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Comparison of bolus doses of ephedrine and phenylephrine on intraoperative hypotensive episodes during Cesarean section under spinal anaesthesia.

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Abstract

Introduction: Spinal anaesthesia is considered the standard anesthetic technique for elective caesarean section. Hypotension is the most common side effect of the procedure in the obstetric patient. Without prophylactic measures spinal anesthesia for caesarean delivery is associated with hypotension in 80% of cases. There is increase in the use of vasopressors than either crystalloid or colloid alone for prevention and treatment of hypotension. But no ideal vasopressors till now has been devised**.**

Aim and Objectives: To compare the vasopressor effects of ephedrine and phenylephrine in ameliorating hypotension in elective caesarean delivery receiving crystalloid coloading during intrathecal bupivacaine injection.

Material Methods: 30 pregnant women were selected for the study. All the data were expressed as mean +SD. Statistical analysis were performed with SPSS for windows (SPSS Inc., Chicago, IL, USA), version 17.0 for analysis of demographic comparison of groups, x2, unpaired student's t-test and paired-t-test were applied. $p<0.05$ were considered as statistically significant.

Result: 7/15 (46.66%) patients in the phenylephrine group and 7/15 (46.66%) patients in the ephedrine group had one or more episode of hypotension and required one or more bolus of vasopressor. The number of rescue doses required in group E and group P was statistically insignificant [Table 4]. There was a higher incidence of bradycardia in patients receiving phenylephrine than those receiving ephedrine [Table 4].

Conclusion: Ephedrine 5 mg and phenylephrine 100 µg are equally efficient in managing hypotension during spinal anesthesia for caesarean delivery. Neonatal outcome remains equally good in both the groups.

Keywords: Ephedrine, Phenylephrine, Hypotension during spinal anesthesia for caesarean delivery, Neonatal outcome.

Introduction

Now-a-days, Spinal anaesthesia is considered the standard anesthetic technique for elective caesarean

section[1]. However, hypotension is the most common side effect of the procedure in the obstetric patient. Without prophylactic measures spinal anesthesia for caesarean delivery is associated with hypotension in 80% of cases[2].

Hypotension after subarachnoid block can result in adverse perinatal outcomes, such as maternal nausea and vomiting, dizziness and may be an important contributory factor for maternal death. Profound hypotension, as a complication of subarachnoid block can lead to serious complication like hypoxia in the mother and the fetus. As placental blood flow is directly proportional to the maternal blood pressure, so maternal hypotension can lead to placental hypo perfusion and fetal asphyxia, resulting in less fetal oxygenation and fetal acidosis.

There is increase in the use of vasopressors than either crystalloid or colloid alone for prevention and treatment of hypotension .Crystalloid pre-hydration has poor efficacy for preventing hypotension, probably because it undergoes rapid distribution. As an alternative vasopressors are gaining increasing prominence as the primary technique for the prevention and treatment of spinal hypotension during Caesarean delivery [3] with varying degrees of success.

Despite the use of prophylactic intravenous (i.v) infusion or bolus vasopressors such as ephedrine for the last three decades, a good number of failures have also been reported.[4] Ephedrine has been the vasopressor of choice since it has been shown to have a more protective effect on uterine blood flow and perfusion pressure than α-adrenergic agonists[5] . However, ephedrine is not considered the gold standard for prophylaxis and treatment of hypotension after spinal anesthesia for caesarean delivery as, higher dose of ephedrine causes significant maternal tachycardia and fetal acidosis.[6] More recent evidence has supported the use of alpha agonists such as phenylephrine demonstrating better acid base status and similar efficacy in blood pressure control.

Hence, the present study was designed to compare the vasopressor effects of ephedrine and phenylephrine in ameliorating hypotension in elective caesarean delivery receiving crystalloid coloading during intrathecal bupivacaine injection.

Material & Methods

The evaluation of "Comparison of bolus doses of ephedrine and phenylephrine on intraoperative hypotensive episodes during Cesarean section under spinal anaesthesia" was carried out in the department of Anaesthesia AVBRH, a constituent of Jawaharlal Nehru Medical College Sawangi, Wardha, during August 2016 – August 2017. Institution ethics committee approval and written informed consent from patients were obtained.

Inclusion Criteria

- ASA I and II posted for elective Cesarean section.
- All the patients who were willing to give informed consent.
- Age group 18 to 40 years.
- Weight 40-70 kg.
- Height 150 -160 cm.

Exclusion Criteria

1. Patients not willing to give consent.
2. Patients who had a past history of reaction to study drugs & /or allergy to local anesthetics
3. Patients having

- Major hepatic, renal or cardiovascular dysfunction
- Contraindication to central neuraxial blockade
- Bleeding coagulopathy

4. Patients who were taking anti-emetic medications.
5. Obese patient

6. Patients with pregnancy related complications such as fetal malpresentation, pregnancy-induced hypertension, gestational diabetes mellitus and patients with pre-eclampsia and eclampsia.

Method

30 pregnant women (patient) were selected for the present study. After pre-anesthetic evaluation and investigations, the patients were explained about the procedure. Informed written consent was obtained. Standard pre-operative procedure was followed and base line vital parameters were recorded. 18G IV cannula secured and randomly allocated into two groups of 15 each with computer generated data. Group E received intravenous (IV) ephedrine 5mg and Group P received intravenous (IV) phenylephrine 100 mcg when there was a fall in maternal systolic blood pressure (SBP) >20% from the base line .

In the operation theatre, routine monitors (electrocardiogram, noninvasive blood pressure, pulse oximeter) attached. Co-loading with rapid administration of 20ml/kg of Ringer Lactate was started. Spinal anesthesia was given with 25 G Quincke needle in lateral position at the L_3-L_4 interspace. Once the free flow of cerebrospinal fluid (CSF) was obtained, 2ml (10mg) of 0.5% Bupivacaine (heavy) was administered at 0.2ml /sec. Patients were then placed in the supine position. Oxygenation were given via a Hudson mask at the rate of 3 L/min.

Sensory block were assessed by pinprick test. The onset of sensory blockade (defined as the time from the injection of intrathecal drugs to the absence of pain at the T8 dermatome were recorded every minute till the T8 level was achieved.

Onset of motor blockade were assessed at 5-min intervals till 15 min (i.e., B5, B10 and B15) according to the modified Bromage scale. Grades of sedation during surgery was assessed by the Ramsay's sedation.

Blood pressure (systolic, diastolic and mean), heart rate, respiratory rate and peripheral oxygen saturation (SpO_2) were recorded 5 min before the intrathecal injection (0) and at 5, 10, 15, 20, 25 and 30 min after the injection, and subsequently every 15 min. Bradycardia (defined as heart rate of less than 50) was treated with intravenous 0.6 mg atropine sulfate. Patients were also assessed for side-effects like nausea, vomiting, hypotension, bradycardia, itching, fetal distress.

Statistical analysis

All the data were expressed as mean +SD. Statistical analysis were performed with SPSS for windows (SPSS Inc., Chicago, IL, USA), version 17.0 for analysis of demographic comparison of groups, x2, unpaired student's t-test and paired-t-test were applied. $p<0.05$ were considered as statistically significant.

Observation

Table 1: Demographic data of Groups E and P

	Group E (n=15)	Group P (n=15)	P value
Age (years)	30.17±0.49	31.13±0.51	0.58
ASA I:II (n)	14:1	13:2	0.42
Weight (kg)	60.25±7.80	68.26±8.61	0.06
Height (cm)	153.29±4.77	152.39±5.23	0.51

n = Number of patients

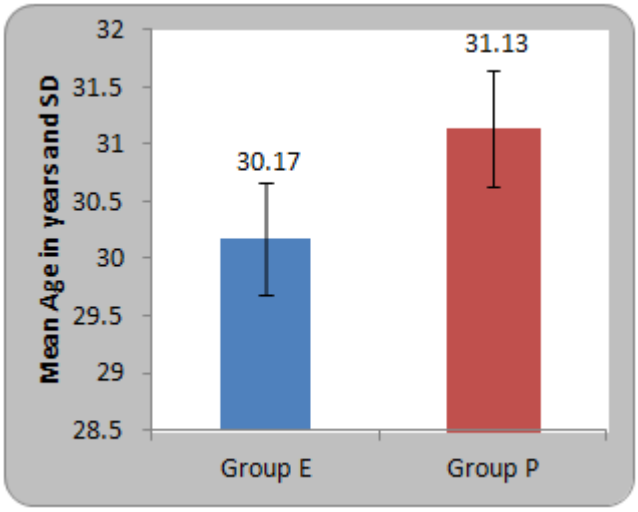

Figure 1

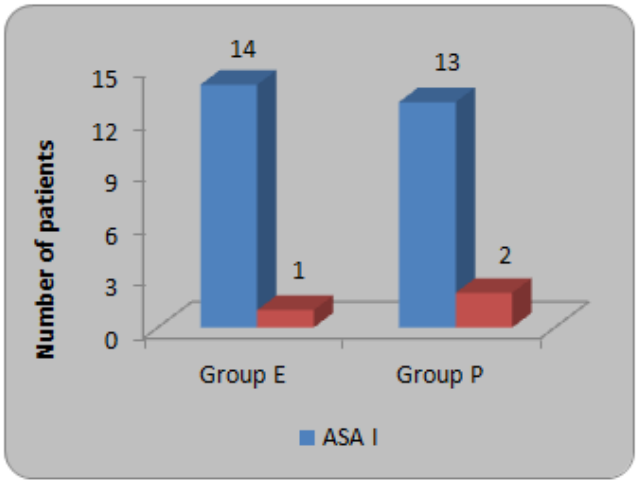

Figure 2

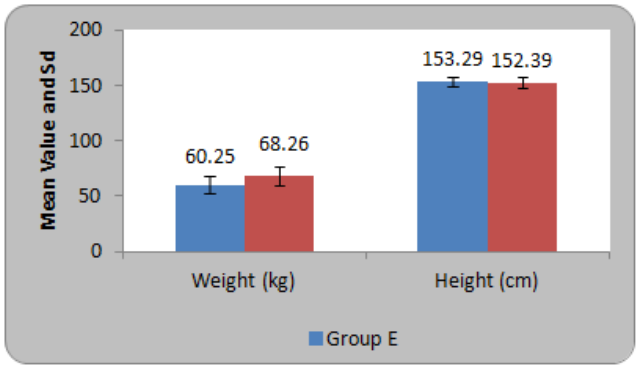

Figure 3

Table 2: Heart rate recordings during various stages of anaesthesia in both groups

Heart Rate	Group E	Group P
0 Minutes	79.20±16.01	77.57±14.40
5 Minutes	79.80±11.47	75.57±8.472
10 Minutes	81.97±9.750	76.60±11.83
15 Minutes	87.37±6.990	84.20±7.599
20 Minutes	86.37±7.299	81.83±10.95
25 Minutes	86.00±10.00	80.50±11.40
30 Minutes	86.60±8.261	82.73±8.081
45 Minutes	81.03±10.36	77.23±12.53
60 Minutes	85.07±7.565	85.97±11.43
75 Minutes	86.97±6.990	83.63±6.744
90 Minutes	86.37±7.850	84.10±20.50

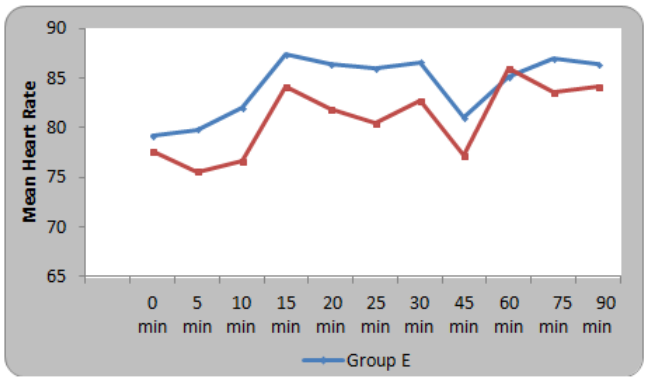

Figure 4

Table 3: SPO2 recordings during various stages of anaesthesia in both groups

SPO2	Group E	Group P
5 Minutes	97.90±1.322	98.23±1.135
10 Minutes	98.00±1.486	98.27±1.285
15 Minutes	97.07±1.639	97.77±1.278
20 Minutes	97.57±1.524	97.77±1.775
25 Minutes	97.63±1.691	98.03±1.629
30 Minutes	97.67±1.583	98.17±0.9129
45 Minutes	97.60±1.734	98.10±1.373
60 Minutes	98.23±1.524	98.17±1.053
75 Minutes	97.57±1.675	97.83±1.487
90 Minutes	97.47±1.655	98.10±1.494

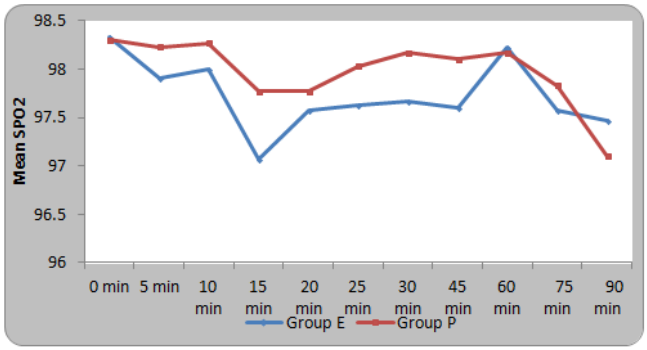

Figure 5

Table 4: Vital signs of the two groups at different time intervals

Parameters	Group E (n = 15) (%)	Group P (n = 15) (%)	P value
Hypotension(yes)	7 (46.66%)	7 (46.66%)	1.00
Hypotension(no)	8 (53.33%)	8 (53.33%)	1.00
Bradycardia	0	2 (13.33%)	0.01
Nausea / Vomiting	4 (26.66%)	6 (40%)	0.15
Tachycardia	0	0	

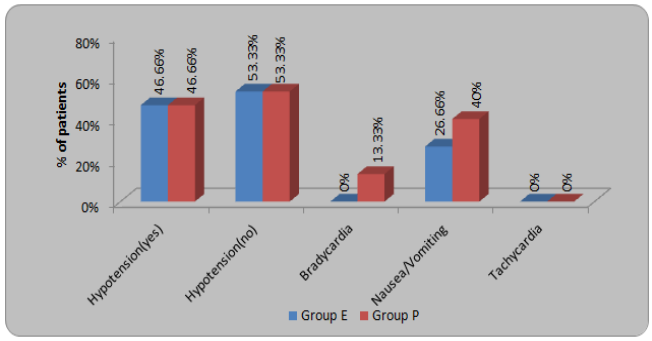

Figure 6

Table 5: Apgar score of the two groups at different time intervals

Parameters	Group E (n = 15)	Group P (n = 15) (%)	P Value
APGAR (0 min)	7.73±0.39	7.69±0.41	0.767
APGAR (1 min)	9.11±0.41	8.97±0.49	0.252
APGAR (5 min)	9.08±0.32	8.95±0.31	0.249
Baby weight(kg)	3.068±0.322	3.163±0.334	0.781

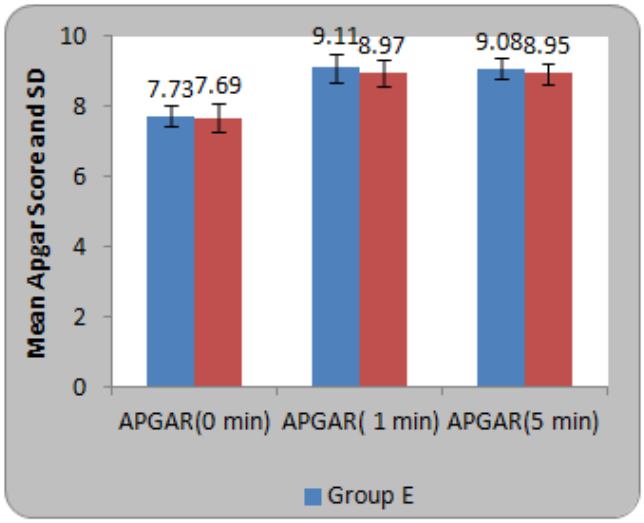

Figure 7

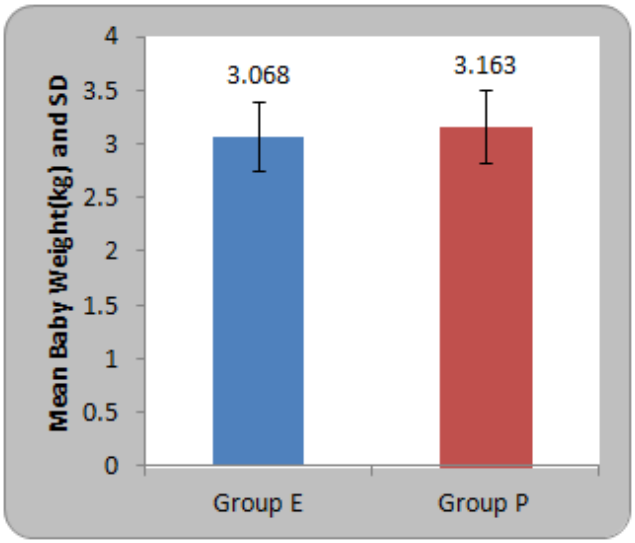

Figure 8

Results

The two groups, i.e., group E and group P matched with regard to their age, body weight and height [Table 1]. Overall, 7/15 (46.66%) patients in the phenylephrine

group and 7/15 (46.66%) patients in the ephedrine group had one or more episode of hypotension and required one or more bolus of vasopressor. The number of rescue doses required in group E and group P was statistically insignificant [Table 4]. There was a higher incidence of bradycardia in patients receiving phenylephrine than those receiving ephedrine [Table 4]. The comparison of mean of heart rate in different time interval in between groups. Compared with the baseline values, the change in mean heart rate among different time intervals were found to be non-significant at any given time interval ($p > 0.05$) as shown in table above and shows the similar trends in between groups. Intraoperatively there was no bradycardia recorded in both groups at any given time interval. However the difference in SPO2 was not found be statistically significant among different study groups at any given time intervals ($p>0.05$).

The difference in birth weight of neonates between the two groups was statistically insignificant.

Discussion

In the present study, there was no statistically significant difference in the incidence of hypotension with rapid administration of crystalloid at the time of induction of spinal anesthesia (coload) in both the groups ($P > 0.05$). Moreover, the overall incidence of hypotension in the study population was 48% that was significantly less compared to the incidence (more than 80%) observed in NganKeeWD et al studies.[2]

In this study, there was a higher incidence of bradycardia in patients receiving phenylephrine than those receiving ephedrine. This is expected to be due to increase in blood pressure with an α-agonist that might lead to reactive bradycardia (baroreceptor reflex). However, this was responsive to glycopyrollate without adverse consequences. The result of this study is in accordance with the studies of Nazir et al.[7] (5/50 vs 17/50 in the phenylephrine group) and Lee et al.[8] [relative risk (RR) of 4.79; 95% confidence interval (CI), 1.47-15.60] with $P < 0.05$. On the other hand, the incidence of nausea and vomiting was also more in the phenylephrine group than the ephedrine group 14/40 (35%) versus 9/40 (22.5%) in our study that was not statistically significant ($P = 0.16$).

In our study, the average vasopressor consumption was reduced in the ephedrine group compared to the phenylephrine group, assuming that the equivalent doses of ephedrine and phenylephrine were 5mg and 100 µg, respectively.[9] The incidence of fall in blood pressure was maximum during the first 10 min following the subarachnoid block and we observed that vasopressor use was maximum during this period. This corresponds to the immediate sympathetic block after intrathecal injection. We also observed that phenylephrine was used more frequently in 10 min compared to ephedrine. It is distinctly apparent by the wider SDs of mean SBP values in the phenylephrine group but no statistical significant difference was observed ($P > 0.05$). On the other hand, NganKee et al.[10] and Dyer et al.[11] opined that vasopressor requirements was reduced till the time of delivery in their studies. The average median dose was 0 mg versus 10 mg of ephedrine ($P < 0.001$) in the study by NganKee et al.[10]

Gunda et al.[12] compared the effectiveness and side effects of vasopressors ephedrine and phenylephrine administered for hypotension during cesarean delivery under spinal anesthesia. However, their study suggested that phenylephrine may be the more appropriate vasopressor when considering maternal well-being. This may have been due to less dose of ephedrine (3

mg) that was used in their study as compared with this study.

Conclusions

We concluded from our present study that ephedrine 5 mg and phenylephrine 100 µg are equally efficient in managing hypotension during spinal anesthesia for caesarean delivery. Maternal bradycardia was more in the phenylephrine group and there was no difference in the incidence of fetal outcome between the groups. Neonatal outcome remains equally good in both the groups.

Limitations

There are various factors which are difficult to account in the study but which can affect the outcome of present study like maternal body weight, height, maternal age, gestational weeksand block height , fetal weight and its gestational age , small for gestational age , IUGR for fetal complications like acidosis and can make the result of this study difficult to interpret.

Implications

If ephedrine and phenylephrine will be found effective in ameliorating hypotension in spinal anesthesia for caesarean delivery without any significant maternal and fetal outcome they can be used as drug of choice to prevent hypotention and its associated maternal and fetal complications.

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