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Original Research Article

Study of Dosage of Prophylactic Intravenous Ephedrine for Spinal Induced Hypotension during Caesarian Section

Dharmeshkumar H. Gohil[1], Krupali Patel[2], Richa V. Patel[3]

[1]Associate Professor, Department of Anaesthesia, GMERS Medical College, Navsari, Gujarat, India
[2]Assistant Professor, Department of Anaesthesia, GMERS Medical College, Navsari, Gujarat, India
[3]Associate Professor, Department of Anaesthesia, GMERS Medical College, Navsari, Gujarat, India

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Corresponding author: Dr. Richa V. Patel
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Abstract

Background: Occurrence of hypotension during spinal anaesthesia for caesarean section is a common phenomenon. It is due to a decrease or variation in the haemodynamic pressure, resulting from sympathetic block. Hence, ephedrine plays a vital role as a vasoconstrictor. Hence, ephedrine is the most preferred drug.

Method: Out of 90 (ninety), 45 were administered ephedrine, and 45 in the controlled group were administered the same quantity of normal saline during spinal anaesthesia. Haemodynamic and neonatal outcomes were noted and compared.

Results: In comparison of systolic BP at the intervals of 1, 2, 3, and 15 minutes, there were significant p-values. In Apgar studies at the internal of 1 and 5 minutes, there was a significant O value. Moreover, the pH of umbilical cord blood also had a significant p-value.

Conclusion: It is proved that IV infusion of ephedrine is more effective in preventing hypotension in parturients undergoing caesarean section without causing haemodynamic complications.

Keywords: Spinal Anesthesia, Hemodynanicity, Apgar score, Crystalloid, Ephedrine.

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Introduction

Spinal anaesthesia is commonly used for lower abdominal and inferior extremity surgeries. It is induced by injecting small amounts of local anaesthetics into the cerebrospinal fluid (CSF). At either L2-L3, L3-L4 or L4-L5 inter spinal levels. It is simple and economical. It takes less time to produce a more rapid set of sensory and motor blocks. It has been shown to block the stress response to surgery, decrease intraoperative blood loss, postoperative thromboembolism and decreased morbidity and mortality [1]. Maternal hypotension is a major complication of spinal anaesthesia, and the incidence is up to 80% observed in day-to-day spinal anaesthetic surgeries. It creates risk for both the mother and the baby. It is associated with dizziness, nausea, and vomiting and may interfere with surgical procedures. If uncorrected, the decreased uterine blood flow may result in an acidotic neonate requiring active resuscitation [2]. Lateral uterine displacement and preloading with crystalloids or colloids have been commonly used to prevent spinal-induced hypotension [3], but these alone may provide only partial protection. A combination of preloading and vasopressin drugs has maximum efficacy in preventing spinal-induced hypotension. Ephedrine is proven to be more effective for increasing arterial blood pressure with better preservation of utero-placental blood flow [4]. Hence, an attempt is made to evaluate and compare the efficacy of ephedrine in caesarean section surgery.

Material and Method

90 (ninety) patients admitted to the obstetrics and gynecology department of GMERS Medical College Hospital, Navsari-396445, Gujarat, India, were studied.

Inclusion Criteria: Age between 20 and 45 years old, with a Body Mass Index (BMI) between 20 and 45. ASA grades I and II who gave their consent in writing were selected for this study.

Exclusion Criteria: Patients who refused spinal anesthesia; patients having allergic reactions to local anesthetics and opioids; patients with coagulopathy disorders (due to bleeding disorders, liver disease, or on anticoagulants); patients with severe cardiac, respiratory, hepatic, or renal

disease; and patients with pre-eclampsia and eclampsia were excluded from the study.

Method: Out of 90 (ninety) patients, 45 patients in Group-1 received 1 ml of (5 mg) ephedrine intravenously. 45 patients in Group-2 (the controlled group) received an equal volume of normal saline intravenously, immediately after the subarachnoid block, with 10 mg of 0.5% bupivacaine.

A thorough pre-anesthesia evaluation was done a day before the scheduled operation for all patients, and oral administration of PPI (Ranitidine 150 mg) was advised the night before surgery. On the day of the operation, injections of ondansetron (10 mg) and ranitidine (50 mg) were given intravenously 20 minutes before the administration of spinal anesthesia. Upon arrival of the patients at the operation theater, baseline parameters were recorded with the help of a multichannel cardiac monitor. Preloading was done with ringer lactate solution (15 ml/kg body weight) about 15 minutes before the intended time of intrathecal drug administration.

Under strict aseptic precautions, lumbar puncture was performed at the L3–L4 intervertebral space using a midline approach with a 25-gauge Quincke spinal needle in the lateral decubitus position, and 10 mg of 0.5% bupivacaine (heavy) was administered intrathecally. Immediately, either 1 ml of 5 mg injection of ephedrine or an equal volume of normal saline was given intravenously to the parturient according to the computer-generated randomization method. The hemodynamic parameters, such as heart rate, systolic BP, percentage saturation of oxygen (SpO2), and electrocardiogram, were recorded at 1-minute intervals until delivery of the baby, and thereafter, at 5-minute intervals until the end of surgery, IV fluid was administered in the form of Ringer Lactate at a rate of 100 ml per hour. A decrease in systolic BP of more than 20% from baseline was considered "hypotension" and treated with rapid infusion of Ringer lactate and 5 mg intravenous Ephedrine. A heart rate of 60 beats per minute, or bradycardia, was also treated with intravenous 0.6 mg atropine sulfate. Apgar scores for babies were recorded at 1 and 5 minutes.

The duration of the study was June 2022 to June 2024.

Statistical Analysis: Various parameters, e.g., demographic hemodynamics and Apgar scores, in both groups were compared with the z test and noted. The statistical analysis was carried out in SPSS software.

Observation and Results

Table 1: Comparison of demographic parameters in both groups, viz. age (years), height (cm), and weight (kg), more or less the same; hence, the p-value is insignificant ($p>0.8$).

Table 2: Comparison of systolic blood pressure in both groups - at 1 minute, 2nd minute, 3rd minute, and 15th minute, there is a significant p-value ($p<0.001$).

Table 3: Comparison of hemodynamic data and clinical manifestations.

- Hypotension: 26 (57.7%) in group A, 34 (75.5%) in group B.
- Rescuer Ephedrine: 3.03 (± 0.2) in group A, 4.08 (± 0.3) in group B, t-test 19.5 and $p<0.001$

Table 4: Comparison of neonatal outcome in both groups.

- Apgar score at 1 minute: 8.98 (± 0.15) in group A, 8.82 (± 0.26) in group B, t-test 3.37 and $p<0.001$.
- Apgar score at 5 minutes: 9.95 (± 0.15) in group A, 9.84 (± 0.26) in group B, t-test 2.45 and $p<0.001$.
- Umbilical cord blood pH – 7.35 (± 0.02) in group A, 7.32 (± 0.03) in group B, t-test 5.58, $p < 0.001$.

Table 1: Comparison of demographic variables parameters in both groups (Total No of patient - 90)

Sl. No	Parameters	Group-A Study group (45)	Group-B Controlled (45)	t-test	p-value
1	Age (year)	26.10 (± 3.28)	25.84 (± 2.76)	0.43	P>0.662
2	Height (cms)	158.16 (± 3.32)	158.54 (± 4.25)	0.47	P>0.637
3	Weight (Kg)	62.02 (± 5.15)	64.54 (± 6.82)	1.97	P>0.051

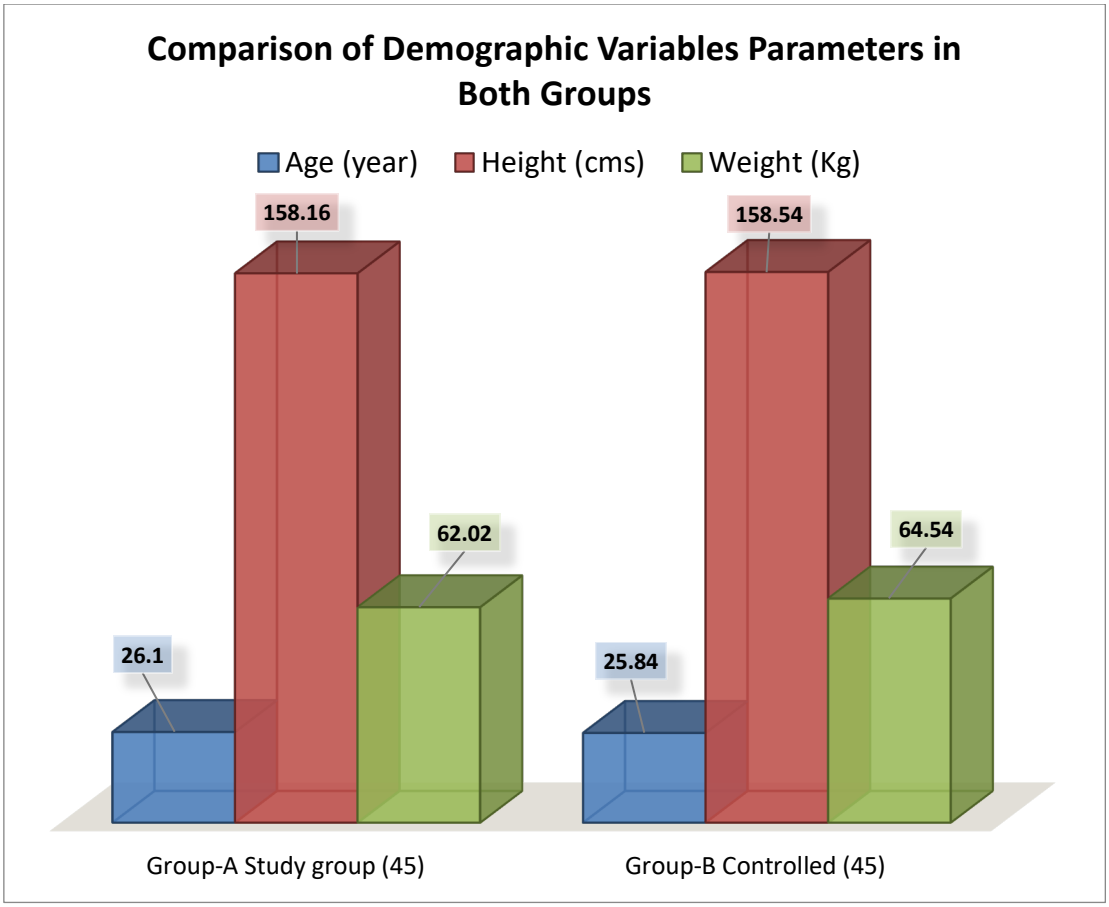

Figure 1: Comparison of Demographic Variables Parameters in Both Group

Table 2: Comparative study of Systolic Blood Pressure (SBP) mm / Hg (median range) recorded at induction, incision, end of resection and extubation (Total No of patient - 90)

Time Interval	Group-A (45)	Group-B (45)	t-test	p-value
0	122 (± 5.96)	123.22 (± 4.26)	1.11	P>0.267
1	120.78 (± 15.55)	100.08 (± 22.25)	5.11	P<0.001
2	119.15 (± 15.4)	88.78 (± 12.55)	10.3	P<0.001
3	119.25 (± 10.49)	87.6 (± 8.82)	15.4	P<0.001
5	112.34 (± 7.44)	114.22 (± 7.84)	1.16	P>0.24 N.S
10	110.42 (± 6.03)	109.42 (± 3.72)	0.94	P>0.34 N.S
15	112.12 (± 6.66)	108.75 (± 3.25)	3.05	P<0.001
20	111.14 (± 5.42)	109.36 (± 3.92)	1.78	P>0.077 N.S
25	110.04 (± 5.12)	110.35 (± 5.25)	0.28	P>0.77 N.S
30	111.12 (± 6.5)	110.15 (± 3.06)	0.90	P>0.367 N.S
35	110.36 (± 6.14)	110.36 (± 3.16)	00	P>0.100 N.S
40	111.24 (± 6.75)	111.25 (± 3.85)	0.0086	P>0.993 N.S
45	113.15 (± 6.00)	111.36 (± 3.63)	1.94	P>0.055 N.S

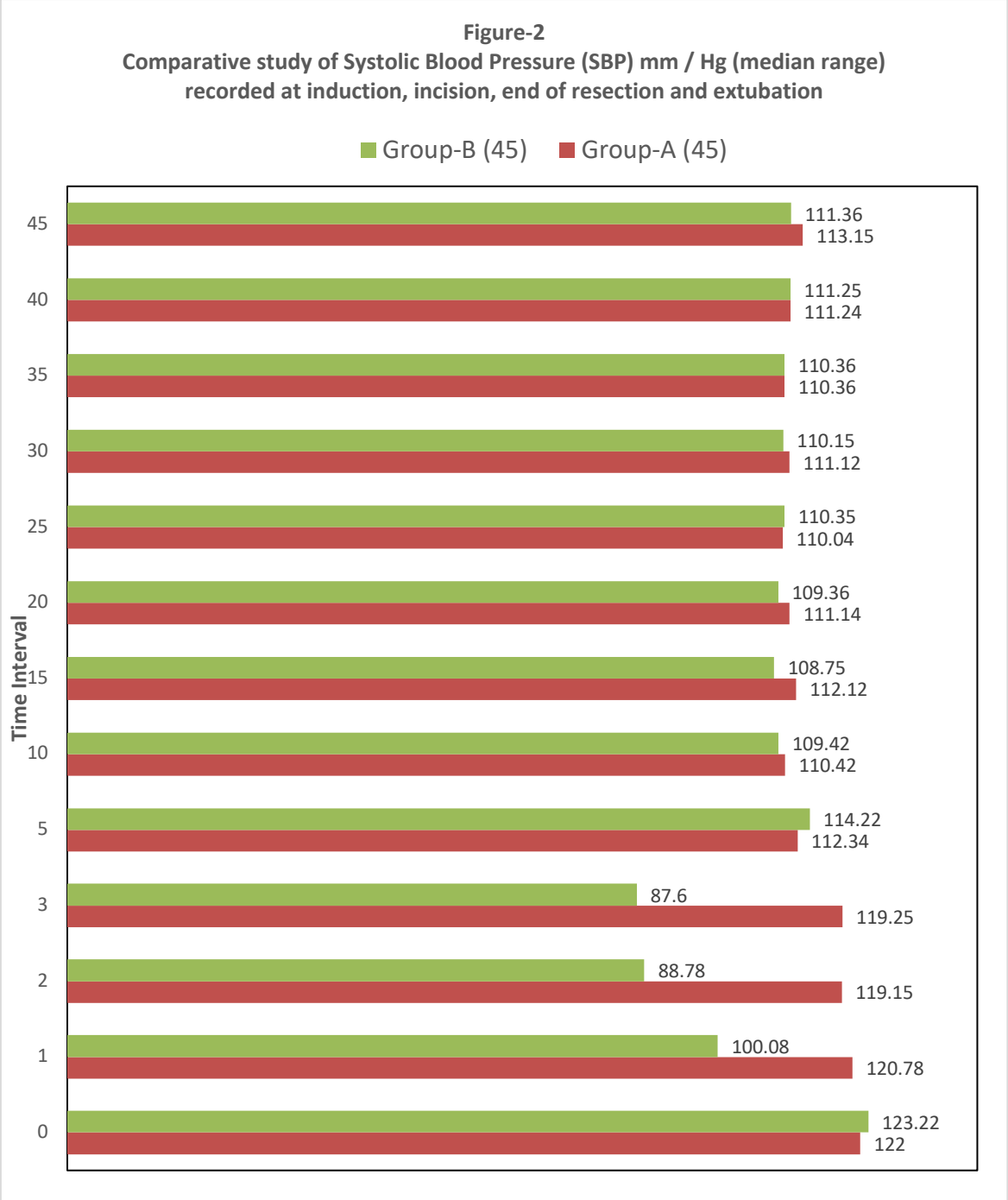

Figure 2: **Comparative study of Systolic Blood Pressure (SBP) mm / Hg (median range) recorded at induction, incision, end of resection and extubation**

Table 3: Comparison of Hemodynamic data and clinical manifestations (Total No of patient - 90)

Parameter	Group-A (45)	Group-B (45)	t-test	p-value
Hypotension	26 (57.7%)	34 (75.5%)	--	--
Reactive Hypertension	--	--	--	--
Rescue Ephedrine	27 (60%)	34 (75.5%)	--	--
Rescue Ephedrine dose (mg)	3.03 (± 0.2)	4.08 (± 0.3)	19.5	P<0.001
Bradycardia	--	--	--	--
Nausea and vomiting	--	--	--	--
Average time for baby delivery	4.92 (± 0.6)	4.66 (± 0.8)	1.74	p>0.084 N.S

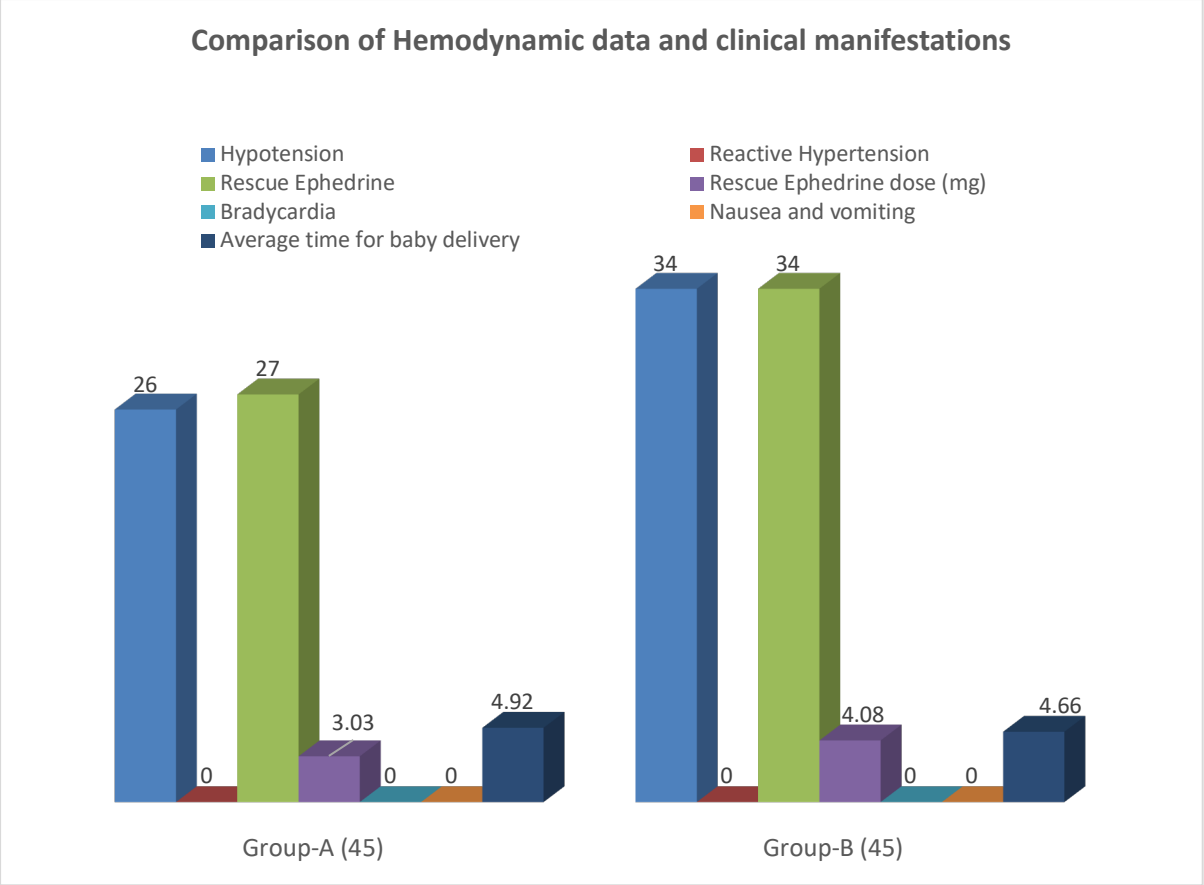

Figure 3: Comparison of Hemodynamic data and clinical manifestations

Table 4: Comparison of Neonatal outcome in both groups (Total No of patient - 90)

Parameter	Group-A (45)	Group-B (45)	t-test	p-value
Apgar Score at 1 min	8.98 (± 0.15)	8.82 (± 0.26)	3.57	P<0.001
Apgar Score at 5 min	9.95 (± 0.15)	9.84 (± 0.26)	2.45	P<0.001
Umbilical cord blood pH	7.35 (± 0.02)	7.32 (± 0.03)	5.58	P<0.001

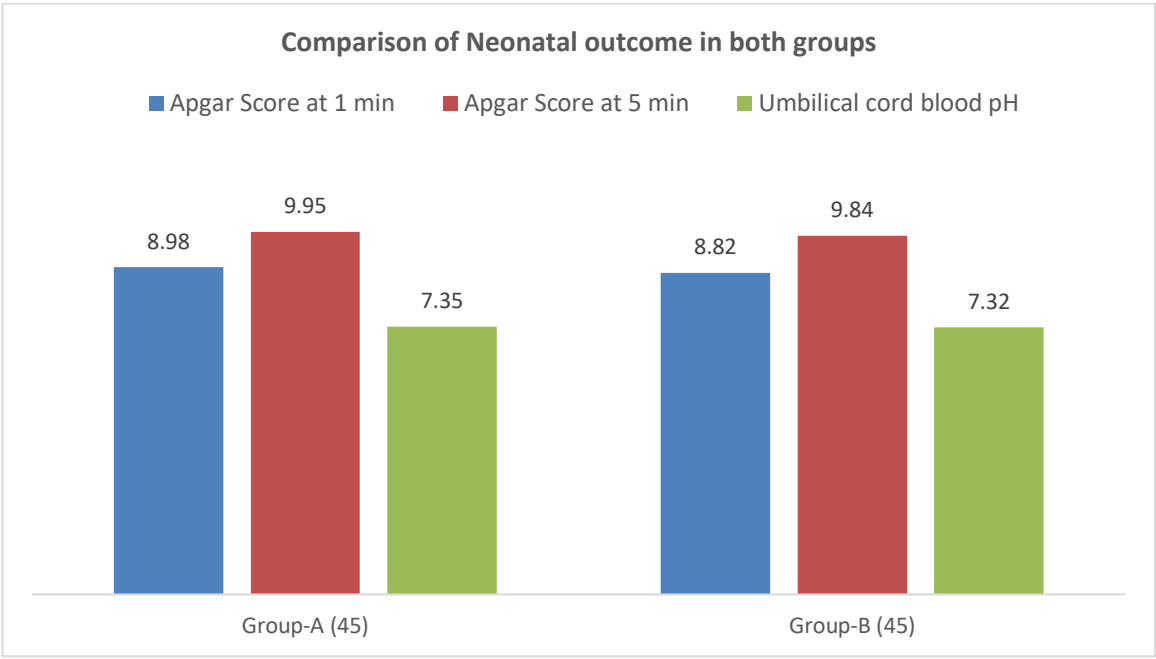

Figure 4: Comparison of Neonatal outcome in both groups

Discussion

The present study is upon the usage of prophylactic intravenous ephedrine for spinal-induced hypotension during cesarean section in the Gujarat population. In comparison of demographic variables, parameters of both groups had intervals of 1, 2, 3, and 5 minutes and significant p-values ($p<0.001$) (Table 2).

In comparison of hemodynamic data, the rescue ephedrine dose (mg) is 3.03 (± 0.2) in group A and 4.08 (± 0.3) in the controlled group, with a t-test of 19.5 and a p-value of <0.001, which is highly significant (Table 3). In the comparison of neonatal outcome at 1 minute, 5 minutes had a significant p-value ($p<0.001$). The pH of umbilical cord blood was compared in both groups, and the p-value was highly significant (Table 4). These findings are more or less in agreement with previous studies [5,6,7].

The incidence of hypotension is higher in cesarean sections due to the cardiac changes of the parturient. Compression of the inferior vena cava by the hypertrophic uterus and the development of collateral venous plexus circulation in the epidural space lead to a decrease in the amount of CSF (cerebrospinal fluid) in the lumbosacral area and a higher cephalad spread of local anesthesia [8].

Ephedrine is the vasopressor of choice for prevention of hypotension after spinal anesthesia during cesarean section because of its ability to maintain utero-placental blood flow [9]. Ephedrine's action is mainly indirect, through stimulating norepinephrine release from sympathetic nerve endings, and the utero-placental circulation is largely devoid of direct sympathetic innervations, so it is considered resistant to the vaso-constrictive effects of ephedrine [10].

It is also reported that ephedrine was injected intramuscularly and observed to cause hypertension whenever spinal anesthesia was not successful [11].

Prophylactic IV ephedrine administered either by infusion or multiple boluses has been considered the gold standard method for preventing hypotension. Moreover, the effect of an IV bolus of ephedrine on arterial pressure is transient and lasts for only 10–15 minutes [12]. Hypotension after the delivery of the fetus is usually ignored, as it may be related to excessive blood loss during a C-section.

Summary and Conclusion

A short period of hypotension (less than 2 minutes) is frequently associated with spinal anesthesia for cesarean sections. Prophylactic IV ephedrine infusion is more effective in preventing hypotension due to spinal anesthesia without causing significant tachycardia or hypertension. The present study demands a pharmacological and patho-physiological study because the exact cause and factors that cause hypotension for a shorter duration are still unclear.

Limitation of study: Owing to the remote location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research paper is approved by the Ethical Committee of Zydus Medical College and Hospital, Dahod-389151 Gujarat, India.

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