ORIGINAL RESEARCH PAPER

Anaesthesiology

PROPHYLACTIC INTRAVENOUS EPHEDRINE IN PREVENTION OF HYPOTENSION IN EMERGENCY CAESAREAN SECTION

KEY WORDS: I.V. ephedrine, Spinal anesthesia, Spinal Hypotension.

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ABSTRACT

Background: Routine surgeries done under spinal do not have the problem of hypotention as there is adequate preloading . Hypotension is the most dangerous event following spinal anaesthesia in emergencies . Various measures are being adopted to treat this condition. We studied the efficacy of intravenous administered ephedrine for the prophylaxis of hypotension following spinal anaesthesia.

Aim: The study aims to determine the efficacy of prophylactic I.V. administered ephedrine in minimizing the incidence of hypotension following spinal anaesthesia in patients undergoing emergency lower segment caesarian section.

Materials and Methods: Around 100 patients belonging to ASA grade 1and 2 undergoing emergency lower segment caesarian section were randomly allocated equally into two groups (E,C). Group E received 12 mg of I.V.Ephedrine and Group C received a Placebo 10 minutes before spinal anesthesia.

Results: There was a significantly higher incidence of hypotension in Group C (60% patients) compared to Group E-12 (27%). The 95% Confidence Interval for the difference in proportions between Groups C and E-12 was 6-60%, $P < 0.05$. Fewer rescue boluses of ephedrine were required in Group E-12 compared with Group C (1.8 ± 1.2 vs. 3.3 ± 2.1, $P < 0.05$). There were no significant differences in the incidence of maternal nausea or vomiting, or of neonatal acidaemia between groups.

Conclusion: We found that the incidence of hypotension and the need for the use of intravenous ephedrine for treatment of hypotension was lower in the patients who received I.V. ephedrine prophylaxis. There were no significant side effects noticed due to the administration of ephedrine prophylaxis.

INTRODUCTION

Spinal anesthesia is one of the most common techniques of anaesthesia used in practice for more than 100 years. The technique is simple to perform and is relatively safe. The resulting anaesthetic state is excellent and a wide variety of lower abdominal and lower limb surgeries can be performed under spinal anaesthesia. All these factors make the technique quite popular. However, the procedure is not devoid of complications. Hypotension, at times of severe nature, complicates the procedure. Various measures like preloading with intravenous fluids and systemic use of vasopressors are adopted to manage the condition.

On many occasions patients land up in emergencies and have to be taken in OT without adequate preloading. Paul Morgan emphasized the role of vasopressors in the management of hypotension induced by spinal and epidural anaesthesia Although spinal and epidural blocks provide excellent anaesthesia for many operations, they are frequently accompanied by hypotension. This is largely the result of sympathetic nerve blockade. Excessive hypotension may potentially produce myocardial and cerebral ischaemia, and is associated with neonatal acidaemia in obstetric practice. One of the mainstays of management is the use of vasopressor agents and those currently available are not perfect.. Ephedrine was the first agent used for this purpose and it has withstood the test of time: it is the agent against which all others are compared. It remains the first-line agent in obstetric anaesthesia as it does not affect the fetus adversely. [1]

R Jackson J A Reid concluded that volume preloading is not essential to prevent spinal-induced hypotension at caesarean section. They compared the protective effect of 1000 ml preload with 200 ml preload of crystalloid solution, administered during the 10 min before spinal anaesthesia was induced, in 60 healthy women with no fetal compromise undergoing elective Caesarean section. The spinal anaesthetic was managed identically in both groups by an anaesthetist who was unaware of the volume of fluid administered. A prophylactic infusion of ephedrine 60 mg in Hartmann's solution 500 ml was given according to maternal arterial pressure There was no significant difference in ephedrine requirements between the two groups or in the incidence, severity or duration of hypotension.They have now abandoned the routine of preloading before regional anaesthesia.[2,3,4]

Several authors in their studies have now exploited the vasoconstrictor role of ephedrine either Orally or in IV or as Infusion and have found out that ephedrine remains the first-line agent in obstetric anaesthesia as it does not affect the fetus.It causes palpitation and tachycardia to an acceptable limit.Therefore the present study was undertaken to assess the efficacy of the use of prophylactic I.V. administered ephedrine for the prevention of hypotension following spinal anaesthesia.

MATERIALS AND METHODS

The study was conducted at Department of Anaesthesiology Grants Gov Medical College and Sir J J Groups of hospital Mumbai . The details of the study were presented before the hospital ethical committee and the approval was obtained. The study included 100 patients belonging to age group 25 to 35 years, female patients, assessed under ASA grade I and undergoing emergency lower segment caesarean surgeries.

Patients who were obese (BMI > 30) and those with any known present or past medical illnesses were excluded from the study. Informed consent was taken from the patients. All the patients were premedicated with inj. Ranitidine 50 mg before surgery. The patients were then randomly allocated into two groups, Group E (Ephedrine Group) and Group C(Control Group).

Baseline blood pressure (average of 3 readings), pulse rate and oxygen saturation were recorded. Patients in group E received 12 mg of Ephedrine I.V. and Patients in group C received a placebo

Ten minutes later the patients were shifted to the operation theatre. Standard monitoring was done. Preloading was done with 10 ml/Kg of Ringer Lactate over 10 minutes. Anaesthetic procedure was standardized in both the groups. Spinal anaesthesia was administerted with a 25 G Qunicke's needle at the L3 – L4 interspace using 2.2 ml of 0.5% hyperbaric bupivacaine. Level of sensory block was assessed using pinprick sensation. The level of block was optimized to be around T6 – T8 dermatomal level by suitable adjustment of the operating table till the fixation of the drug. Crystalloid at the rate of 10ml / kg/hr was used for maintenance during the intra operative period.

All the patients were monitored throughout the procedure. Systolic Blood Pressure, Diastolic blood pressure and mean arterial

blood pressure were monitored by noninvasive automated oscillatory method and Heart rate was measured by ECG, before spinal and immediately after spinal anaesthesia. During intraoperative period the parameters were monitored at interval of 3minutes upto first 15 minutes, then every 5 minutes till 30th minute, every 10 minutes till 60th minute and every 15minutes till 120 minutes. Other parameters such as SPO2, urine output, were also monitored.

Hypotension was defined as decrease in systolic BP of more than 20% of Baseline value. Hypotension was treated with IV fluids and inj. Ephedrine IV boluses of 6mg increments. Bradycardia was defined as heart rate less than 60/min and treated with inj. Atropine 0.3 mg increments. The patients were observed in the recovery room. Blood pressure and other vital parameters were monitored every 30 minutes thereafter till the complete regression of the sensory & motor blockade. Occurrence of side effects like dry mouth, headache, palpitations, urinary retention, anxiety, restlessness, tremor, nausea and vomiting were recorded.

Statistical Analysis

The results of the study were tabulated and analysed using the Chi square test and Student "t" test. Both the groups were comparable with respect to age, height and weight of the patients. There was no significant difference in the baseline blood pressure values in both the groups.

The number of patients who had a significant fall in systolic blood pressure following spinal anaesthesia was 19(38%) in the group C and 1(2%) in the group E. This was statistically significant (p value 0.00001).

OBSERVATIONS AND RESULTS

TABLE 1 : COMPARISON OF AGE, HEIGHT AND WEIGHT OF THE TWO GROUP OF PATIENT.

Parameter	Group A	Group B	t Value	P value	
	Mean	S.D.	Mean	S.D.	
Age(Years)	33.54	8.14	36.68	8.87	1.844	0.062
Height (Cm)	159.00	5.44	158.96	5.64	0.0361	0.9713
Wight (Kg)	57.32	7.32	56.52	5.57	0.6150	0.5400

The demographic data showed that two groups were similar with respect to age, height and weight

Table : 2 Comparison of SBP (mm Hg) in the two groups

Peroid	Group A		Group B		t Value	P value	Significant
	Mean	S.D.	Mean	S.D.			
Baseline	121.98	7.36	123.85	11.45	0.9715	0.3337	No
At SAB	127.14	7.36	123.96	10.47	1.757	0.137	No
2 minutes	128.74	8.18	116.2	10.95	6.487	0.0001	Yes
4 minutes	126.84	7.90	107.72	9.73	10.787	0.0001	Yes
6 minutes	121.94	10.10	102.52	9.56	9.874	0.0001	Yes
8 minutes	120.34	11.84	100.1	11.09	8.822	0.0001	Yes
10 minutes	118.7	11.44	100.78	8.91	8.739	0.0001	Yes
20 minutes	118.6	9.10	101.18	7.87	10.238	0.0001	Yes
30 minutes	119.92	8.14	104.18	7.44	9.695	0.0001	Yes
40 minutes	118.84	6.60	107.46	7.28	8.189	0.0001	Yes
50 minutes	117.74	6.90	109.72	6.76	5.871	0.0001	Yes
60 minutes	115.6	7.53	118.33	10.41	1.503	0.1379	No

Table: 3 Comparison of DBP (mmHg) in the two groups

Peroid	Group A		Group B		t Value	P value	Significant
	Mean	**S.D.**	**Mean**	**S.D.**			
Baseline	79.32	4.97	79.0	6.73	0.271	1.4555	No
At SAB	81.7	5.95	78.82	6.60	1.496	0.1379	No
2 minutes	81.72	7.59	75.66	6.25	4.358	0.0001	Yes
4 minutes	80.44	7.69	71.76	5.54	6.476	0.0001	Yes
6 minutes	77.78	7.58	68.46	6.4	6.643	0.0001	Yes
8 minutes	76.5	7.40	67.38	7.92	5.590	0.0001	Yes
10 minutes	75.54	7.49	66.4	6.53	6.504	0.0001	Yes
20 minutes	75.44	6.01	67.6	6.01	6.522	0.0001	Yes
30 minutes	75.78	5.20	67.62	4.25	8.592	0.0001	Yes
40 minutes	75.76	6.10	70.1	5.19	4.997	0.0001	Yes
50 minutes	75.48	5.76	70.96	4.88	4.234	0.0001	Yes
60 minutes	73.2	3.27	76.66	6.66	3.298	0.0014	Yes

Table 4: Comparison of HR (beat/minute) in the two groups

Peroid	Group A		Group B		t Value	P value	Significant
	Mean	S.D.	Mean	S.D.			No
Baseline	78.34	7.97	81.14	8.05	1.748	0.0836	No
At SAB	81.98	8.29	83.2	6.77	0.806	0.4222	Nos
2 minutes	83.08	8.33	85.26	7.35	1.388	0.1684	Yes
4 minutes	83.2	8.76	88.32	8.3	3.000	0.0034	Yes
6 minutes	83.3	8.27	89.58	8.66	3.708	0.0003	Yes
8 minutes	82.56	8.11	92.26	9.07	5.637	0.0001	Yes
10 minutes	82.62	8.04	92.1	8.41	5.761	0.0001	Yes
20 minutes	81.84	6.48	93.26	7.63	8.067	0.0001	Yes
30 minutes	81.6	6.56	92.08	7.87	7.233	0.0001	Yes
40 minutes	80.56	5.95	90.44	6.96	7.826	0.0001	Yes
50 minutes	81.26	5.53	89.6	6.59	6.855	0.0001	Yes
60 minutes	79.2	4.55	96.0	12.49	8.937	0.0001	Yes

DISCUSSION

Hypotension is one of the most important and significant complications following spinal anesthesia. Sudden and severe hypotension may compromise vital organ perfusion which may result in irreversible insult to the organ functions. Various mechanisms have been postulated as the cause for the hypotension. Pooling of blood in the lower extremities due to the sympathetic blockade following spinal anesthesia and the blockade of sympathetic accelerator fibres to the heart are the major contributors to this phenomenon. [1]

Systemic administration of vasopressors has been shown to be effective both as a prophylactic measure and as treatment for hypotension. Ephedrine is one of the most studied and the most common drug used in clinical practice. Various studies have proved the role of prophylactic use of ephedrine administered in different doses via the intravenous and intramuscular route.

Many methods are being employed for the prevention and treatment of this condition. Preloading the patients with crystalloids or colloids before administration of spinal anesthesia is being adopted in usual practice for the prevention of hypotension. However the efficacy and usefulness of this method have been questioned.[2,3,4]

In the present study, we used ephedrine in a dose of 12 mg by I.V. route as a prophylaxis administered 10 minutes before spinal anesthesia. We have observed a statistically significant difference in the incidence of hypotension following spinal anesthesia in the ephedrine group compared to the control group where a placebo was used. Subsequently ephedrine had to be administered intravenously with increased incidence following hypotension in the control group. Prophylactic use of ephedrine administered intravenously thus decreases the incidence of hypotension significantly following spinal anesthesia.

Kang, Yoo G. Abouleish, EzzatCaritis studied role of prophylactic intravenous ephedrine infusion during spinal anesthesia for cesarean section.In their study ephedrine sulfate was administered to 44 healthy parturients undergoing elective cesarean section under spinal anesthesia. Twenty patients received ephedrine infusionimmediately after induction of spinal anesthesia to maintain maternal systolic blood pressure between 90% and 100% of the base line systolic blood pressure (mean dose of ephedrine 31.6 mg). Twenty-four patients (control group) received 20 mg of ephedrine as an intravenous bolus). The results suggest that prophylactic ephedrine infusion is safe and desirable in healthy parturients undergoing cesarean section under spinal anesthesia.[5]

J. P. R. Loughrey F. Walsh did a similar study like us in which they usedprophylactic intravenous bolus ephedrine for elective Caesarean section under spinal anaesthesia A total of 68 patients were randomized to receive a simultaneous 2 mL bolus intravenously of either 0.9% saline (Group C, n = 20), ephedrine 6 mg (Group E-6, n = 24), or ephedrine 12 mg (Group E-12, n = 22). There was a significantly higher incidence of hypotension in Group C (60% patients) compared to Group E-12 (27%). The 95% Confidence Interval for the difference in proportions between Groups C and E-12 was 6-60%, P < 0.05. Fewer rescue boluses of ephedrine were required in Group E-12 compared with Group C (1.8 ± 1.2 vs. 3.3 ± 2.1, P < 0.05). There were no significant differences in the incidence of maternal nausea or vomiting, or of neonatal acidaemia between groups.They concluded that a prophylactic bolus of ephedrine 12 mg intravenously given at the time of intrathecal block, plus rescue boluses, leads to a lower incidence of hypotension following spinal anaesthesia for elective Caesarean section compared to intravenous rescue boluses alone.[6]

Vercauteren, Marcel Coppejans, Hilde C Hoffmannstudied prevention of hypotension by a single 5-mg dose of ephedrine during small-dose spinal anesthesia in prehydrated cesarean delivery patients.To evaluate the effectiveness of prophylactic ephedrine for the prevention of hypotension associated with spinal anesthesia, 50 parturients undergoing cesarean delivery received either ephedrine 5 mg or saline IV in a double-blinded fashion immediately after the induction of spinal anesthesia.Ephedrine boluses (5 mg) were administered IV when the systolic blood pressure or heart rate decreased by more than 30% from baseline values.. Findings suggest that the incidence and severity of hypotension are significantly reduced by the IV administration of a prophylactic dose of 5 mg ephedrine in patients receiving small-dose spinal anesthesia for cesarean delivery.[7]

Lee, Anna, NganKee, Warwick et al did a quantitative, systematic review of randomized controlled trials of ephedrine versus phenylephrine for the management of hypotension during spinal anesthesia for cesarean delivery.This review compared the efficacy and safety of ephedrine with phenylephrine for the prevention and treatment of hypotension during spinal anesthesia for cesarean delivery. Seven randomized controlled trials (n = 292) were identified after a systematic search of electronic databases (MEDLINE, EMBASE, The Cochrane Controlled Trials Registry), published articles, and contact with authors. Outcomes assessed were maternal hypotension, hypertension and bradycardia, and neonatal umbilical cord blood pH values and Apgar scores. For the management (prevention and treatment) of maternal hypotension, there was no difference between phenylephrine and ephedrine (relative risk [RR] of 1.00; 95% confidence interval [CI], 0.96–1.06). Maternal bradycardia was more likely to occur with phenylephrine than with ephedrine (RR of 4.79; 95% CI, 1.47–15.60).

Women given phenylephrine had neonates with higher umbilical arterial pH values than those given ephedrine (weighted mean difference of 0.03; 95% CI, 0.02–0.04). There was no difference between the two vasopressors in the incidence of true fetal acidosis (umbilical arterial pH value of <7.2; RR of 0.78; 95% CI, 0.16–3.92) or Apgar score of <7 at 1 and 5 min. This systematic review does not support the traditional idea that ephedrine is the preferred choice for the management of maternal hypotension during spinal anesthesia for elective cesarean delivery in healthy, nonlaboring women.[8,9]

R. Vasanthageethan, S. Ramesh Kumar etal studied the efficacy of orally administered ephedrine for the prophylaxis of hypotension following spinal anaesthesia. Around 100 patients belonging to ASA grade I undergoing lower abdominal and scrotal surgeries were randomly allocated equally into two groups (E,C). Group E received 30 mg of oral ephedrine and Group C received a placebo 30 minutes before spinal anesthesia. They found that the incidence of hypotension and the need for the use of intravenous ephedrine for treatment of hypotension was lower in the patients who received oral ephedrine prophylaxis. There were no significant side effects noticed due to the administration of oral ephedrine prophylaxis.[10]

The I.V. route for ephedrine administrations is easy and simple to practice. No significant complications were observed due to ephedrine use in our study. Previously few studies have showed similar results with the use of ephedrine prophylaxis for prevention of hypotension following spinal anaesthesia.

CONCLUSION

A prophylactic bolus of ephedrine 12 mg intravenously given at the time of intrathecal block, plus rescue boluses, leads to a lower incidence of hypotension following spinal anaesthesia for emergency Caesarean sections compared to a placebo.

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