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Comparison of Prophylactic Ephedrine with Crystalloid Preloading for Prevention of Hypotension due to Spinal Anaesthesia for Caesarian Sections

Sahaja Gunda[1] and Giridhar Janampet Bekkam[2*]

[1]Department of Anaesthesia, Nizamabad Govt. Medical College and Hospital, Nizamabad, Telangana, India

[2]Department of Anaesthesia, Panimalar Medical College Hospital, and Research Institute, Chennai, India

[*]Corresponding e-mail: giridharjb@gmail.com

ABSTRACT

Background: *Hypotension is the usual complication of spinal anesthesia in cesarean section. The present study was done to compare the efficiency of Ephedrine infusion and crystalloid preloading for the prevention of post-spinal hypotension.* ***Methodology:*** *This study was conducted on sixty patients who were randomly divided into two groups of 30 patients each. Group I (n=30) received 15 ml/kg of lactated Ringer's solution 10 min before spinal anesthesia, and Group II (n=30) received prophylactic 5 mg ephedrine first and second minute and 1 mg every minute until 15 min after the spinal anesthesia. Heart rate and systolic blood pressure were measured at 1 min after spinal anesthesia, and then every 3 minutes for the first 30 minutes then every 5 minutes for the next 30 minutes, and then after 30 minutes.* O_2 *saturation was recorded every 30 minutes.* ***Observations and Results:*** *incidence of Hypotension was significantly higher in group I (40%) compared to group II (20%) (p-value 0.01). There is a significant fall in SBP in a fluid group compared to the ephedrine group. A significant increase in the incidence of nausea and vomiting was observed in group I (17%) when compared to group II (3%), (p-value 0.02) and a non-significant increase in the incidence of Bradycardia was observed in group I (20%) when compared to group II (3%), (p-value 0.2).* ***Conclusion:*** *IV infusion of ephedrine was found to be very effective compared to crystalloid preloading in the prevention of hypotension in patients receiving spinal anesthesia for cesarean section.*

Keywords: Ephedrine infusion, Preloading, Hypotension, Spinal anesthesia

INTRODUCTION

In patients undergoing cesarean delivery, Spinal anesthesia gives a quick, rigorous, and symmetrical sensory and motor block of high quality [1,2]. Spinal anesthesia is usually given in the cesarean section, but a higher incidence of hypotension is one of the disadvantages of this procedure, as the incidence varies from 70% to 80% [3]. Spinal anesthesia-induced hypotension in the mother can cause placental hypoperfusion and fetal asphyxia [4].

To lower the incidence and severity of hypotension, many techniques were attempted which includes the routine use of lateral uterine displacement, infusion of up to 2 liters of fluids for intravascular volume expansion, which may reduce the risk of hypotension but does not eliminate it, and use of vasopressor as ephedrine which may be an effective alternative for hypotension prevention acts directly by stimulating alpha and beta-adrenergic receptors and indirectly by releasing norepinephrine from nerve endings in the autonomous nervous system [5-7].

The present study was done to compare the efficacy of ephedrine infusion versus crystalloid preloading in reducing the incidence of hypotension during spinal anesthesia for cesarean section.

MATERIALS AND METHODS

This prospective randomized comparative study was done at a government medical college and general hospital, Nizamabad from June 2020 to December 2020 on 60 healthy pregnant female patients with normal pregnancies

planned for elective Caesarean section. Approval from the institutional ethics committee was taken and from each patient informed written consent was taken. Patients were divided randomly into two equal groups (Ephedrine group and fluid group) of 30 patients each (by closed envelope method) before being moved to the operating theatre. Continuous monitoring with electrocardiography, non-invasive blood pressure, heart rate, and pulse oximetry was started once a patient enters the operating room. Baseline systolic blood pressure, heart rate, and arterial oxygen saturation were recorded. By using (18G) peripheral cannula a suitable peripheral vein was cannulated.

With the patient in a sitting position, spinal anesthesia was done at interspace L3-L4 with a 22 gauge spinal needle. All the patients received the same amount of local anesthetic 2 ml of 0.5% heavy Bupivacaine +fentanyl (25 μg). Then the patient was placed in the left lateral position by using a wedge under the right hip with slight elevation of the head; oxygen nasal cannula was used 4 liters/minute. Heart rate and systolic blood pressure were measured non-invasively at 1 min after spinal anesthesia, and then every 3 minutes for the first 30 minutes then every 5 minutes for 30 minutes then after 30 minutes. O_2 saturation was recorded by pulse oximetry continuously and recorded every 30 minutes.

Oxytocin was administered after fetus delivery (10 units in 500 ml lactated Ringer) in both groups. Nausea and vomiting were also recorded. Nausea and vomiting were treated with 10 mg metoclopramide. Postoperatively, all patients in the two groups were assessed for Heart rate, Blood pressure noninvasively, and oxygen saturation and were recorded postoperatively after 30 minutes.

Data were analyzed using a statistical package of social studies SPSS version 16. Continuous variables were presented as mean ± standard deviation and categorical variables were presented as frequencies and percentages. Analysis of data was done using student t-test and Chi-square test. p-value ≤ 0.05 was considered statistically significant.

RESULTS

Sixty patients were randomly allocated into group I (fluid group) and group II (ephedrine group) of 30 patients each. Demographic Data including age, BMI were collected and there were no significant differences between the two groups (Table 1).

Table 1 Demographic data of patients

	Group 1 (fluid)	Group 2 (Ephedrine)	p-value
Age	31.03 ± 5.75	30.84 ± 4.08	0.3
BMI	34.5 ± 1.53	35.1 ± 1.64	0.4

Concerning systolic blood pressure, higher SBP was seen in Group-II (Ephedrine) when compared to Group-I (Fluid); in group-I, there was a significant fall in SBP from 22 minutes (Table 2 and Figure 1).

Table 2 Systolic BP (mm Hg)

	Group-I (fluid)	Group-II (ephedrine)	p-value
Baseline	122.6 ± 7.8	121.1 ± 9.9	0.09
1 min	118.3 ± 12.3	118.4 ± 12.3	0.48
4 min	103.9 ± 8.8	112.2 ± 15.5	0.06
7 min	104.6 ± 12.8	111.1 ± 13.7	0.4
10 min	105.7 ± 10.1	111.4 ± 13.2	0.4
13min	106.7 ± 6.6	109.4 ± 12.0	0.3
16 min	105.4 ± 10.2	116.6 ± 10.9	0.08
19 min	106.9 ± 10.9	114.7 ± 13.5	0.3
22 min	108.1 ± 11.8	118.8 ± 10.8	0.04*
25 min	107.3 ± 8.6	117.4 ± 9.7	0.03*

28 min	107.3 ± 12.5	118.5 ± 11.9	0.02*
31 min	108.3 ± 8.3	119.1 ± 9.7	0.01*
36 min	110.4 ± 9.7	119.2 ± 9	0.02*
41 min	109.1 ± 6.1	120.2 ± 6.0	0.001*
46 min	112.4 ± 6.8	121.4 ± 9.8	0.001*
51 min	115.0 ± 5.4	121.2 ± 6.7	0.001*
56 min	117.1 ± 9	122.7 ± 6.2	0.001*
61 min	119.2 ± 6.2	124.8 ± 5.2	0.001*
90 min	120.5 ± 6.5	121.4 ± 7.59	0.001*
Data represented as Mean ± SD, *: Statistically significant (p<0.05)			

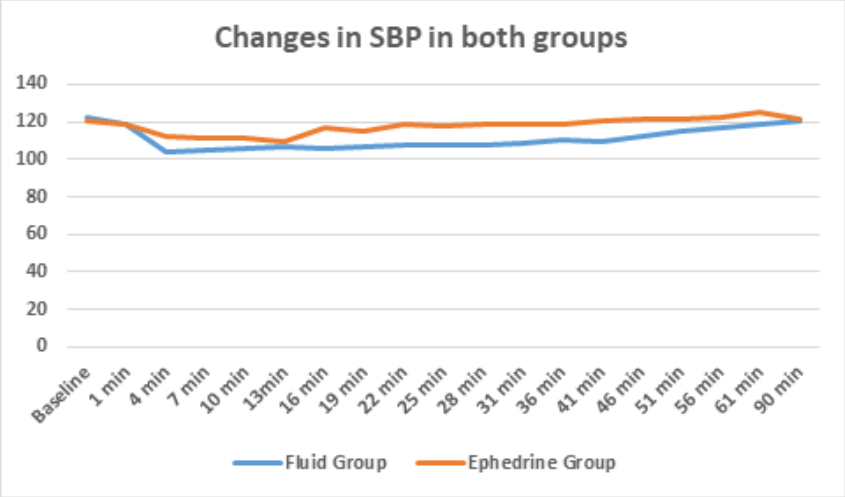

Figure 1 SBP changes in both groups

Regarding Heart rate, it was higher in group II when compared to group-I which was not statistically significant (Table 3 and Figure 2).

Table 3 Heart rate

	Group-I (fluid)	Group-II (ephedrine)	p-value
Baseline	86.5 ± 6.7	91.3 ± 8.8	0.08
1 min	89.5 ± 7.2	94.6 ± 10.4	0.01*
4 min	89.7 ± 11.6	93.2 ± 12.1	0.1
7 min	87.7 ± 10.5	94.2 ± 8.8	0.7
10 min	86.8 ± 10.3	92.3 ± 11.1	0.06
13min	85.7 ± 8.4	93.2 ± 10.1	0.4
16 min	85.9 ± 9.3	91.4 ± 8.5	0.08
19 min	84.6 ± 11.7	91.2 ± 10.5	0.2
22 min	83.5 ± 11.2	90.8 ± 10.4	0.5
25 min	82.7 ± 7.4	89.7 ± 8.8	0.1

28 min	81.8 ± 10.4	89.5 ± 10.8	0.3
31 min	81.6± 7.2	89.4 ± 8.8	0.1
36 min	80.8 ± 8.8	88.5 ± 8.1	0.7
41 min	79.6 ± 7.2	87.5 ± 8.1	0.8
46 min	79.4 ± 8.3	87.2 ± 7.6	0.9
51 min	78.6 ± 4.4	87.1± 7.8	0.2
56 min	77.6 ± 8.1	86.8 ± 7.3	0.5
61 min	78.4 ± 7.3	86.3 ± 7.6	0.6
90 min	77.8 ± 8.6	85.2 ± 6.5	0.7
*statistically significant (p<0.05)			

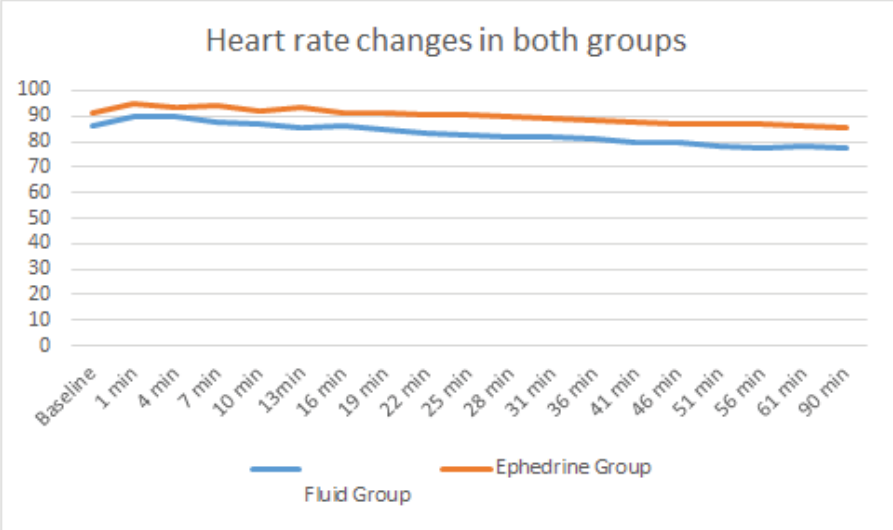

Figure 2 Heart rate changes in both groups

Oxygen saturation was not statistically significant between the two groups (Table 4).

Table 4 Oxygen saturation

	Group I (fluid)	**Group II (Ephedrine)**	**p-value**
Baseline	97.4 ± 0.8	98.2 ± 0.7	0.34
30 min	96.8 ± 0.5	99.5 ± 0.4	0.12
60 min	98.5 ± 0.4	98.7 ± 0.4	0.23
90 min (Post)	97.8 ± 0.5	98.9 ± 0.6	0.14
Data represented as Mean ± SD.			

Concerning the incidence of complications, the incidence of hypotension was significantly higher in group I (12/30) when compared to group II (6/30) with a p-value of 0.01. A significant increase in the incidence of nausea and vomiting was observed in group I (17%) when compared to group II (3%), (p-value 0.02) and a non-significant increase in the incidence of Bradycardia was observed in group I (20%) when compared to group II (3%), (p-value 0.2) (Table 5).

Table 5 Incidence of complications

	Group 1 (n=30) (fluid)	Group 2 (n=30) (Ephedrine)	p-value
Hypotension	12 (40%)	6 (20%)	0.01*
Nausea and vomiting	5 (17%)	1 (3%)	0.02 *
Bradycardia	6 (20%)	1 (3%)	0.2
*statistically significant ($p<0.05$)			

DISCUSSION

Hypotension induced by spinal anesthesia-induced hypotension is treated physiologically by increasing the venous return thereby increasing preload and restoring the cardiac output. Position of head down or leg elevation (10"-15") or leg wrapping with elastocrep bandage does not abolish the incidence of hypotension [8,9]. Crystalloids on the other hand are required in great volumes (>15 ml/kg) to decrease the incidence of hypotension, These large volumes have detrimental effects like increased central venous pressure, blood dilution leading to decrease in oxygen-carrying capacity, the release of atrial natriuretic peptide initiating diuresis, thereby attenuating the effect of volume load on blood pressure [10-13]. Because of the above reasons, spinal anesthesia-induced hypotension can be prevented by prophylactic administration of a pharmacologic agent [6,14,15]. Compared to α-or β-adrenergic agonist, mixed adrenergic agonist such as Ephedrine more ideally corrects the non-cardiac circulatory sequelae of spinal anesthesia [16]. Studies have shown that episodes of hypotension can be prevented by prophylactic bolus or infusions of IV Ephedrine without unwanted side effects [17-19].

In our study, we compared the effectiveness of fluid preloading with 15 ml/Kg lactated Ringer (group I) *versus* prophylactic IV ephedrine infusion without fluid preload (group II) for prevention of hypotension after spinal anesthesia for cesarean section. Our results showed that SBP was higher in the ephedrine group when compared to the fluid group, and it was statistically significant. Our study showed that the incidence of Hypotension and the incidence of nausea and vomiting were more in a fluid group compared to the Ephedrine group and it was statistically significant.

Bhovi, et al., in their study observed that the incidence of hypotension was significantly more in the fluid group compared to the ephedrine group [20]. The incidence of hypotension in the ephedrine group in their study was (12%) whereas in our study the incidence of hypotension in the ephedrine group was (20%).

Gajraj, et al., in their study found that hypotension incidence was significantly higher in the crystalloid group compared to the infusion group [21]. But there was no statistically significant difference in the incidence of nausea and vomiting.

CONCLUSION

IV infusion of ephedrine was found to be very effective compared to crystalloid preloading in the prevention of hypotension in patients receiving spinal anesthesia for cesarean section.

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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