthesia, Hemodynamic effects of ephedrine. Brit. Journal of Anesthesia 1995;75:262-65
9. Asha N.Chesnutt. Physiology of normal pregnancy. Critical Care Clinics 2004 ; 20: 609-15.
10. Anna Lee, Warwick D, Ngan Kee, Tony Gin. Prophylactic ephedrine prevents hypotension during spinal anesthesia for cesarean delivery, but does not improve neonatal outcome: A quantitative systemic review. Canadian J Anesthesia 2002; 49: 588-599.
11. C A Ewaldsson, RG Hahn. Volume kinetics of Ringer's solution during induction of spinal and general anesthesia. Brit J Anesthesia 2001; 87: 406-414.
12. Marcel P Vercauteren, Hilde C Coppejans, Vincent H Hoffman, Hugo A Adriaensen. Prevention of hypotension by a single 5mg dose of ephedrine during small dose spinal anesthesia in prehydrated cesarean delivery patients. Anesthesia Analgesia 2000; 90: 324.
13. Warwick D Ngan Kee, Kim S Khaw, Bee B Lee, Tze K Lau, Tony Gin. A dose response study of prophylactic intravenous ephedrine for prevention of hypotension during spinal anesthesia for cesarean delivery. Anesthesia Analgesia 2000; 90: 1390-5.
14. Michael A Forlich, Donald Caton. Baseline heart rate may redict hypotension after spinal anesthesia in prehydrated obstetric patients. Can J Anesthesia 2002; 49: 185-186.
15. B T Ayorinde, P Buczkowski, J Brown, J Shah, D J Buggy. Evaluation of pre-emptive intramuscular phenylephrine and ephedrine for reduction of spinal anesthesia induced hypotension during cesarean section. Brit J Anesthesia 2001; 86: 372-376.
16. G Dahlgren, F Granath, H Wessel. Prediction of hypotension during spinal anesthesia for cesarean section and its relation to the effect of crystalloid or colloid preload. Intl J of Obstetric Anesthesia 2007; 16(2): 128-134.
17. Kafle SK, Rout CC, Rocke DA. Prevention of hypotension following spinal anesthesia for cesarean section. Intl. Anesthesia. Clin 1994;32: 117-35.
18. Kohki Nishikawa, Michiaki Yamakage, Akiyoshi Namiki. Prophylactic intramuscular small dose phenylephrine blunts spinal anesthesia induced hypotensive response during surgical repair of hip fracture in elderly. Anesthesia Analgesia 2002; 95: 751-756.
19. Amanda Barie, David Pescod. Obstetric anesthesia, developing anesthesia. Australian society of anesthetists, July 2006 .
20. Riley ET, editorial I, British Journal of Anesthesia 2004; 92: 459-61.
21. Thomas D J, Robson S C, Redfern N, Hughes D, Boys R J. Randomized trial of bolus phenylephrine or ephedrine for maintenance of arterial pressure during spinal anesthesia for cesarean section. British J Anesthesia 1996; 76: 61.
22. Jackson R, Reid J A, Thorburn J, Volume preloading is not essential to prevent spinal induced hypotension at caesarean section British J Anesthesia: 1995; 75:262-5
23. Sternlo J E, Rettrup A, Sandin R. Prophylactic intramuscular ephedrine in bupivacaine spinal anesthesia. British J Anesthesia 1995; 74: 517.
24. Shiv K Sharma, Gajraj Noor M, Sidawi J Elaine. Prevention of hypotension during spinal anesthesia: A comparison of

intravascular administration of hetastarch versus lactated ringer's solution. Anesthesia Analgesia 1997; 84: 111.

25. Webb A A, Shipton E A. Re-evaluation of intramuscular ephedrine as prophylaxis against hypotension associated with spinal anesthesia for cesarean section. Canadian J Anesthesia 1998; 45: 367.

26. Chung C J, Bae S H, Chae K Y, Chin Y J. Spinal Anesthesia with 0.25% hyperbaric bupivacaine for cesarean section: Effects of volume. British J Anesthesia 1996; 75: 145.

27. Karinen J, Rasanen J, Alahuta S, Jouppila R, Jouppila P. Effect of crystalloid and colloid preloading on uteroplacental and maternal hemodynamic state during spinal anesthesia for cesarean section. British J Anesthesia 1995; 75: 531.

28. Simon L, Boulay G, Ziane A F, Effect of injection rate on hypotension associated with spinal anaesthesia for cesarean section. British J Anesthesia 1999; 82: 161.

29. Sarvela P Johanna, Halonen Pekka M, Kortila Kari T. Comparison of 9mg of intrathecal plain and hyperbaric bupivacaine both with fentanyl for cesarean delivery. Anesthesia Analgesia 1999; 89: 1257.

30. Marcel P Vercauteren, Hilde C Coppejans, Vincent H Hoffman, Hugo A Adriaensen. Small dose hyperbaric versus plain bupivacaine during spinal anesthesia for cesarean section. Anesthesia Analgesia 1998; 86: 989.

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