

The Efficacy of Prophylactic Combination Therapy using Ephedrine IV alongwith fluid Preload as Compared to Fluid Preloading alone or IV Ephedrine alone in Prevention of Maternal Hypotension during Spinal Anesthesia for Caesarean Section

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ABSTRACT

Objectives: To compare the efficacy of prophylactic combination therapy using IV ephedrine in bolus doses in conjunction with fluid preload as compared to fluid preload alone or IV ephedrine alone, for prevention of maternal hypotension after spinal anesthesia for caesarean section.

Methodology: This hospital based study was conducted at Department of Anesthesiology & Intensive Care, CMH Peshawar from Sep 2011 to May 2012. Ninety patients of ASA grade I receiving spinal anesthesia for elective Caesarian section were randomly divided into three groups. Group-I (Crystalloid group) received only fluid preload with ringers solution 20ml/kg body weight; Group-II (Ephedrine group) received IV ephedrine 0.25mg/kg BW only just after initiation of SAB and Group III (Combination group) received fluid preload with ringers solution 20 ml/kg body weight plus ephedrine 0.25mg/kg BW given iv just after initiation of spinal anesthesia. Intra operative hemodynamic changes and fetal outcome were monitored, recorded and the data were analyzed statistically.

Results: Although incidence of hypotension was not much significant in all the three groups but haemodynamic stability was much better and sustainable in group III receiving combination therapy.

Conclusions: Prophylactic combination therapy with fluid preload in conjunction with IV ephedrine 0.25mg/kg BW can effectively prevent spinal induced maternal hypotension during cesarean section.

Key words: Combination therapy, spinal anesthesia; caesarian section; ephedrine; hypotension.

INTRODUCTION

Spinal anesthesia is frequently used for lower abdominal and lower extremity surgical procedures. It is induced by injecting small amounts of local anesthetic into the cerebrospinal fluid (CSF). It is economical, simple to perform and takes comparatively less time to produce more rapid onset of good quality sensory as well as motor block¹. It has been shown to block the stress response to surgery, decreases intra-operative blood loss, lower the incidence of post operative thrombo-embolism and decrease morbidity and mortality in high risk patients². However one of its important and predicted physiological effect is hypotension^{3,4,5} with the incidence reported to be 80-90% or more in an untreated control group undergoing caesarean section with a spinal anaesthetic⁶.

Causes of this hypotension are multifactorial including sympathetic nerve blockade up to T5 causing a fall in systemic vascular resistance (SVR) leading to reflex increase in heart rate and cardiac

output. Denervation of the splanchnic autonomic ganglia (T5-11), however, also causes a significant venodilatation of the mesenteric bed with an increase in venous capacitance. This reduces the venous return to the extent that the reflex increase in cardiac output may be compromised or even abolished. These factors are compounded by the reduced venous return attributable to aortocaval compression in the third trimester of pregnancy. Spinal anaesthesia extending above T4 directly affects the cardiac sympathetic innervations, thereby attenuating the compensatory tachycardia and so a high spinal block may further reduce the heart rate^{7,8}.

Harrop-Griffiths have suggested that another reflex (Bezold-Jarisch) may contribute to episodes of maternal hypotension in this setting. This reflex involves baroreceptors, in an under filled left ventricle, mediating a neural response which leads to increased parasympathetic activity over-riding the sympathetic tone. This reflex (although not fully understood) may explain why vasopressors and anticholinergic agents sometimes do not produce the expected results and also may explain the bradycardia seen in mothers in whom the spinal block is well below the T3-5 dermatomes⁹.

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It is also worth mentioning here that incidence of hypotension is less in patients who are in labour¹⁰ and in patients with pre-eclampsia¹¹ so there is less support for the use of prophylactic vasopressors in these patients. Pre-eclamptic patients to sustain arterial pressure after the spinal block. In pre-eclampsia, vascular epithelium is damaged by a process involving placental-derived proteins, leading to an imbalance between pro- and anti-angiogenic growth factors^{12,13} which results in persistent vasoconstriction.

In our study we evaluated the efficacy of combined use of preloading and vasoconstrictors for prevention of post spinal hypotension when compared to preloading or vasoconstrictors alone and found better results of combination therapy. The aim of study was to find a safe and highly effective method to prevent spinal-induced maternal hypotension without causing adverse effects in parturients.

METHODOLOGY

A blind, randomized, interventional study was conducted at Department of Anesthesiology & Intensive Care, CMH Peshawar from September 2011 to May 2012. Ninety patients of ASA grade I and II scheduled to undergo elective caesarian section under spinal anaesthesia were included in the study. In addition patients having any other contraindication of spinal anaesthesia were also excluded from study. The patients were randomly allocated into three groups of 30 each. Group I patients (crystalloid group) received preloading with 20ml/kg BW of ringer’s lactate over 10 to 15 minutes period using fluid pusher preceding the subarachnoid block. Group II patients (vasoconstrictor group) received intravenous bolus of 0.25mg/kg body weight ephedrine from a prefilled syringe, immediately on turning the patient to supine position after initiation of successful spinal anaesthesia. Group III patients

(combination group) received preloading with 20ml/kg BW of ringer’s lactate over 10 to 15 minutes period preceding the spinal block followed by intravenous bolus of 0.25mg/kg body weight ephedrine. Frequency of hypotension, nausea, vomiting were noted.

All the data was entered into PSS version 11 and analyzed. Mean and standard deviation of age was calculated. Frequency of hypotension, nausea, vomiting, and were also compared in three groups, Chi-square test was test of significance with $p \leq 0.05$.

RESULTS

The mean age of the patients in group I was 31.5±7.5 years, in group II 31.4±8.3 and in group III 31.6±7.8 respectively. There was significant lower incidences of hypotension in the combination group compared with the single therapy groups i.e. Group I vs Group II vs Group III 1(3.33%) vs 8(38.1%) vs. 18(85.7%) ($P < 0.001$). There were significant lower incidences of nausea and vomiting in the combination group compared with the other two groups 1(3.33%) vs 4(19%) vs. 12(57.1%) ($P < 0.05$). Analysis of neonatal out come was assessed clinically by a paedriatician using Apgar score only and showed no significant differences between the study groups. ($P > 0.05$). The incidence of hypotension was 23.33%, 13.33% and 6.67% in group-I, II and III respectively. The incidence of hypotension was significantly lower in Group III receiving combination therapy (Table 1). This group also required doses of rescue IV ephedrine to treat hypotension only in one patient which is highly insignificant (Table 1). The incidence of nausea and vomiting was higher in group-I and was related to hypotension. There was no statistically significant difference between the groups II and III related to NV. No patient developed severe NV. Patients were given Inj. maxolone 10 mg IV state after vomiting once.

Table 1: Haemodynamic effects (Hypotension) requiring rescue treatment

Haemodynamic parameters	Crystalloid group	Ephedrine group	Combination group	P value
Hypotension	7(23.3%)	4(13.3%)	2(6.7%)	0.001
Reactive hypertension	0(0.0%)	0 (0.0%)	1(3.3%)	0.8

DISCUSSION

Haemodynamic changes occur abruptly with spinal anaesthesia compared to the epidural technique, thereby leading to clinical manifestations and maternal-foetal complications associated with hypotension frequently happen with subarachnoideal anaesthesia¹⁴.

In one of combination therapy method, Akhtar et al found that modified supine wedged position with

table tilt, crystalloid co-hydration and prophylactic i/v atropine is an effective combination technique which prevents spinal induced hypotension in caeserian delivery¹⁵.

Another group of research workers from Dicle university and Mustafa Kamal university of Turkey applied combination of more than two methods for prevention of post spinal hypotension in c/section. The combined use of low-dose Bupivacaine, colloid

preload and wrapping of the legs using Esmarch bandage was found to be an effective mean of preventing the incidence of post spinal hypotension¹⁶.

In one of study conducted by Kee and co-workers, it was found that crystalloid cohydration along with phenyl ephedrine infusion can be used as an effective technique for prophylaxis of post spinal hypotension during routine c/section in their study results

Only 1 of 53 patients (1.9% in combination therapy group experienced hypotension versus 15 of 53 patients (28.3% in Crystalliod group ($P=0.0001$). Compared with group 0, patients in group 1 had greater values for the following: serial measurements of systolic blood pressure ($P=0.02$), minimum recorded systolic blood pressure ($P=0.0002$), and minimum recorded heart rate ($P=0.013$). Neonatal outcome and maternal side effects were similar between groups¹⁷.

Bhagat et al also conducted a similar study on combination therapy where they concluded that the combined use of relatively low volume preloading and reduced dose of vasoconstrictors is a very effective method in reducing the incidence, severity and duration of spinal hypotension and provides better haemodynamic stability when compared to preloading or vasoconstrictors alone. Reducing the dose of vasoconstrictor in the combination group could obviate this problem. Moreover, low volume of preloading as in the combination group can be safely administered in the parturient and the elderly patients¹⁸.

Prophylactic ephedrine given by infusion in combination with crystalloid was found to be more effective than crystalloid prehydration alone in the prevention of hypotension during spinal anesthesia for elective caesarean section. This was proved by Khooshideh M and Heidari MH from Department of Obstetrics and Gynecology, Zahedan University of Medical Sciences, Zahedan, Iran¹⁹.

We found combination therapy highly satisfactory for the prevention of post spinal hypotension during c/section without significant maternal side effects and with good fetal outcome. It has also been shown to virtually eliminate the need for rescue treatment of maternal hypotension during spinal anesthesia for elective cesarean delivery when compared to intravenous bolus ephedrine therapy or prophylactic use of fluid preload alone.

CONCLUSION

We conclude that the prophylactic use of combination¹⁶ therapy with bolus fluid preload 20ml/kg BW along with

IV ephedrine in 0.25mg/kg body weight is highly effective in routine cases for the prevention of incidence of maternal hypotension.

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