Original Article

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Comparison of Hemodynamic Response and Vasopressor Requirement Following Spinal Anaesthesia, between Normotensive and Mild Gestational Hypertension Patients Undergoing Caesarean Section: A Prospective Study

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Abstract

Background: Neuraxial anaesthesia is the preferred anaesthesia technique for delivery by caesarean section. Despite controversies, there is evidence that supports the use of spinal anaesthesia in severe preeclampisa group. Present evidence suggests that gestational hypertension and preeclamsia are distinct entities, however very few attempts are made to study the hemodynamic changes and vasopressor requirement in mild gestational hypertension parturients following spinal anaesthesia for caesarean delivery. The aim of the present study was to compare heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, Mephenteramine requirement and neonatal outcome between normotensive and mild gestational hypertension parturients undergoing caesarean delivery under spinal anaesthesia. *Materials and Methods:* A total of 60 parturients not in labour, scheduled for elective caesarean section, meeting inclusion criteria, were included in the study, 30 were in normotensive group and 30 were in mild gestational hypertension group, with blood pressure <160/110mm hg. Spinal anaesthesia was administered using 2.2ml of 0.5% hyperbaric Bupivacaine (Heavy). Baseline hemodynamic parameters were recorded before spinal anesthesia and then at every 2 minute interval after spinal block for the first 30 minutes and thereafter every 5 minutes until completion of surgery. Hypotension was defined as, more than 30% of decline in mean arterial pressure compared to baseline in both groups (or systolic blood pressure <100 mmHg in healthy parturients) and was treated with injection Mephenteramine, 5mg bolus intravenously, Apgar score was noted at 1 and 5 minutes after birth. *Results:* The minimum systolic blood pressure, mean arterial pressure and heartrate recorded were lower in normotensives but the difference between the two groups was not statistically significant. The average Mephenteramine requirement in normotensive group (8.5 mg) was slightly more than in mild gestational hypertension (8.25mg) group. Apgar scores at 1 and 5 minutes after birth were comparable in both the groups. *Conclusion:* Hemodynamic response and vasopressor requirement following spinal anesthesia in mild gestational hypertension group was similar to normotensive group with comparable Apgar scores. .

Keywords: Gestational Hypertension; Hypotension; Mephenteramine; Spinal Anaesthesia.

Introduction

Pregnancy induced hypertension is a major cause of morbidity and mortality in obstetrics complicating 3-8% of all pregnancies [1]. It encompasses a range of disorders including pre-eclampsia(PE) and eclampsia, as well as gestational and chronic hypertension. Gestational hypertension (GHTN), the most common form of hypertension in pregnancy [2], is defined by an elevated blood pressure (over 140/90mmHg), on atleast two occasions, at 6 hours apart, in a woman with no pre-existing hypertension, at or beyond 20 weeks gestation, in the absence of proteinuria, a transient condition that resolves by 12 weeks post partum [3,4]. GHTN is an

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independent entity, not merely a mild or pre-onset form of PE; has significant differences with PE with respect to epidemiologic, pathologic, pathogenetic and hemodynamic characteristics [5].

It is a distinct disorder, representing a benign regulatory imbalance between systemic vascular tone and cardiac output. Despite controversies, there is evidence that supports the use of spinal anaesthesia(SA) even in severely (PE) groups [6-14], as general anesthesia is rarely preferred because of potentially difficult airway, hypertensive response to laryngoscopy and intubation, risk of aspiration, drug interaction or impaired villous blood flow [15].

However, there are very few studies comparing the effect of spinal anaesthesia on hemodynamics and vasopressor requirements and neonatal outcome, in mild GHTN parturients with normotensives, for caesarean delivery. Therefore the present study was designed.

Material and Methods

Following approval from Institutional ethics committee, 60 parturients not in labour, of ASA (Physical status I and II), age between 20-35 years, weight (45-75 kgs) scheduled for elective caesarean section, were included after taking written, informed consent.

30 were in normotensive group and 30 were in mild GHTN group, with blood pressure <160/110mm hg., requiring anti-hypertensive therapy. Patients with cardiac disease, chronic hypertension, renal disease, diabetes mellitus, coagulopathy, placental abruption, severe foetal distress, oliguria, cerebral or visual disturbances, allergy to local anesthetics and infection at the site, were excluded.

All the patients were pre-medicated with injection Ranitidine 50mg intravenous (IV) and injection Metoclopramide 10mg (IV), 45 minutes prior to surgery, anti-hypertensive medications were continued in GHTN parturients . Before performing sub-arachnoid block(SAB), pre-loading was done using Ringers Lactate (RL) solution 10ml/kg, over the course of 15 to 20 minutes. Standard multichannel monitors were attached and baseline hemodynamic parameters such as, heart rate (HR), systolic blood pressure(SBP), diastolic blood pressure(DBP), mean arterial pressure(MAP) were recorded.

Under aseptic precautions, SAB was administered with 26G spinal needle in lumbar 3-4 interspace, in lateral position, using 2.2 ml of 0.5% Bupivacaine (Heavy). Patient was turned to supine position with left lateral tilt. After achieving adequate sensory block (T4- T6 level) surgery was commenced. Heart rate and blood pressure were recorded at two minutes interval for 30 minutes after the block and then every 5 minutes until the end of surgery.

Hypotension was considered if the MAP declined more than 30% of baseline in both the groups or SBP <100mmHg in normotensive group, were treated with inj. Mephenteramine 5mg (IV) and repeated if required to maintain MAP within 30% of baseline. Bradycardia (HR <60 beats / min), if associated with hypotension was treated with 0.6mg (IV) Atropine.

All the patients received 1500-2000 ml of RL solution during anesthesia. The volume of fluid was not restricted in mild GHTN group.

Lowest SBP, DBP and MAP were noted, lowest and highest HR were recorded for each patient. The total amount of Mephenteramine required was recorded. Apgar score at 1 minute and 5 minutes, birth weight and gestational age of the baby were also compared.

Statistical Analysis

Data was compiled in Microsoft excel worksheet and student test was used to detect significant difference for difference of means and chi-square test was used for difference of proportions. $P < 0.05$ was considered significant.

Results

Parturients in the two groups were comparable regarding age, weight, height ,gestational age of fetus and sensory level attained (Table 1&2).

The mean baseline SBP, DBP and MAP were higher in mild gestational (GHTN) parturients. The mean baseline heart rate were comparable in both groups (Table 3 & 4).

The SBP, DBP and MAP, all decreased from the baseline in both the groups following SAB, (Table 3&4), but the minimum recorded SBP, MAP and HR were lower in normotensive group which was statistically not significant (Table 5).

Percentage fall of SBP, DBP and MAP from mean base line values was statistically significant in both groups, fall being more in GHTN group (Table 3 &4). Average Mephenteramine consumption in both groups was nearly equal, 8.25 mg in GHTN group and 8.5 mg in normotensive group (Figure 1).

Discussion

Neuraxial anaesthesia is the preferred anesthetic technique for delivery by caesarean section. Single-shot spinal, combined spinal-epidural and epidural anaesthesia have all been used effectively. Hypotension, following spinal, occurs in about 64% of cesarean delivery without adverse maternal or foetal outcome (Aya, AG et al) [6]. It can be

Table 1: Comparsion of variables between normotensive parturients and gestational hypertension parturients

Variables	Normotensive parturients Mean±SD	Gestational hypertension parturients Mean±SD	t-test value	P-value and significance
Age in years	24.06±2.24	23.76±2.21	t=0.526	P>0.05, NS
APGAR at 1m	8.67±0.88	8.76±0.93	t=0.93	P>0.05, NS
APGAR at 5m	9.47±0.50	9.27±0.69	t=0.501	P>0.05, NS
Gestation in weeks	38.47±0.97	38.63±0.88	t=0.672	P>0.05, NS

Table 2: Comparison of sensory level between Normotensive parturients and gestational hypertension parturients

Sensory level	Normotensive parturients No. of cases	Gestational hypertension parturients No. of cases	Chi-square test and p-value
T_4	7	9	X=0.89
T_5	11	10	p>0.05
T_6	8	6	Not Significant
T_7	4	4	
T_8	0	1	
Total	30	30	

Table 3: Comparsion of haemodynamic variable between base line values and after spinal anaesthesia in gestational hypertension parturients

Variables	Base line Mean ± SD	After spinal anesthesia Mean ± SD	t-test value	P-value and significance	Percentage change
SBP	136.77±6.4	118.62±3.8	t=13.12	P<0.000, HS	13.28%
DBP	90.3±6.43	69.09±5.96	t=14.28	P>0.000, HS	23.58%
MAP	99.76±5.78	81.78±4.11	t=13.51	P>0.000, HS	18.0%
HR	98.20±4.19	101.25±3.26	t=3.11	P>0.01, S	3.0%

Table 4: Comparsion of haemodynamic variable between base line values and after spinal anaesthesia in Normotensive parturients

Variables	Base line Mean ± SD	After spinal anesthesia Mean ± SD	t-test value	P-value and significance	Percentage change
SBP	117.86±3.96	111.29±2.18	t=7.63	P<0.001, HS	5.56%
DBP	73.31±6.88	67.16±6.39	t=3.5	P>0.01, S	8.36%
MAP	88.07±3.45	78.422.85	t=11.09	P>0.000, HS	10.96%
HR	97.11±4.05	92.55±3.19	t=4.42	P>0.001, HS	9.07%

Table 5: Comparsion of haemodynamic variable (lowest mean values) between Normotensive parturients and gestational hypertension parturients after spinal anaesthesia

Variables	Normotensive parturients Mean ± SD	Gestational hypertension parturient Mean ± SD	t-test value	P-value and significance
SBP	91.4±13.3	99.3±17.6	t=1.82	P<0.005, NS
DBP	49.8±7.6	47.55±9.8	t=0.891	P>0.05, NS
MAP	60.6±9.6	62.15±11.3	t=0.679	P>0.05, NS
HR	77.5±10.23	83.45±13.6	t=1.87	P>0.05, NS
Mephenteramine requirement	8.5mg	8.25mg		

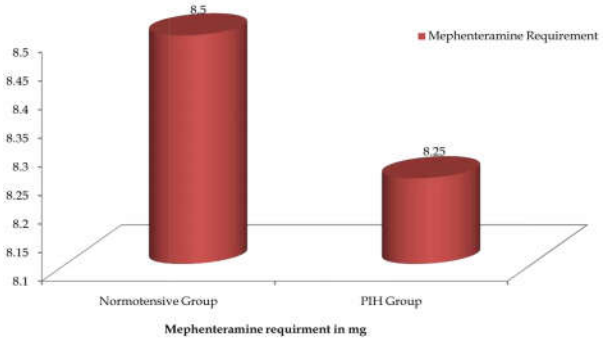
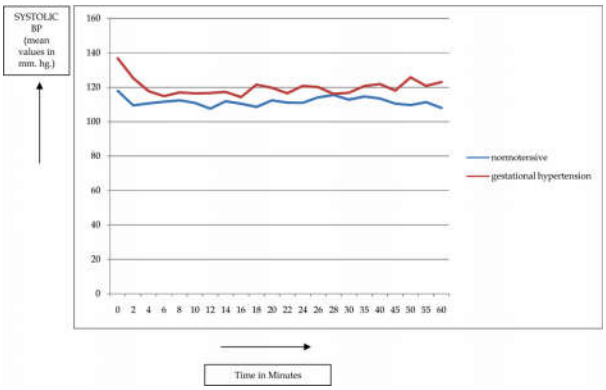
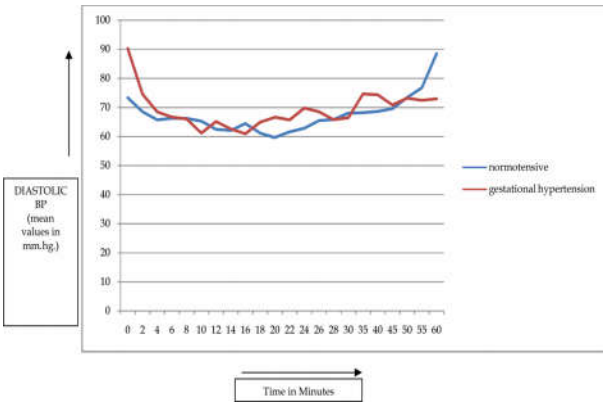


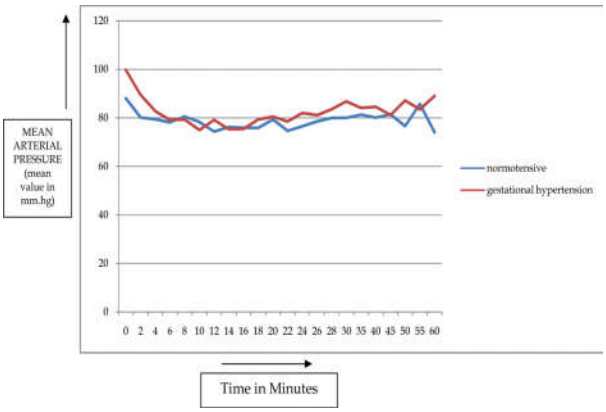
Fig. 1: Simple bar diagram represents mephenteramine requirement



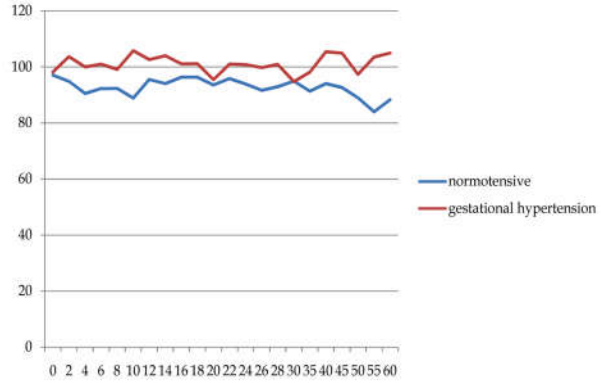
Graph 1: Trends of systolic blood pressure in two groups



Graph 2: Trends of diastolic blood pressure in two groups



Graph 3: Trends of mean arterial pressure in two groups



Graph 4: Trends of heart rate in both the groups

successfully managed with titrated doses of intravenous Ephedrine (3-5mg), Phenylephrine (50-100mcgms) or Mephenteramine (5-10mgs bolus) (Mohta M et al [8], Kansal A et al [9]. General anaesthesia is often considered unsafe in obstetric practice, more so in patients with pregnancy induced hypertension (PIH), because of potentially difficult airway, hypertensive response to laryngoscopy and intubation, risk of aspiration, Magnesium potentiating the effect of non-depolarizing muscle relaxants and impaired villous blood flow (Joupilla P et al) [15].

The concern of producing sudden, severe hypotension after spinal anaesthesia, in severe (PET) parturients for caesarean delivery was a deterrant. Number of studies have been conducted to observe the hemodynamic effects of regional anaesthesia in these parturients.

Aya A G et al [6] observed that the risk of hypotension was six times less in patients with severe PET . Dyer et al [7] also found similar results. Visalya putra et al [10] compared the hemodynamic effect of spinal anaesthesia and epidural anaesthesia in severe eclamptic patients and found episodes of significant hypotension (SBP <100mg) were transient in both the groups with comparable neonatal outcome and felt spinal anesthesia in severe eclamptics to be safe. Hood et al [11] found that parturients who had spinal anaesthesia required more fluid compared to epidural groups without any adverse sequelae like pulmonary oedema; and that pre-loading is necessary in PIH parturients before spinal anaesthesia, as hypovolemia and vasospasm are present. Molica JL et al [12], concluded that, about 10ml/kg fluid be used to preload the PIH parturients over a period of 10-15 minutes at the time of spinal anesthesia .In the present study preloading was found safe. Gogarten et al [13], summarized the evidence and concluded that the incidence of hypotension and vasopressor

requirements are reduced during caesarean delivery for severe PET done under spinal anesthesia and felt routine preloading should not be used. If necessary co-loading to be followed to lessen the risk of fluid overload.

Ephedrine has been used to counter spinal hypotension during caesarian delivery as it does not adversely affect the uterine blood flow. Kansal A et al [9] have shown Mephenteramine to be equally effective to treat spinal hypotension during cesarean delivery as was observed in our study.

Roofthooft E et al [14], showed that lowering the dose of local anesthetics improves maternal hemodynamic stability; however such strategy could compromise the adequacy of anaesthesia with requirement of supplementary analgesia and possible neonatal consequences. Ramnathan J et al [15], Rasooli S et al [17] have also found better hemodynamic stability with adequate anaesthesia with use of low dose hyperbaric Bupivacaine (7.5mg-12mg) and as low as 6mg with opioids such as Fentanyl or Sufentanyl. Russel IF [18] found opioids as adjuants to neuraxial anesthesia to improve quality of block, without producing higher level of analgesia to pin prick, consequently felt that lower anesthetic doses cannot be recommended unless an epidural catheter is in place, that is, combined-spinal epidural (CSE) to supplement the spinal block if anaesthesia is inadequate before or during surgery. Benhemon D et al [19] found that low dose CSE anaesthesia may not be the optimal technique for all patients and Institutions. In concurrence with these studies, conventional dose of Bupivacaine was used in the present study.

But Wick AJ [20] opined that during elective cesarean delivery, adequate uterine contractions can be achieved with lower doses of oxytocin (0.5-3 units). Thomas J.S. et al [21]. observed that, slow injection of oxytocin can minimize cardiovascular effects without compromising the therapeutic benefit, similar to our study.

In our study, spinal anaesthesia was chosen because of its simple technique, less time consuming, rapid onset of action, cost-effectiveness and intensity of block and established safety in PIH cases as found in various studies.

Nir Melamed et al [5], summarizing the evidence, observed that gestational hypertension and pre-eclampsia are distinct entities with different clinical characteristics, found that although GHTN is the most common form of hypertension in pregnancy, attention is more focused on PE because of its adverse implications on maternal-fetal health; further found that in the absence of risk factors for development of PE, women with isolated hypertension in pregnancy will most likely have GHTN and the risk of adverse maternal-infant outcome is low. To validate this observation our study was undertaken to compare the hemodynamic response, vasopressor requirements and neonatal outcome in mild GHTN parturients, following spinal anaesthesia for cesarean delivery.

After pre-loading and establishing subarachnoid block with conventional dose of Bupivacaine 0.5% (Heavy) 2.2ml, blood pressure decreased in both the groups from the baseline, but the minimum SBP, MAP and HR were higher in mild gestational hypertension group (99.3±17.6 mmHg, 62.15±11.3 mmHg, 83.45±13.6/min, respectively,) in comparison with normotensive groups (91.4±13.3mmHg, 60.6±9.6mm Hg, 77.5±10.23/min respectively,) which were statistically not significant.

The percentage fall in mean SBP and MAP, when compared to pre-operative mean baseline values was statistically significant in both the groups but there were no periods of prolonged hypotension in both the groups, as is evident in the graphic trends.

Vasopressor requirement was also found to be equal in both groups indicating similar vascular sensitivity.

Our study result doesn't corroborate with the study of Aya et al, Goguertan et al and other afore mentioned studies comparing severe PE with normotensive parturients for caesarean delivery, where the hemodynamic changes were significantly less in PE group, the reasons being, as observed by Smith et al [22] and Saha et al [23], damaged vascular endothelium, as seen in severe PE, produces increased amount of endogenous vasopressor-like thromboxane and endothelin, resulting in persistent vasoconstriction, which is not altered even after SAB, resulting in less hemodynamic alterations; this contrasts with normal pregnancy, where altered balance of vascular tone, reduced response to endogenous pressors and increased synthesis of vasodilator prostaglandins and nitric oxide, make them very sensitive to spinal anesthesia, producing hypotension after SAB. This is consistent with our study, showing statistically significant percentage fall in the mean(SBP, DBP, MAP) in both the groups, when compared to their mean baseline values prior to block.

Mir Melamed [5] et al observed that decidual vasculopathy, villous infarction, and placental infarction is confined to PE. Endothelial dysfunction,

endothelial cell damage, imbalance between pro and anti angiogenic factors, and antiplatelet action, is not seen in GHTN; therefore felt that, in the absence of risk factors for development of PE, GHTN parturients having adverse maternal-foetal outcome is low, as was also found in the course of our study of GHTN parturients for caesarean delivery after spinal anaesthesia.

Joyner M. J. et al [24], found a close relationship between level of sympathetic activity and decrements in blood pressure that occur after SAB in hypertensives . The reduction in blood pressure after spinal anesthesia is co-related with degree of pre-operative blood pressure. This was consistent with GHTN group in our study, where pre-operative blood pressure was adequately controlled with antihypertensives as was evident from the mean baseline blood pressure values, resulting in comparable hemodynamic changes in both the groups, after SAB.

Tukuda [25] et al and Nishikawak et al [26] found that when pre-operative blood pressures were normalized with antihypertensive treatment, there was no difference between the incidence of hypotension following spinal anaestheisa in hypertensive versus normotensive patients and the reason for this, is, the improvement in vascular structural changes and the achievement of a decrease in basal sympathetic activity with the use of effective antihypertensive treatment. These findings support our study; results showing similar hemodynamic changes between the two groups after spinal anaesthesia.

Vasopressor requirements in both the groups was similar, suggesting that the vascular sensitivity to exogenously administered vasopressor is same in both the groups, unlike in PE parturients, who, because of endothelial damage, are sensitive to vasopressors.

Though there were statistically significant changes in hemodynamic parameters from mean baseline values in both groups and inj. Mephenteramine was used to treat transient hypotension, we found good neonatal outcome in both groups, with respect to Apgar score at 1 min and 5 min after birth.

Conclusion

We found that, there was no significant difference in the hemodynamic response and vasopressor requirement, between mild GHTN and normotensive parturients for caesarean delivery under spinal anesthesia and neonatal outcome was comparable between two groups.

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