ORIGINAL ARTICLE

COMPARISON OF VASOPRESSOR EFFECTS OF BOLUS INFUSIONS OF PHENYLEPHRINE AND EPHEDRINE FOR MAINTENANCE OF MATERNAL ARTERIAL PRESSURE DURING SPINAL ANAESTHESIA IN CAESAREAN SECTION

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ABSTRACT: A comparative study was performed on 60 patients to observe the effect of bolus phenylephrine versus ephedrine during hypotension after subarachnoid block for maintenance of arterial pressure during spinal anaesthesia in caesarean section. The patients were divided into two groups of 30 each and were randomly allocated to receive an IV bolus of any of the two drugs. Phenylephrine was administered as 500 µg in 1ml bolus IV and Ephedrine was administered as 6mg Inj. Ephedrine Hydrochloride in 1ml bolus IV. It was observed that systolic arterial pressure was elevated significantly for first six minutes of bolus dose in Phenylephrine group as compared to Ephedrine group.
KEYWORDS: Phenylephrine, Ephedrine, Spinal Anaesthesia, Caesarean Section, Hypotension.

INTRODUCTION: Administration of anaesthesia to a parturient requires the highest degree of care and expertise because the anaesthetist has to cater to both mother and foetus simultaneously. Spinal anaesthesia induced hypotension has been reported as in many of 85% of patients.[1] Hypotension induced in the mother may have negative impact on the foetus as it can precipitate placental hypoperfusion to the foetus. Measures such as application of careful positioning and volume preloading with colloids and crystalloids have been used but are not fail proof.[2] In this study the author has observed the comparative effect of bolus Phenylephrine and bolus Ephedrine on maintenance of arterial pressure during spinal anaesthesia in caesarean section.

MATERIAL & METHODS: After approval from Institutional Ethical Committee (IEC) informed consent from each patient was taken and 60 patients who volunteered for this study were divided into two groups; Group P and Group E; each of which contained 30 volunteers. At term stable patients who were undergoing elective caesarean sections and had developed hypotension after subarachnoid block (SAB) were studied.

INCLUSION CRITERIA:

(a) Age of patients: 18-30 years.
(b) Healthy term single foetus.
(c) ASA grade I & II.

EXCLUSION CRITERIA:

(a) Twin pregnancy and congenital malformations.
(b) Prevailing cardiac and/or respiratory disease(s).
(c) Bleeding, neurological and endocrine disorders.

PRE-ANAESTHETIC EVALUATION:

(a) Pre-anaesthetic examination.
(b) Detailed obstetric history.
(c) General and systemic evaluation.
(d) Routine pre-operative investigations.
(e) Bupivacaine sensitivity.
(f) Explanation of the study to patients.

GROUPING OF PATIENTS:

Group P: 30 patients receiving Phenylephrine 500 µg in 1 ml as bolus IV when hypotension developed.

Group E: 30 patients receiving 6mg Inj. Ephedrine Hydrochloride in 1ml bolus IV when hypotension developed.

TECHNIQUE OF ANAESTHESIA: The anaesthetic technique was standardized for the study so that the influence of anaesthetic drug was the same for every patient. Each patient was kept on overnight fasting. Patients were pre-medicated with Inj. Glycopyrolate 0.2mg 1M half an hour before spinal anaesthesia. All patients received Inj. Ranitidine 50mg and Inj. Metaclopramide 10mg IV in the operation theatre. After arrival of the patient in the operation theatre, IV line was secured using 18G intracath. Non-invasive monitoring of pulse rate, blood pressure and ECG chest leads were connected to the patient. All patients were preloaded with 10ml/kg body weight of Ringer Lactate solution just prior to spinal anaesthesia and followed by crystalloid solution for maintenance. Oxygen at the rate of 5L/min was administered with disposable facemask to each patient. Blood pressure and pulse rate were recorded at 1-minute interval for 3 minutes after preloading. Average of the above parameters were taken as baseline parameters. All equipments of resuscitation were kept prepared before administration of spinal anaesthesia. With careful antiseptic preparation, all patients were placed in left lateral position for initiation of spinal anaesthesia. Along the coronal plane, shoulders and hips were placed vertically. An assistant maintained the patient in that position. According to standard operating procedure the back of the patient was sterilized and draped. Lumbar puncture was performed in the intervertebral space between L_3 and L_4. Using a 25/26G spinal needle, once a successful lumbar puncture was confirmed, SAB was performed using a 0.5% Inj. Bupivacaine (heavy). The patient was made to lie in supine position with a wedge placed under the right buttock. The operating table was kept horizontal and the time was recorded. Observations were made for SBP, DBP, and Pulse Rate at every two minutes for first twenty minutes and at five minutes upto the end of surgery. After confirmation of sensory block by pinprick with 24G needle upto spinal level dermatome of T_5-T_6 the operation was initiated. Post umbilical cord clamping, Oxytocin 10 IU IV in slow drip and Inj.

Ergometrine IV were administered. APGAR score was recorded at 1 minute and 5 minutes after delivery. Depending on the group to which the patient belonged, drugs were used in bolus for maintenance of blood pressure. The solutions of vasopressors were prepared by the author. Hypotension after SAB was defined as a fall of ≥20% from the baseline or an absolute value of <90mm Hg of SBP. Higher amongst these was taken as the Hypotension Value (HV) this study. Simultaneously, side effects were recorded and managed accordingly. Bradycardia was taken as SBP of less than 60 beats per minute or >20% decrease from the baseline. Blood pressure below 90mm of Hg was treated with drugs to be compared according to the group of the patient. Bradycardia was treated with Inj. Atropine 0.5mg IV. Intergroup and Intragroup comparisons of the data obtained were performed. The results were statistically analyzed (Mean±SD). The difference between mean values were evaluated by students 't' test. P value of <0.05 was considered significant and <0.0001 was considered highly significant.

OBSERVATIONS: Both the groups were physically comparable in character. Both were similar in sensory block level, time to develop hypotension, mean time to delivery and uterine incision to delivery interval. Decrease in both systolic and diastolic arterial pressure was statistically significant ($p<0.001$) at the onset of hypotension and increased after administration of bolus dose of both drugs. Intergroup comparison revealed that rise in SBP after 2,4 and 6 minutes of administering the study drug was less in Group E. DBP after 6 minutes of administering the study drug was significantly less ($p<0.005$) in Group E. In Group P, twenty four patients required single bolus dose while four patients required double dose and the remaining two patients required triple dose to maintain SBP within 20% limit of normal value. In Group E, fourteen patients required single bolus dose while twelve patients required double dose and the remaining four patients required triple dose to maintain SBP within 20% limit of normal value. Three patients in each group developed nausea and vomiting while two patients in each group encountered bradycardia. Apgar score did not reveal any undesired effect on the foetus.

Characteristics	Group P (n=30)	Group E (n=30)
Maternal Age (Mean±SD) yrs	22.9±3.7	24.6±2.6
Maternal Weight (Mean±SD) kgs	64.3±1.9	62.1±2.2
Maternal Height (Mean±SD) inches	61.8±3.7	63.1±2.8
SAB to Hypotension Time minutes	4.5	4.5

Table 1: Physical characteristics of the patients

Intervals	Systolic Blood Pressure (SBP) in mm of Hg	
	Group P (Mean±SD)	Group E (Mean±SD)
Basal Value	126.5±6.7	126±11.4
Hypotension (VP+)	94.9±6.9	93.3±7.5
VP + 2 mins	116.5±14.3	107.1±11.4
VP + 4 mins	120.2±16.9	107.4±14.6

VP + 6 mins	120.3±13.5	111.9±11.1
VP + 8 mins	121.7±11.8	114.8±9.7
VP + 10 mins	120.3±10.7	119.4±10.3
VP + 20 mins	120.7±9.7	114.6±13.3
VP + 30 mins	122.3±8.5	118.9±11.8

Table 2: Comparison of systolic blood pressure recorded at different intervals in both groups

VP+ = Vasopressor agent administered.

Intervals	**Systolic Blood Pressure (SBP) in mm of Hg**	
	Group P (Mean±SD)	**Group E (Mean±SD)**
Basal Value	79.5±6.7	77.9±7.4
Hypotension (VP+)	59.9±5.4	60.3±4.1
VP + 2 mins	71.4±5.4	68.4±7.1
VP + 4 mins	74.3±9.5	68.4±8.3
VP + 6 mins	74.6±6.9	68.9±7.1
VP + 8 mins	74.9±7.4	71.5±5.3
VP + 10 mins	74.7±7.3	72.6±5.7
VP + 20 mins	74.2±5.1	70.2±7.3
VP + 30 mins	75.2±5.2	73.6±6.5

Table 3: Comparison of diastolic blood pressure recorded at different intervals in both groups

Intervals	**Heart Rate (Per Minute)**	
	Group P (Mean±SD)	**Group E (Mean±SD)**
Basal Value	101.8±17	98.7±19
Hypotension (VP+)	115.8±22	109.6±17
VP + 2 mins	90.5±16	112.1±20
VP + 4 mins	87.8±18	109.9±24
VP + 6 mins	92.8±18	103.6±26
VP + 8 mins	95.8±16	103.2±22
VP + 10 mins	96.6±17	104.8±19
VP + 20 mins	99.7±14	106.9±16
VP + 30 mins	99.8±14	104.6±14

Table 4: Change in heart rate (Mean±SD)

APGAR Score	**Group P (Mean±SD)**	**Group E (Mean±SD)**
At 1 minute	8.5±0.5	7.9±0.6
At 5 minutes	9.5±0.5	9.3±0.6

Table 5: Comparison of Apgar Score in both groups

DISCUSSION: Post SAB for caesarean section, hypotension can be minimized by the use of IV fluids preload, avoidance of aortocaval compression and judicious use of vasopressor agents. It has been show that percentage decrease in placental perfusion is related to the percentage reduction in maternal arterial pressure and not to the absolute reduction in pressure.[3] For the purpose of this study the criteria for hypotension was laid down. Pharmacologically Ephedrine has mixed action, directly and indirectly on α and β receptors. Phenylephrine has pure α receptor activity. In restoring maternal arterial pressure, which is above 100 mm of Hg, the action of bolus Phenylephrine 100mg is equivalent to that of Ephedrine 5mg.[4] Transient maternal hypotension does not affect neonatal acid-base balance and both Phenylephrine and Ephedrine increase cardiac preload.[5] In this study the author observed that both the vasopressor agents maintained arterial pressure within 20% limit of baseline. Action of Phenylephrine was better in first six minutes of bolus dose in contrast to Ephedrine. This may be due to that, Phenylephrine has peak effect within one minute, whereas ephedrine takes 2-5 minutes.[6] Phenylephrine causes significant reduction in heart rate after the bolus dose which is a consistent effect in phenylephrine treated women in other studies also.[7] Maternal heart rate was observed to be slower with Phenylephrine.

CONCLUSION: Phenylephrine is as effective as Ephedrine and when used in small incremental bolus injections, it appears to have no adverse effects and neonatal effects in healthy, non-labouring parturients. Though both drugs involved in this study are effective vasopressors with desirable pharmacological actions, Phenylephrine has quicker peak effect in comparison to Ephedrine. Its bradykinetic effect is particularly advantageous in cardiac patients and in cases where tachycardia is totally undesirable.

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