

Prophylactic Bolus & Infusion of Phenylephrine & Ephedrine for Maintaining Maternal Hemodynamics in Caesarean Section under Spinal Anaesthesia.



Medical Science

KEYWORDS : sub Arachnoid block, hypotension, prophylactic techniques, pharmacology, ephedrine and phenylephrine

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ABSTRACT

BACKGROUND AND OBJECTIVES: Spinal anaesthesia is the anaesthetic technique of choice in caesarean section due to maternal & fetal advantages. Hypotension is the most common intraoperative complication associated with SAB. Uncorrected, it is detrimental to mother as well as fetus. Hence, the present study was undertaken using prophylactic bolus followed infusion doses of ephedrine and phenylephrine, hemodynamics monitored and side effects noted. **MATERIAL & METHODS:** After ethical committee clearance & written consent, 100 pregnant women posted for elective/emergency caesarean section under SAB were randomly allotted into group E & group P, to receive: 20µg bolus phenylephrine iv immediately after spinal anaesthesia, followed by 10 µg/min infusion (gr.P) throughout the surgery or 6mg bolus ephedrine iv immediately after spinal anaesthesia, followed by 0.1 mg/min infusion (gr.E), throughout the surgery. Other preoperative, intra operative and post operative management were kept uniform in both groups. Hemodynamics, Uterine tone, uterine bleeding and Neonatal monitoring (APGAR scoring) were monitored and assessed during study period. Hypotension was treated with rescue dose i.e; bolus drug of the respective group. Bradycardia was treated with inj.atropine. Patients were followed up post-operatively for possible adverse effects. **Results:** Results were compiled & compared b/n the 2 groups & analyzed statistically. Maternal arterial blood pressure was well maintained in both the groups i.e; overall there was no statistically significant difference (p=0.832) Group E individuals showed stable systolic arterial pressure compared to group P. Incidence of bradycardia was nil in group E, whereas it was 24% in group P requiring treatment with inj. atropine. Uterine tone & uterine bleeding were comparable b/n the two groups. **Conclusion:** The present study, comparing the efficacy of prophylactic bolus followed by infusion of ephedrine & phenylephrine for caesarean sections shows that Ephedrine prophylaxis is associated with better overall maintenance of hemodynamics. The incidence of bradycardia was more with phenylephrine. There were no major effects on uterine tone / uterine bleeding / APGAR score in both groups.

INTRODUCTION

The delivery of the infant into the arms of a conscious and pain free mother is one of the most exciting and rewarding moments in medicine. With the increasing boom in the incidence of Caesarean section¹, the anaesthesiologist is trapped in a delicate web of decision making over the type of anaesthetic technique to be employed which guarantees the safety of both the mother and fetus.

In caesarean section under spinal anaesthesia hypotension has been reported in as many as 85% of the patients.⁴ Maternal hypotension is associated with distressing symptoms like dizziness, nausea, vomiting and may also interfere with surgical procedure and also can cause fetal bradycardia⁵ and acidosis.⁶ Careful positioning and volume preloading with crystalloid or colloids have been used to prevent it, but these are not complete measures^{7,8} and vasopressor is required to correct hypotension quickly.⁹ Infusion of large volume of crystalloids over a short period of time carries a risk of pulmonary edema and postoperative urinary retention.

The usual approach to use vasopressors in this clinical setting is reactive rather than proactive, spinal anaesthesia induced maternal hypotension is allowed to develop and then treated accordingly. We have studied prophylactic bolus followed by infusion dose Phenylephrine, Ephedrine for maintenance of maternal arterial pressure during spinal anaesthesia in Caesarean section.

MATERIALS AND METHODS

This comparative study was done on parturients coming for elective as well as emergency Caesarean section conducted under spinal anaesthesia in VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BELLARY.

After approval from our institutional ethics committee, 100 parturients ASA I and II scheduled for elective as well as emergency Caesarean section who developed hypotension after subarachnoid block (SAB) were studied. All parturients were at term, had uncomplicated singleton pregnancy with cephalic presentation.

The protocol was explained to all patients in detail in their own language and informed written consent was taken.

Following criteria's were adopted for selecting parturients.

Inclusion Criteria:

- Patients scheduled for elective as well as emergency lower segment Caesarean section.
- Aged between 18-35 years.
- Patients with ASA Class I and II

Exclusion Criteria:

- a) Patient refusal for the procedure
- b) Patients with significant coagulopathies and other contraindications for spinal anaesthesia.
- c) Patient with pregnancy induced hypertension
- d) Patients with history of significant systemic disorders (cardiovascular, respiratory or central nervous system)

Patient's height and weight were measured during the pre-anaesthetic visit. Baseline values for maternal systolic blood pressure, diastolic blood pressure and heart rate were recorded. Inj. Ranitidine 50 mg and ondansetron 4 mg were given intravenously 30 mins before surgery.

Patients were transported to the operating theatre in left lateral position with an 18G intravenous cannula in a peripheral vein.

After preloading pulse rate, systolic and diastolic arterial pressure, oxygen saturation, ECG were recorded thrice when middle value was taken as a base line values.

They were randomly divided into two groups of 50 each as per the study drugs i.e; group P, group E.

Lumbar puncture was performed under strict aseptic precautions in left lateral position by a midline approach using 23 G Quincke spinal needle inserted at L₂₋₃ or L₃₋₄ vertebral interspace. After establishing a free flow of clear cerebrospinal fluid, 9mg (1.8ml) of hyperbaric bupivacaine 0.5% was injected.

With maintenance of continuous left uterine displacement,

study drugs were administered accordingly

Group P : Phenylephrine 20µg as IV bolus, immediately after SAB, followed by infusion 10µg/min

Group E : Ephedrine 6 mg as IV bolus ,immediately after SAB , followed by 0.1 mg/min infusion

Pulse rate, systolic and diastolic arterial pressure, oxygen saturation, ECG were recorded after subarachnoid block, at 1st, 2nd, 3rd, 4th, 5th, 7th, 9th and 10th minute, after that for every 5mins until the surgery.

Whenever hypotension (defined as fall in systolic pressure >15% from the baseline value) occurred the bolus dose of study drug was given IV.

The bradycardia i.e. a pulse rate of 60 min⁻¹ or less was treated with increments of atropine 0.3 mg I.V, upto maximum of 3mg.

Fall in saturation <95% , treated by O₂ supplementation of 4 lts through hudson's face mask.

Segmental spread of anaesthesia was determined by pin prick to assess loss of pain sensation every minute until 5th min .

Uterine incision and delivery time noted. Injection Oxytocin 10units in 500 ml RL were given after clamping the cord. Neonatal condition was assessed by Apgar score at 1 and 5 minutes after delivery.

Results

All the parameters recorded in the study proforma, analysed and compared using Student t test and Chi square test using SPSS version 15.

Demographics.....no statistical significance between the two groups

Changes in heart rate:(table 1a)Heart rate changes were well maintained towards basal in Gr.P than Gr.E . 12 patients in Gr.P – bradycardia requiring treatment ,not associated hypotension.

Changes in systolic blood pressure(table 1b) SBP well maintained in both the groups till 20th min, subsequently group P stabilized towards the basal & group E slightly higher than the basal

Changes in diastolic blood pressure(table 1c) overall persistent fall in both the groups & values stayed slightly lower than basal

Changes in MAP(table 1d) Overall trend towards fall was not statistically significant. Group P showed moderate fall in MAP compared to group E.

Hypotension(table 1e)

- No incidence of significant hypotension in both the groups.

U-D time & Neonatal Status(table 1f)

Uterine tone well maintained in both the groups.

Nausea ,vomiting & desaturation were not significant in both the groups.

DISCUSSION

Amidst this chaos, regional anaesthesia especially spinal anaesthesia proved to be the most preferred technique for Caesarean section.⁶²⁽⁵⁶⁾The reason being, the unique potential of spinal technique to provide anaesthesia with a blend of low degree of physiologic trespass and with profound degrees of sensory denervation and muscle relaxation. Thus, the safety of spinal anaesthesia is of dual nature; pharmacological as well as physiologic.

The only flaw with this technique is the troublesome and persistent incidence of hypotension especially in gravid

parturients. For the purpose of our study, hypotension was defined as a decrease in arterial pressure greater than 15% from the baseline systolic pressure⁴⁵⁽³⁹⁾

Dinesh Sahu and colleagues⁴⁵⁽³⁹⁾ found that maternal hypotension during spinal anaesthesia for Caesarean delivery was a persistent problem in approximately 85% of cases. Other studies quote an incidence of 50-80%. Differing definitions of "significant" hypotension are partly responsible for the wide variation in incidence of hypotension reported in literature.⁴⁹⁽⁴³⁾

This high incidence and severity of maternal hypotension following spinal anaesthesia could be attributed to various factors as mentioned below.⁶⁷⁽⁶¹⁾

1. Amount of local anaesthetic injected was found to produce a higher level of anaesthesia in pregnant term females than in pregnant females.
2. Factors causing hypotension after spinal anaesthesia which are common to both pregnant and nonpregnant females like sympathetic blockade leading to vasodilatation and consequent decrease in preload and cardiac output.⁶⁷⁽⁶¹⁾
3. Additional factors that may accentuate the cardiovascular response to sympathetic denervation include
 - i. Large amounts of blood present in uterus.
 - ii. Weight of uterus impairs venous return from extremities during spinal anaesthesia, especially in supine position, thus decreasing cardiac output.
 - iii. "Bearing down" of patient causes abdominal muscle contraction which further decreases venous return to heart.⁶⁷⁽⁶¹⁾

Thus, there has been a constant ongoing search by anesthesiologists to recognize this dangerous haemodynamic instability and correct it promptly. Thomas and Colleagues³⁵⁽²⁷⁾ reported that bolus phenylephrine 100 µg is as effective as ephedrine 5 mg in restoring maternal arterial pressure above 100 mmHg. Moran and Colleagues²⁷⁽²²⁾ gave ephedrine 10 mg or phenylephrine 80 µg IV bolus to maintain systolic arterial pressure above 100 mmHg. They concluded that phenylephrine is as effective as ephedrine and when used in small incremental bolus injections, it appears to have no adverse neonatal effects in healthy, non laboring parturients.

Ramanathan and colleagues²¹ studied in 127 healthy patients undergoing elective caesarean section under epidural anaesthesia. They concluded that transient maternal hypotension does not affect neonatal acid – base status, both ephedrine and phenylephrine do not cause fetal acidosis, when used for treating maternal hypotension.

In our study cardiovascular stability was better with phenylephrine. It caused significant reduction in heart rate after the bolus dose, which is a consistent effect in phenylephrine treated women in their studies also^{21,27,28,35,39(21,22,25,27,33)} In ephedrine group the heart rate increased compared to preoperative values which we found as statistically significant consistent with the study by Dinesh Sahu.³⁹⁽³³⁾ It may be due to beta adrenergic effect of ephedrine which the phenylephrine lacks.

There was no significant effect of vasopressor on fetus in terms of Apgar score at 1 and 5 minutes which correlated well with the study by Dinesh Sahu.³⁹⁽³³⁾

Thomas D.G. et al³⁵⁽²⁷⁾ showed 58% incidence of bradycardia (heart rate less than 60 beats /min) when phenylephrine was given as IV bolus after induction of spinal anaesthesia, but in our study the incidence was 24%(12 patients). In our study we found only nausea as side effect.

In conclusion, we have found that prophylactic iv bolus followed by infusion of phenylephrine and ephedrine are effective in maintenance of arterial pressure within 15% limit of baseline, though phenylephrine has quicker peak effect in comparison to ephedrine and it causes reduction in heart rate, which may be advantageous in cardiac patients and patients in whom

tachycardia is undesirable.

CONCLUSION

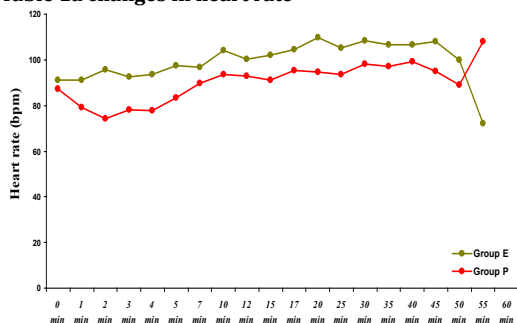
Based on the present clinical comparative study, the following conclusions can be made:

1. Both vasopressors effectively maintained arterial blood pressure during spinal anaesthesia for caesarean section.
2. Phenylephrine has quicker peak effect.
3. Phenylephrine caused significant reduction in heart rate than ephedrine.
4. Both the drugs did not have any adverse effects on the fetus or the mother.

Thus it can be concluded that prophylactic IV bolus followed by infusion Phenylephrine, Ephedrine can be safely used during spinal anaesthesia for caesarean section for treatment of hypotension.

Tables

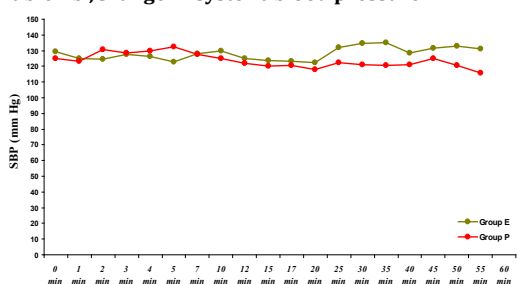
Table 1a changes in heart rate



Heart rate changes were well maintained towards basal in Gr.P than Gr.E

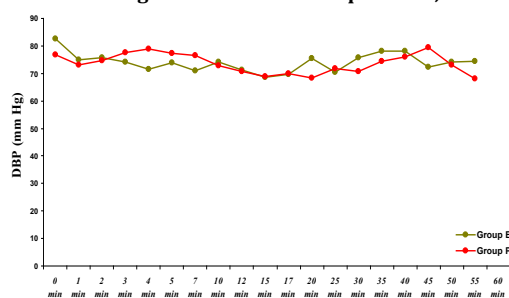
12 patients in Gr.P – bradycardia requiring treatment, not associated hypotension.

Table 1b; Change in systolic blood pressure :



SBP well maintained in both the groups till 20th min, subsequently group P stabilized towards the basal & group E slightly higher than the basal.

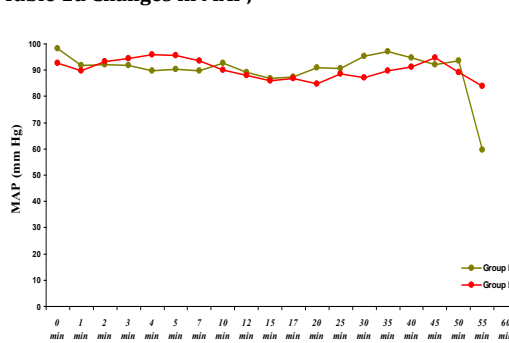
Table 1c Changes in diastolic blood pressure;



Group E: persistent fall, stayed lower than basal

Group P – similar trends .Fall @ 4th min in Gr E was greater compared to Gr P.

Table 1d Changes in MAP;



Group E: persistent fall from 1st min.

Group P: persistent fall, moderate compared to Gr.E

Table 1e SEVERITY OF HYPOTENSION

Hypotension	0-5%	5-10%	10-15%	>15%
Group E(%)	2	30	52	-
Group P(%)	6	40	48	-

Table 1f; no statistical significance in uterine incision and delivery time between the two groups

Uterine incision & delivery time	Average time
Group E	60±5 sec
Group P	61±7 sec

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