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Study of Pre-loading and Vasoconstrictors as Combined Prophylaxis for Hypotension During Sub-Arachnoid Anaesthesia

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Abstract

Background: Hypotension following spinal anaesthesia is common physiological complications associated with nausea, vomiting, dizziness aspiration, syncope and cardiac arrhythmias. Hence proper prophylaxis for hypotension is essentialin lower abdominal and lower limb surgeries.

Method: Total sixty patients aged between 35 to 65 years undergoing lower abdominal and inferior extremities were studied. Patients were randomly classified into three groups 20 patients in each group. Group-I patients crystalloid group received RL and placebo. Group-II (Vasoconstrictor) group received Ephedrine and Group-III (combination group) received RL (ringer lactate) and Ephedrine. Hemodynamic parameters and side effects of each group was noted and compared.

Results: There was significant prophylaxis in all three groups at different intervals of 5, 10, 15, 20, 25 and 30 minutes ($p<0.001$) highly significant P and F values and 1 (5%) hypotension was observed in group-III, followed by 4 (20%) in group-II and 9 (45%) highest hypotension in group-I and least side effects were also observed in group-III patients.

Conclusion: It is concluded that group-III (combination groups) preloaded with RL solution and Ephedrine after the injection of spinal anaesthetic drug proved ideal prophylaxis for hypotension during subarachnoid anaesthesia.

Keywords: Ringer lactate, Ephedrine, Hypotension, Vasoconstrictor

Introduction

Hypotension following spinal anaesthesia is a common physiological complication with an incident of ranging from 25-75% among general population and a little higher in patients undergoing caesarean section occasionally spinal anaesthesia induced hypotension can be significantly severe, more so in pregnant females which can increase intra-operative or post-operative morbidity[(1)(2)]. The spectrum of morbidity associated with hypotension may include vomiting, nausea, dizziness, aspiration, syncope and cardiac arrhythmias [(3)]. Hypotension following spinal

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anaesthesia is mainly due to sympathetic blockade leading to peripheral vasodilatation and venous pooling of blood. As a result there is decreased venous return and cardiac output leading to hypotension [4]. There are various methods to prevent this hypotension following spinal anaesthesia in both pregnant and non-pregnant females and males undergoing lower abdominal and lower extremity patients. Hence attempt was made to evaluate pre-loading and vasoconstrictors as combined prophylaxis for hypotension during subarachnoid anaesthesia.

Material and Method

Sixty patients aged between 35 to 60 years admitted at GSL Medical College hospital Rajamundry Andhra Pradesh were studied.

Inclusive Criteria: ASA grade-I and II scheduled to undergo elective and surgical procedures on the lower extremity or lower abdomen under spinal anaesthesia were selected for study.

Exclusion Criteria: Patients with cardiovascular, respiratory disorders, congenital heart anomalies, Hypertension, preeclampsia, diabetes mellitus, electrolyte imbalance, Hb% less than 10 gm% weight more than 80 Kg fasting less than six hours. Patients already on antihypertensive treatment were excluded from the study.

Method

Patients were randomly classified into 3 groups (20 patients in each group). Group-I patients (crystalloid) group received 15 ml/kg Ringer lactate over 20 minutes preceding the subarachnoid block, followed by intravenous injection of placebo for next 20 minutes after the delivery of spinal anaesthetic drug. Group-II patient (vasoconstrictor group) received intravenous bolus of 5 mg ephedrine in the first and second minute, followed by 1 mg ephedrine at the end of each minute for next 18 minutes following anaesthesia. Group-III patients (combination group) received pre-loading 7.5 ml/ kg of ringer lactate over 10 minutes period preceding the spinal block followed by intravenous bolus of 2.5 mg Ephedrine in the first and second minutes and 0.5 mg Ephedrine at the end of each minute for next 18 minutes after the injection of spinal anaesthesia on arrival at operation theatre two IV lines were secured An 18 gauze canula with triway kept open with ringer lactate solution was used to preloading and giving additional boluses of IV fluid during an event of hypotension. Another 20 gauge canula with tri-way was used for injecting ephedrine and for infusion of fluids during anaesthesia.

No pre-medication was given and subarachnoid puncture was performed using 23 gauge spinal needles at L_{34} inter-space with patients in sitting position. 2.5 ml of hyperbaric bupivacaine 0.5% was injected intrathecally and patient returned to supine position. A wedge was placed under the right hip for left uterine displacement in the patients undergoing caesarean section supplemental oxygen / 5L / minute was given through face mask. The level of loss to pin prick sensation was assessed and surgery was started when sensory loss of T6 was achieved. An infusion of lacteal ringer solution at the rate of 2m / Kg per hour was administrated during anaesthesia and the rate was not altered during the study period.

In each patient a baseline recoding of arterial pressure and pulse rate was made before pre-loading the patients I group-I and III and before positioning the patients for subarachnoid block in group-II. Subsequently the recordings were done at 5, 10, 15, 20, 25 and 30 minutes after the subarachnoid injection of the anaesthetic drug. However every minute monitoring was done to assessany haemodynamic changes and institution corrective therapy. A sphygmomanometer was culted around the arm and brachial artery pressure was recorded in the form of systolic Arterial pressure (SAP) Hypotension was defined as decreased in SAP more than 30% of the baseline or less than 90 mm / Hg. During the episodes of Hypotension addition bolus of 2m/kg of lactated Ringer solution was given. A maximum three boluses were given. However supplementation of IV fluids failed to reverse hypotension, bolus dose of ephedrine 6mg was given intravenously and solution repeated if necessary. Pulse oximetre was used to record the pulse rate. The patents were monitored for any reactive hypertension (SAP more than 30% of the base line values), Nausea and vomiting.

Duration of study was June-2021 to July-2022

Statistical analysis: Comparison pre-loading and vasoconstrictors for Hypotension, comparative study in management of Hypotension in all three groups and incidence of Hypotension, Nausea and vomiting in all three groups were compared with ANOVA test, chi-square test p value. The statistical analysis was carried out in SPSS software. The ratio of male and female was 1:2.

Observation and Results

Table 1: Comparative study of preloading and vasoconstrictors as combined prophylaxis for Hypotension during subarachnoid Anaesthesia.

- In Baseline – 125.3 (± 32) in group-I, 127.2 (± 10.07) in group-II, 125.65 (± 12.02) in group-III F-0.147 and P=0.863, p value is insignificant
- At 5 minutes 108.9 (± 15.94) in group-I, 127.9 (± 14.7) in group-II, 122.70 (± 12.7) in group-III F=9.31 p<0.003, p value is highly significant
- At the interval of 10 minutes 104.6 (± 17.8) in group-I, 118.2 (± 15.7) in group-II, 120.65 (± 15.3) in group-III, F=5.54, p<0.006 (p value is highly significant)
- At the interval of 15 minutes 108.8 (± 15.5) in group-I, 120.4 (± 15.86) in group-II, 118.8 (± 13.4) in group-III, F=3.503 and p<0.03 (p value is highly significant)
- At the interval of 20 minutes 109.6 (± 15.34) in group-I, 123.8 (± 15.86) in group-II, 121.4 (± 11.8) in group-III, F=5.70 and p<0.005 (p value is highly significant)
- At the interval of 25 minutes 111.6 (± 14.1) in group-I, 124.3 (± 13.3) in group-II, 121.32 (± 12.30) in group-III, F=4.97 and p<0.02 (p value is highly significant)
- At the interval of 30 minutes 114.4 (± 13.02) in group-I, 125.2 (± 11.90) in group-II, 121.10 (± 12.3) in group-III, F=3.81 and p<0.02 (p value is highly significant)

Table 2: Comparative study of Hypotension and its management

- No. of Hypotension patient 9 in group-I, 4 in group-II, 1 in group-III, chi-square 9.13 and p<0.001 (p value is highly significant).
- Number of Episodes Hypotension – 11 in group-I, 4 in group-II, 1 in group-III, chi-sq 13.46 and p<0.001 (p value is highly significant).
- Number of boluses of IV fluid (%) – 4 in group-I, 2 in group-II, 1 in group-III, chi-sq 2.26 and p>0.005 (p value is insignificant).
- Number of boluses of IV fluid – 9 in group-I, 5 in group-II, 2 in group-III
- Percentage of patients required 6 mg Ephedrine 6 in group-I, 2 in group-II, 0 (zero) in group-III
- Number of boluses of 6 mg Ephedrine – 7 in group-I, 2 in group-II, 0 in group-III, chi-sq 10.19 and p<0.006 (p value is highly significant).

Table 3: Comparative incidences of Hypotension Nausea and Vomiting

- Hypotension0 (zero) in group-I, 1 (5%) in group-II, 0 (zero) in group-III chi-sq 2.033, p<0.36 (p value is Insignificant)
- Nausea 3 (10%) in group-I, 1 (5%) in group-II, 0 (zero) in group-III chi-sq 2.10, p<0.34 (p value is Insignificant)

Table-1 (ANOVA TEST) Mean Systolic Blood Pressure

Mean systolic BP	Group-I (20)	Group-II (20)	Group-III (20)	Test statistic P value
Baseline	125.32 (±12.85)	127.2 (±10.07)	125.65 (±12.02)	F=0.1471 P=0.8635
5 Minutes	108.91 (±15.94)	127.9 (±14.78)	122.70 (±12.17)	F=9.3101 P=0.0003**

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Mean systolic BP	Group-I (20)	Group-II (20)	Group-III (20)	Test statistic P value
10 Minutes	104.65 (±17.88	118.2 (±15.77)	120.65 (±15.32	F=5.5486 P=0.0063**
15 Minutes	108.85 (±15.54)	120.4 (±15.86)	118.85 (±13.42)	F=3.5031 P=0.0367*
20 Minutes	109.65 (±15.34)	123.82 (±15.11)	121.4 (±11.86)	F=5.7044 P=0.0055**
25 Minutes	111.64 (±14.16)	124.30 (±13.30)	121.32 (±12.30)	F=4.9719 P=0.0102**
30 Minutes	114.44 (±13.02)	125.25 (±11.90)	121.10 (±12.5)	F=3.8178 P=0.0278*

* indicates significant and

**indicates highly significant

On comparison of systolic blood pressure values among Group I, Group II and Group III initially at baseline no significant difference observed i.e they are comparable with each other.

After every 5 minutes follow up systolic blood pressure values are increasing in all three groups and on comparison of average values statistically significant difference observed (P<0.01).

Comparative study of Hypotension during and its management

Table-2 (ANOVA TEST)

Details	Group-I (20)	Group-II (20)	Group-III (20)	P value
No. of Hypotension patients	9	4	1	Chi-square=9.13 P=0.010**
No. of Episodes of Hypotension	11	4	1	Chi-square=13.4659 P=0.0011**
No. of patents Managed by IV fluids (%)	4	2	1	Chi-square=2.2641 P>0.05
No. of boluses of IV fluid	9	5	2	Chi-square=6.3068 P=0.0427*
Patients required 6mgEphedrine	6	2	0	Chi-square=8.076 P=0.0176*
No. of Boluses of 6mg Ephedrine	7	2	0	Chi-square=10.1960 P=0.0061**

*indicates significant and

**indicates highly significant

On comparison of proportions of Hypotension, Episodes of Hypotension, boluses of IV fluid of IV, patients required 1mg Ephedrine and patients required 6mg Ephedrine significant difference observed among there groups ($p<0.05$) while no significant difference observed in proportions of patients Managed byIV fluids ($P>0.05$) among three groups.

Table-3 (ANOVA TEST)

Comparative Incidence of Hypotension, Nausea and Vomiting

Incidences	Group-I (20)	Group-II (20)	Group-III (20)	Test statistic P value
Hypotension	0	1 (5%)	0	Chi-square=2.033 P=0.3616
Nausea	3 (15%)	1 (5%)	1 (5%)	Chi-square=1.7454 P=0.4178
Vomiting	2 (10%)	1 (5%)	0	Chi-square=2.1052 P=0.3490

Comparison of incidences of Hypotension, Nausea and Vomiting statistically no significant difference observed among three groups ($P>0.05$).

Discussion

Present comparative study of pre-loading and vasoconstrictors as combined prophylaxis for hypotension during subarachnoid anaesthesia. Three groups were evaluated at different intervals of 5, 10, 15, 20, 25 and 30 minutes and ANOVA test and p value were highly significant (Table-1). Number of patients of hypotension were compared in all three groups least number of hypotension was observed in group-III 1 (5%), followed by 4 (20%) in group-II and maximum number of hypotension were observed in group-I was 9 (45%) and highest episodes of hypotension was also observed in group-I-II and least in group-III and maximum number of boluses of I. V. 9 (45%) and boluses of Ephedrine 7 (35%) was also given to group-I (Table-2). Incidence of Nausea 3 (15%) patients and vomiting 2 (10%) was observed in group-I, 1 (5%) Nausea in group-II and III and 0 (zero) vomiting was observed in Group-I patients (Table-3). These finding are more or less in agreement with previous studies [6][7][8].

Group-I was crystalloid, Group-II was (vasoconstrictor) and Group-III was (combination) group when efficacy three regimens were evaluate din prevention of spinal hypotension. Crystalloids were preferred over colloids for preloading as latter was more expensive and some solutions had a significant risk of anaphylaxis[9]. However large quantity of I.V. fluids may be dangerous in elderly patients and parturient [10]. Ephedrine has both alpha and beta actions hence it is ideal vasoconstrictor. Ephedrine may cause tachycardia and hypertension hence it must be used cautiously in IHD and hypertensive patients.

Combination of preloading and vasoconstrictor had maximum effect in preventing spinal hypotension, followed by sole use of vasoconstrictor Hypotension was defined as decreased I systolic arterial pressure (SAP) present study SAP was 30% of base line or less than 90 mm/Hg. The change in SAP is related to the level of block and risk of hypotension increases the height of block. Hypotension following spinal or combined spinal epidural anaesthesia at caesarean section causes both maternal and festal or neonatal adverse effects.

The most common definitions of hypotension is <80% base line or <100 mm Hg or < 80% base line. It was also observed by most obstetric anaesthetist use a threshold of either 100 or 90 mm Hg SAP is a less important than mean arterial pressure (MAP) as a determinant of organ perfusion however, because methods used to measure blood pressure in routine clinical practice did not include the mean arterial pressure.

Acute hypotension reduces cerebral perfusion induces transient brainstem ischemia and activates vomiting centre transient cerebral hypoxia may occur. Spinal anaesthesia decreases splanchnic blood flow by approximately 20% which leads to systemic hypotension.

Summary and Conclusion

Present comparative study of three groups concludes that, combined use of volume preloading and vasoconstrictors is very effective method to manage the hypo-tensive during spinal anaesthesia because this combined use of both preloading and vasoconstrictors maintained the haemodynamic stability as compared to crystalloid and vasoconstrictors individual groups. The present study demands ideal pharmacological profile for α - agonist or alternately role of combined agent so that there will not be any risk factors to mother and neonates during caesarean section moreover on IHD or hypertensive patients.

Limitation of study – Owing to the tertiary location of research centre small number of patients and lack of latest, technologies we have limited findings and results.

This research paper was approved by Ethical committeeGSL Government Medical College and hospital Rajanagaram, Rajahmundry, Andhra Pradesh.

Conflict of interest: No

Source of funding: No

Comparative study of preloading and vasoconstrictors as combined prophylaxis for Hypotension during Subarachnoid Anaesthesia

References

1. Lee A, Nagan Kee WD – Quantitative systemic review of randomized controlled trials of Ephedrine versus phenylephrine for the spinal anaesthesia for caesarean delivery J. Anaesthesia and analgesia 2002, 94; 920-6.
2. Morgan P, Halpem S, Tarish T – The effects of an increased of central blood volume before spinal anaesthesia for caesarean Delivery a qualitative systemic review. Anaesth. Avalg. 2001, 92; 997-1001.
3. Bajwa SJ, Bajwa SK, Kaur J, Singh A – Prevention of hypotension analgesia in Emergency caeserian section Int. J. crit. Illin. Inj. Sci. 2012, 2; 63-9.
4. Ueyema H, He YL, Tanigarm H – Effects of crystalloids and colloid preload on blood volume in the parturient undergoing spinal anaesthesia for elective caesarean section Anaesthesia 1999, 91; 1571-6.
5. Parameshwara G – Spinal Epidural to combined spinal Epidural analgesia the history of central neuroaxial block Ind. J. Anaesthesia 2001, 45 (6); 406-7.
6. David L, Brown – Spinal epidural and caudal anaesthesia. In anaesthesia 5th edition Ronald D Miller editor Philadelphia, Churchill, living stone 2000, 1496-1506.
7. Clark RB, Thomson DS – Prevention of spinal hypotension associated with caesarean section Anaesthesiology 1976, 45; 670-674.
8. Eloner H, BARCO hang J – Influence of post-spinal hypotension on foetal electro-gram. Am. J. obstet. Gynae. 1960, 80; 560-571.
9. Mc Crea AF, Wild smith JAW – prevention and treatment of hypotension during central neutral block Br. J. Anaesthesia 1993, 70; 672-680.
10. Stoeling RK – Allergic reaction during anaesthesia Anaseth. Analg. 1983, 62; 341-356.
11. Macleman FM, Macdonald AF – lung water during the pueraerium Anaesthesia 1987, 42; 141-147.