Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Comparison of Hemodynamic Response and Vasopressor Requirement Following Spinal Anesthesia between Normotensive and Hypertensive Women Undergoing Elective Cesarean Section

Abhishek Jain[1], Gopal Singh Maravi[2]

[1]Post Graduate Student, Department of Anaesthesiology, Netaji Subhash Chandra Bose Medical College, Jabalpur, Madhya Pradesh, India, [2]Associate Professor, Department of Anaesthesiology and Critical Care, Netaji Subhash Chandra Bose Medical College, Jabalpur, Madhya Pradesh, India

Abstract

Introduction: Spinal anesthesia (SA) is the technique of choice in cesarean sections, but it is not widely accepted in hypertension due to fear of sudden and extensive sympathetic blockade. Sympathetic blockade induced hypotension may occur in up to 64–100% of pregnant women who have been given spinal anesthesia for cesarean delivery, especially when hyperbaric solutions are used. Severely pre-eclamptic patients were previously believed to be at high risk of severe hypotension, with maternal and fetal consequences because of reduced plasma volume and because of the need to limit i.v. fluids to avoid iatrogenic pulmonary edema.

Methodology: The present study, "comparison of hemodyanamic response and vasopressor requirement following spinal anesthesia between normotensive and hypertensive women undergoing elective cesarean section" 100 women of age 20–35 years, the American Society of Anesthesiologists physical Status I and II carrying a singleton pregnancy and scheduled to have elective cesarean section in Netaji Subhash Chandra Bose Medical College, Jabalpur, were enrolled into two groups. Group A: 50 were normotensive women and Group B: 50 were hypertensive women. All patients received a standard subarachnoid block under all aseptic precautions with 12.5 mg 0.5% hyperbaric bupivacaine.

Results: Based on the data from our study, it could be concluded that after spinal anesthesia in patients undergoing elective cesarean section-hypertensive group of parturients had less fall in mean systolic blood pressure (SBP), diastolic BP, and mean arterial BP in comparison to normal healthy pregnant women which were statistically significant ($P < 0.05$). Hypertensive group of patients required less ephedrine to treat hypotension in comparison to normotensive patients which were statistically significant ($P < 0.05$). The incidence of hypotension was almost 7 times less in hypertensive parturients than healthy parturients (odds ratio = 23.14, relative risk of hypotension in Group A = 7.2, confidence interval = 7.6–70.3).

Conclusion: To summarize, our results showed that hypotension following SA administered for cesarean section was significantly less in hypertensive patient than in healthy pregnant women. In addition, vasopressor requirements were also less in hypertensive parturients and neonatal outcome was comparable between the two groups. Therefore, subarachnoid block is an acceptable technique to perform in hypertensive parturients due to its virtue of simplicity, rapidity, cost-effectiveness, and intensity of block.

Key words: Caesarean, Hypertension, Spinal anaesthesia, Vasopressor

Access this article online

www.ijss-sn.com

Month of Submission : 12-2019
Month of Peer Review : 01-2020
Month of Acceptance : 02-2020
Month of Publishing : 02-2020

INTRODUCTION

Spinal anesthesia has been shown to block the stress response to surgery, decrease intraoperative blood loss, lower the incidence of post-operative thromboembolism, and decrease morbidity and mortality in high-risk patients.[1]

Corresponding Author: Dr. Gopal Singh Maravi, Department of Anaesthesiology and Critical Care, Netaji Subhash Chandra Bose Medical College, Jabalpur - 482 001, Madhya Pradesh, India.

Cardiovascular system may be profoundly affected by spinal anesthesia (SA) due to unavoidable sympathetic blockade.[2] Numerous studies have been conducted to study the cardiovascular effects of spinal blockade. Hypotension is the most frequent side effect of spinal anesthesia, occurring in more than 30% of patients.[3]

SA is the technique of choice in cesarean sections, but it is not widely accepted in hypertension due to fear of sudden and extensive sympathetic blockade.[4]

In a normal pregnancy, there is reduced sensitivity to exogenous vasoconstrictors leading to the increased vasopressor requirement to reverse the hypotensive effect after subarachnoid block (SAB). In preeclampsia, there is an increased sensitivity to vasoconstrictor agents and less vasopressor is required.[5]

Ephedrine is an indirectly acting α and β adrenergic agonist. A recent survey found that it was used as the sole vasopressor by 95% of consultant obstetric anesthetists in the UK.[6]

The purpose of our study was to compare the hemodynamic response and vasopressor requirement following spinal anesthesia between normotensive and hypertensive women undergoing cesarean section.

METHODOLOGY

The study was carried out in the Department of Anaesthesiology and Critical Care, Netaji Subhash Chandra Bose (NSCB) Medical College and Hospital, Jabalpur (Madhya Pradesh).

Selection of Cases

In this study, 100 women of age 20–35 years, the American Society of Anesthesiologists (ASA) physical Status I and II carrying a singleton pregnancy and scheduled to have an elective cesarean section were enrolled into two groups.

- Group A: 50 were normotensive women
- Group B: 50 were hypertensive women.

The patient with severe preeclampsia was treated with antihypertensive and anticonvulsant (labetalol and alpha methyldopa) and prophylactic dose of magnesium sulfate as part of their routine management in the department of obstetrics and gynecology.

A detailed history, thorough physical examination, routine investigations, and any special investigation if required done for the study.

Criteria for Exclusion

- Patients who refuse for spinal anesthesia
- Patients in whom regional anesthesia is contraindicated
- Patients suffering from coagulopathy, blood dyscrasias, and on anticoagulant therapy
- Patients with congenital heart disease
- Patients with increased intracranial pressure
- Patients with skin sepsis and marked spinal deformity
- Patient with fetal distress, eclampsia, and HELLP syndrome
- Patients with a decreased level of consciousness.

Design of Study

This was a prospective cohort study.

Study Protocol

The careful pre-anesthetic examination was performed and informed consent was taken. No premedication was given.

After shifting the patient in the operating room, routine monitoring devices such as electrocardiogram leads, noninvasive blood pressure (BP) cuff, and pulse oximetry probe were setup. Baseline hemodynamic variables (heart rate [HR], systolic BP [SBP], diastolic BP [DBP], and mean arterial pressure [MAP]) were recorded. Baseline BP was measured as the mean of the three readings taken 5 min after arrival in operation theatre and before doing any invasive procedure. An intravenous access (18 G cannula) was inserted. Ringer lactate (15 ml/kg) was infused as preload. All patients received a standard spinal block under all aseptic conditions as following:

The patient was placed on the operating table in the left lateral position with back and thighs curved and flexed. Under all aseptic precautions, SAB was administered using 25 G Quincke needle in the left lateral position at L3-L4 intervertebral space with 12.5 mg hyperbaric 0.5% bupivacaine. All patients were placed in supine position. All patients received supplemental oxygen immediately after administration of spinal anesthesia.

Sensory level was tested by pinprick method, surgery was allowed as soon as upper level of sensory block reached at T4 level. BP and HR of the patient were measured in the 1st min and then every 3 min until fetal delivery and then every 5 min until the end of operation.

We administered 6 mg of ephedrine when SBP falls about 30% of baseline or when it is <100 mmHg. Lowest SBP, DBP, and MAP were noted for each patient and for the HR both lowest and highest value was recorded.

We also evaluated dose of ephedrine requirement and total amount of ephedrine administered.Patients with inadequate SAB were excluded from the study.

Materials Required

1. Spinal trolley with 25 G spinal needle
2. 5 ml disposable syringe
3. Inj. bupivacaine heavy (0.5%)
4. Inj. ephedrine
5. Emergency drugs/intubation kit
6. Resuscitation kit.

OBSERVATION AND RESULTS

In the present study, 100 women of age 20–35 years, ASA physical Status I and II carrying a singleton pregnancy and scheduled to have an elective cesarean section were enrolled into two groups.

- Group A: 50 were normotensive women
- Group B: 50 were hypertensive women

The patient with severe preeclampsia was treated with antihypertensive and anticonvulsant (labetalol and alpha methyldopa) and prophylactic dose of magnesium sulfate as part of their routine management in the department of obstetrics and gynecology

- All patients received a standard subarachnoid block under all aseptic precautions with 12.5 mg 0.5% bupivacaine heavy
- All data pertaining to demographic characteristics, pulse rate, SBP, DBP, mean arterial BP, and ephedrine requirement in the study group were recorded and subjected to statistical analysis. All case report forms were checked for completeness and inappropriate or illogical responses. The databases were validated and all inconsistencies and differences were resolved. Statistical analyses were performed using software IBM SPSS version 20. Alpha error was considered to be 0.05 (5%). Student's *t*-test, Fisher exact test, and Chi-square test were used the difference in various variables as age, weight, height, and other indicators monitored in the study. In all tests, $P < 0.05$ was taken as statistical significance level.

Table 1 shows the mean age, weight, and height of patients in both the study groups. These data are statistically not significant, as $P > 0.05$ [Graphs 1-3].

Table 2 shows the change in pulse rate in patient of two study groups. There was an initial rise in pulse rate after giving spinal anesthesia and positioning and then gradual fall in pulse rate in patients of both groups which was statistically but not clinically significant. Later on, pulse rate was observed to rise back to pre-operative value [Graph 4].

Table 3 shows the change in mean SBP in patient of two study groups. There was a fall in mean SBP from

Table 1: Demographic data (age, weight, and height)

	Group A		Group B		*P*-value
	Mean	±SD	Mean	±SD	
Age (years)	26.7	1.8	23.7	1.01	0.804
Weight (kg)	57.3	2.1	56.6	3.0	0.176
Height (cm)	157.1	2.4	156.8	2.6	0.54

SD: Standard deviation

Table 2: Changes in intraoperative pulse rate

Group	Pre-SBP (mmHg)	1 min SBP	3 min SBP	8 min SBP	13 min SBP	18 min SBP	23 min SBP	28 min SBP	33 min SBP	38 min SBP	43 min SBP	48 min SBP	53 min SBP	58 min SBP
A (50)														
Mean	75.90	79.4	82.9	82.2	80.0	79.2	77.0	76.2	75.4	75.4	75.3	74.5	74.8	75.4
Standard deviation	5.350	4.92	5.04	4.82	4.71	5.60	5.54	4.40	4.30	3.91	3.89	4.46	5.42	5.20
B (50)														
Mean	96.04	98.6	102	96.5	94.2	92.6	90.6	89.3	87.8	88.0	89.0	89.8	90.5	90.5
Standard deviation	4.526	4.53	4.13	3.73	3.85	4.77	4.22	3.56	3.83	4.10	3.89	3.64	3.86	3.41
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

SBP: Systolic blood pressure

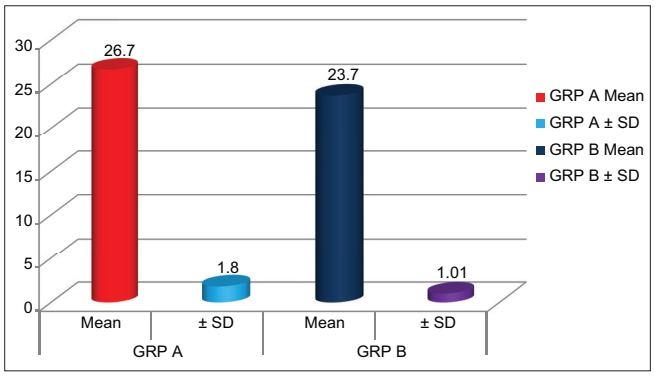
Table 3: Intraoperative SBP

Group	Pre-SBP (mmHg)	1 min SBP	3 min SBP	8 min SBP	13 min SBP	18 min SBP	23 min SBP	28 min SBP	33 min SBP	38 min SBP	43 min SBP	48 min SBP	53 min SBP	58 min SBP
A (50)														
Mean	117.36	111.18	102.90	97.34	101.02	103.88	102.00	105.26	105.48	106.56	107.52	108.38	109.12	109.80
Standard deviation	4.960	4.159	4.908	7.196	5.430	2.946	5.599	2.354	2.950	2.442	1.919	1.772	2.007	1.852
B (50)														
Mean	154.60	148.06	141.44	135.22	132.48	130.78	130.34	131.06	132.56	134.20	135.62	136.82	138.18	140.02
Standard deviation	3.670	4.515	6.247	9.161	5.060	5.582	5.780	5.593	5.496	5.610	5.066	5.074	4.443	4.167
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

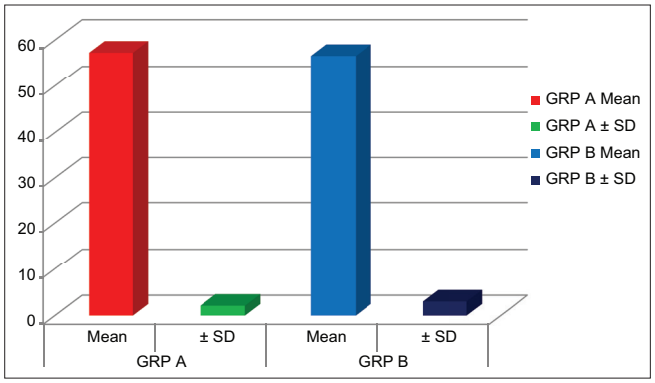
SBP: Systolic blood pressure

pre-operative value in patients of both groups. Later on, the SBP was observed to rise back near to pre-operative values. Fall in mean SBP was more in Group A (117.3 ± 4.9–97.3 ± 7.1) in comparison to Group B (154.6 ± 3.6–130.34 ± 5.7) which was statistically significant ($P < 0.05$) [Graph 5].

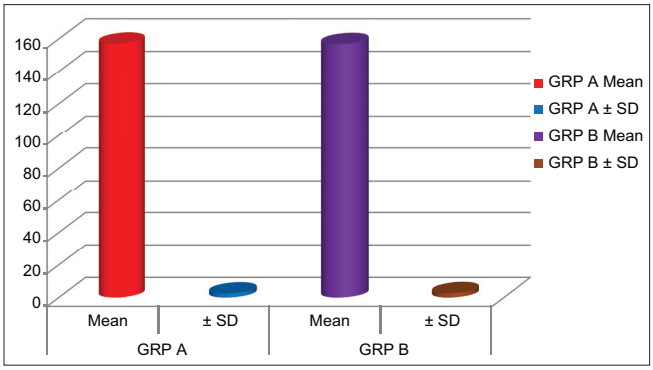
Table 4 shows the change in mean DBP in patient of two study groups. There was a fall in mean DBP from pre-operative value in patients of both groups. Later on, the



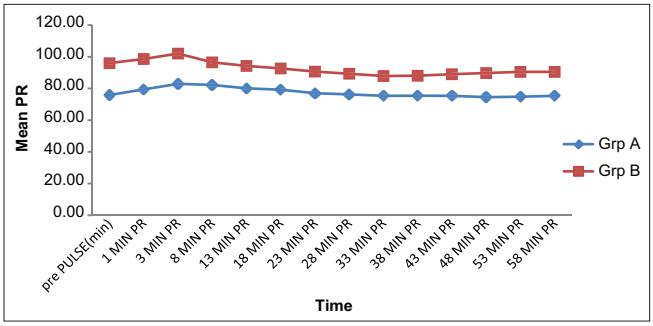
Graph 1: Mean age



Graph 2: Mean weight



Graph 3: Mean height



Graph 4: Changes in intraoperative pulse rate

Table 4: Intraoperative diastolic blood pressure

Group	Pre-SBP (mmHg)	1 min SBP	3 min SBP	8 min SBP	13 min SBP	18 min SBP	23 min SBP	28 min SBP	33 min SBP	38 min SBP	43 min SBP	48 min SBP	53 min SBP	58 min SBP
A (50)														
Mean	76.1	70.4	64.7	60.5	60.0	60.3	59.5	60.4	61.4	62.8	64.2	65.2	66.4	67.3
Standard deviation	5.92	6.49	6.70	6.77	5.21	4.63	4.78	4.46	3.85	3.91	3.56	3.62	3.80	3.42
B (50)														
Mean	100.2	97.0	94.1	90.9	89.6	88.8	89.3	90.1	91.0	91.9	92.5	93.8	94.9	95.4
Standard deviation	3.019	3.80	4.67	7.07	4.69	4.24	4.31	4.51	4.64	4.94	4.25	4.03	3.59	3.32
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

SBP: Systolic blood pressure

Table 5: Intraoperative mean arterial blood pressure

Group	Pre-SBP (mmHg)	1 min SBP	3 min SBP	8 min SBP	13 min SBP	18 min SBP	23 min SBP	28 min SBP	33 min SBP	38 min SBP	43 min SBP	48 min SBP	53 min SBP	58 min SBP
A (50)														
Mean	89.2	83.6	77.2	72.5	73.4	74.6	73.5	75.1	75.7	77.1	78.4	79.2	80.3	81.1
Standard deviation	5.7	5.4	5.8	6.2	4.2	3.4	4.5	2.7	2.7	2.8	2.4	2.7	2.9	2.5
B (50)														
Mean	117.9	113.8	109.6	105.4	103.6	102.6	102.6	103.3	104.4	105.5	106.6	107.8	109.0	109.9
Standard deviation	2.9	3.7	5.0	7.6	4.5	4.3	4.2	4.3	4.2	4.4	3.9	3.6	3.4	3.0
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

SBP: Systolic blood pressure

DBP was observed to rise back near to pre-operative values. Fall in mean DBP was more in Group A (76.1 ± 5.9–59.5 ± 4.7) in comparison to Group B (100.2 ± 3.0–88.8 ± 4.2) which was statistically significant ($P < 0.05$) [Graph 6].

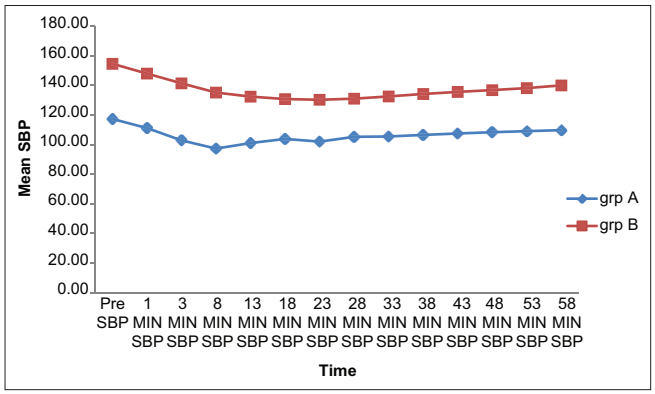
Table 5 shows the change in mean arterial BP in patient of two study groups. There was a fall in mean arterial BP from pre-operative value in patients of both groups. Later on, the arterial BP was observed to rise back near to pre-operative values. Fall in mean arterial BP was more in Group A (89.1 ± 5.6–72.5 ± 6.2) in comparison to Group B (117.9 ± 2.9–102.56 ± 4.2) which was statistically significant ($P < 0.05$) [Graph 7].

Table 6: Intraoperative ephedrine requirement

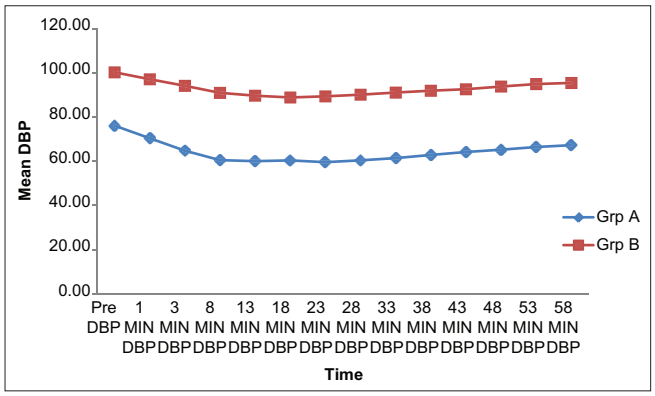
Group	*n*	Mean	Standard deviation
A	36	8.50	3.0
B	5	6.00	0.0
Total	41	8.20	2.9

Table 7: Cases with significant hypotension

Groups	Cases with significant hypotension	Percentage
A	36	72.0
B	5	10.0
Total	41	41.0



Graph 5: Intraoperative systolic blood pressure



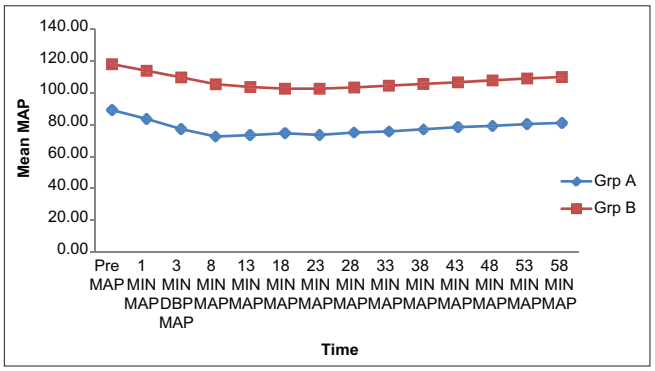
Graph 6: Intraoperative diastolic blood pressure

Table 6 shows the mean ephedrine requirement intraoperatively in both the study groups. Mean ephedrine requirement was less in Group B (5 patients; 6 mg) as compared to Group A (36 patients; 8.5 mg) which was statistically significant [Graph 8].

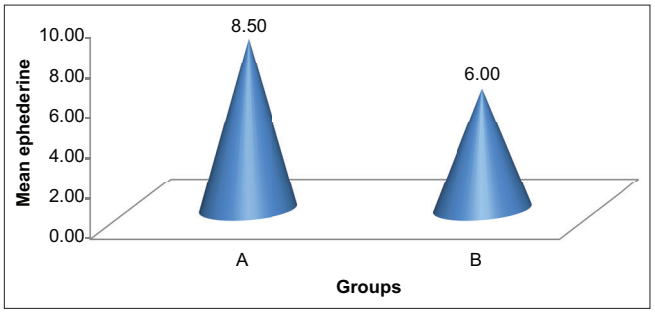
Table 7 shows cases with significant hypotension in both the study groups. In Group A 72% patients experienced significant hypotension requiring ephedrine treatment in comparison to Group B, 10% patients experienced significant hypotension requiring ephedrine treatment which is statistically significant ($P < 0.05$) [Graph 9].

DISCUSSION

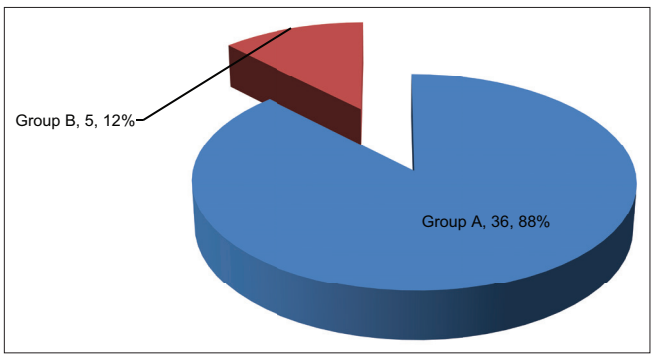
Spinal anesthesia is the most preferred technique because of its simplicity, rapid onset of action, and reliability in



Graph 7: Intraoperative mean arterial blood pressure



Graph 8: Intraoperative ephedrine requirement



Graph 9: Cases with significant hypotension

producing uniform sensory and motor blockade. Spinal anesthesia has been shown to block the stress response to surgery, decrease intraoperative blood loss, lower the incidence of post-operative thromboembolism, and decrease morbidity and mortality in high-risk patients.

Cardiovascular system may be profoundly affected by SA due to unavoidable sympathetic blockade.[2] Numerous studies have been conducted to see the cardiovascular effects of spinal blockade. Hypotension is the most frequent side effect of spinal anesthesia, occurring in more than 30% of patients.[3]

SA is the technique of choice in cesarean sections, but it is not widely accepted in hypertensive patient due to fear of sudden and extensive sympathetic blockade.[4]

Sympathetic blockade induced hypotension may occur in up to 64–100% of pregnant women who have been given spinal anesthesia for cesarean delivery, especially when hyperbaric solutions are used.[7,8] Severely pre-eclamptic patients were previously believed to be at a high risk of severe hypotension, with maternal and fetal consequences[8] because of reduced plasma volume and because of the need to limit i.v. fluids to avoid iatrogenic pulmonary edema.[9,10]

Hypertensive disorders in pregnancy are among the leading causes of maternal mortality, along with thromboembolism, hemorrhage, and nonobstetric injuries.

Although regional anesthesia is used in this group of parturients, current clinical experience demonstrated relative safety of regional technique over general anesthesia. Due to hazards related to the management of the difficult airway and to the hemodynamic consequences of laryngoscopy and tracheal intubation,[11,12] general anesthesia is usually chosen only when regional techniques are contraindicated.

In a normal pregnancy, increased synthesis of endogenous vasodilators such as prostaglandins and nitric oxide produces a vasodilated state, and there appears an increased dependence on sympathetic vasoconstriction for control of vascular tone. This explains the sudden and excessive hypotension after sympathetic blockade produced by SAB in them.[13]

In preeclampsia, vascular endothelial damage occurs, which produces an increased amount of endogenous vasopressors such as thromboxane and endothelin which are responsible in maintaining vessel tone. Sympathetic block following SAB does not alter this vascular response, limiting the excessive fall of BP in pre-eclamptic.[14,15]

In a normal pregnancy, there is reduced sensitivity to exogenous vasoconstrictors leading to the increased vasopressor requirement to reverse the hypotensive effect after SAB. In pre-eclampsia, there is an increased sensitivity to vasoconstrictor agents and less vasopressor is required.[5]

Vascular tone, which modulates BP, is under regulation of two systems: Sympathetic nervous system and vascular endothelium. In pre-eclamptic patients, there are sympathetic over activity and some defects in vascular endothelium which decrease vascular relaxation. Secretion of vasopressor factors in circulation will also be increased. In contrast to sympathetic system, vasopressor factors and endothelial system will not be affected by SA and it may increase the vascular tonicity and reduce the rate of hypotension development. Moreover, due to the presence of high sensitivity of vasculature to vasoconstrictor drugs in pre-eclamptic patients, one can treat hypotension with smaller dose of vasoconstrictors such as ephedrine. All the above mechanisms explain the results of our study that why BP decreases gradually in preeclampsia during cesarean section under SA. On the basis of this theory, BP of these patients will be regulated by a lower amount of ephedrine.

In the present clinical study, "comparison of hemodyanamic response and vasopressor requirement following spinal anesthesia between normotensive and hypertensive women undergoing elective cesarean section."

One hundred women of age 20–35 years, ASA physical Status I and II carrying a singleton pregnancy and scheduled to have an elective cesarean section in NSCB Medical College, Jabalpur, were enrolled into two groups.

- Group A: 50 were normotensive women.
- Group B: 50 were hypertensive women

Patients with severe preeclampsia were treated with antihypertensive and anticonvulsant (labetalol and alpha methyldopa) and prophylactic dose of magnesium sulfate as part of their routine management in the department of obstetrics and gynecology.

- A detailed history, thorough physical examination, routine investigations, and any special investigation as required were done for the study.
- All patients received a standard subarachnoid block under all aseptic precautions with 12.5 mg 0.5% bupivacaine heavy.
- The patients included in this study were comparable regarding demographic characteristics; the mean age of the patients in years in Group A was 26.7 ± 1.8 and in Group B was 23.7 ± 1.0.
- The mean weight of patients in kg in Group A was 57.3 ± 2.1 and in Group B was 56.6 ± 3.0.

- The mean height of patients in cm in Group A was 157.1 ± 2.4 and in Group B was 156.8 ± 2.6.
- Since both the groups were demographically similar ($P > 0.05$ in comparison), it can be presumed that groups were comparable for the purpose of the study. All the patients were preloaded uniformly with Ringer's lactate 10 ml/kg to offset the effect of relative hypovolemia or hypotension.
- The main finding of our study was that in patients undergoing elective cesarean section under hyperbaric bupivacaine spinal anesthesia, hypertensive group of patients experienced less significant fall in BP, and less ephedrine requirement in comparison to normotensive group of patients.

Preoperatively mean pulse rate in Group A was 75.9/min and in Group B was 96.0/min. After giving spinal anesthesia and positioning, there was a initial rise in pulse rate and then gradual fall in both groups of patients. Later on, pulse rate was observed to rise back to pre-operative value. The mean difference between both groups was statistically significant ($P < 0.05$).

Mean SBP in Group A was 117.3 mmHg and in Group B was 154.6 mmHg. There was a fall in mean SBP from pre-operative value in patients of both groups. Later on, the SBP was observed to rise back near to pre-operative values. Fall in mean SBP was more in Group A (117.3 ± 4.9–97.3 ± 7.1) in comparison to Group B (154.6 ± 3.6–130.34 ± 5.7). The mean difference between both groups was statistically significant ($P < 0.05$).

Mean DBP in Group A was 76.1 mmHg and in Group B was 100.2 mmHg. There was a fall in mean DBP from pre-operative value in patients of both groups. Later on, the DBP was observed to rise back near to pre-operative values. Fall in mean DBP was more in Group A (76.1 ± 5.9–59.5 ± 4.7) in comparison to Group B (100.2 ± 3.0–88.8 ± 4.2). The mean difference between both groups was statistically significant ($P < 0.05$).

MAP in Group A was 89.1 mmHg and in Group B was 117.9 mmHg. There was a fall in mean arterial BP from pre-operative value in patients of both groups. Later on, the arterial BP was observed to rise back near to pre-operative values. Fall in mean arterial BP was more in Group A (89.1 ± 5.6–72.5 ± 6.2) in comparison to Group B (117.9 ± 2.9–102.56 ± 4.2). The mean difference between both groups was statistically significant ($P < 0.05$).

Aya *et al.*[14] compared the incidence and severity of SA – associated hypotension in severely pre-eclamptic (*n* - 30) versus healthy (*n* - 30) parturients undergoing cesarean delivery. The severely pre-eclamptic patients comparatively had a less frequent incidence of clinically significant hypotension than the normotensive parturients (16.6% vs. 53.3%).

Aya *et al.*[13] compared the hemodynamic changes between severe pre-eclamptic (*n* - 65) and parturients with pre-term pregnancies (*n* - 71) undergoing SA for cesarean delivery. Hypotension was less frequent in pre-eclamptic patients than in women with pre-term pregnancies (24.6% vs. 40.8%, respectively).

Emmett *et al.*[16] did a hospital-based cohort study comparing the effects of SA between pre-eclamptic patients and normal pregnant women during cesarean section. With their observations, they concluded that the development of hypotension was less in pre-eclamptic women than healthy pregnant women during cesarean section under spinal anesthesia.

Saha *et al.*[17] did a study to compare the hemodynamic response and vasopressor requirement following spinal anesthesia between normotensive and severe pre-eclamptic women undergoing cesarean section. A total of 60 patients included in studies divided into two groups of 30 each (30 healthy patients and 30 severe pre eclamptic patients). The minimum SBP, DBP, and MAP recorded were lower in normotensive, and the difference between two groups was statistically significant.

Our observations in relation to incidence and magnitude of hypotension were congruent to the above-mentioned studies.[13,14,16,17]

We administered 6 mg of ephedrine when SBP falls about 30% of baseline or when it is <100 mmHg. Mean ephedrine requirement was less in Group B (5 patients; 6 mg) in comparison to Group A (36 patients; 8.5 mg). The mean difference between both groups was statistically significant ($P < 0.05$).

In Group A, 72% patients experienced significant hypotension requiring ephedrine treatment in comparison to Group B, 10% patients experienced significant hypotension requiring ephedrine treatment. Risk of hypotension was almost 7 times less in Group B. (odds ratio = 23.14, relative risk of hypotension in Group A = 7.2, confidence interval = 7.6–70.3).

Aya *et al.*[14] observed that severely pre-eclamptic patients had a less frequent incidence of clinically significant hypotension (16.6% vs. 53.3%) which was less severe and required less ephedrine. The risk of hypotension was almost six times less in severely pre-eclamptic patients than that in healthy patients.

Aya *et al*.[13] studied that pre-eclamptic patients (n = 65) required less ephedrine than women in the pre-term group (n = 71) to restore BP to baseline levels (9.8–4.6 mg vs. 15.8–6.2 mg, respectively). The risk of hypotension in the pre-eclamptic group was almost 2 times less than that in the pre-term group.

Valami *et al*.[16] studied that dosage of ephedrine injection in pre-eclamptic patients was less than healthy pregnant women during cesarean section under SA.

Saha *et al*.[17] studied that mean phenylephrine requirement in the normotensive group (151.1 ± 70) was significantly greater (P < 0.0001) than that of pre-eclamptic group (48.3 ± 35). Apgar scores at 1 and 5 min after birth were comparable in both the groups. They used phenylephrine instead of ephedrine.

Our observations in relation to incidence of hypotension and vasopressor requirement were congruent to the above-mentioned studies.[13,14,16,17]

SUMMARY AND CONCLUSION

SA is the technique of choice in cesarean sections, but it is not widely accepted in hypertension due to fear of sudden and extensive sympathetic blockade.[4]

Sympathetic blockade induced hypotension may occur in up to 64–100% of pregnant women who have been given spinal anesthesia for cesarean delivery, especially when hyperbaric solutions are used.[7,8] Severely pre-eclamptic patients were previously believed to be at high risk of severe hypotension, with maternal and fetal consequences[10] because of reduced plasma volume and because of the need to limit i.v. fluids to avoid iatrogenic pulmonary edema.[9,10]

The present study, "comparison of hemodyanamic response and vasopressor requirement following spinal anesthesia between normotensive and hypertensive women undergoing elective cesarean section" 100 women of age 20–35 years, ASA physical Status I and II carrying a singleton pregnancy and scheduled to have and elective cesarean section in NSCB Medical College, Jabalpur, were enrolled into two groups.

- Group A: 50 were normotensive women
- Group B: 50 were hypertensive women.

All patient received a standard subarachnoid block under all aseptic precautions with 12.5 mg 0.5% hyperbaric bupivacaine.

Based on the data from our study, it could be concluded that after spinal anesthesia in patients undergoing elective cesarean section.

Hypertensive group of parturients had less fall in mean SBP, DBP, and mean arterial BP in comparison to normal healthy pregnant women which were statistically significant (P < 0.05).

The hypertensive group of patients required less ephedrine to treat hypotension in comparison to normotensive patients which were statistically significant (P < 0.05).

The incidence of hypotension was almost 7 times less in hypertensive parturients than healthy parturients (odds ratio = 23.14, relative risk of hypotension in Group A = 7.2, confidence interval = 7.6–70.3).

To summarize, our results showed that hypotension following SA administered for cesarean section was significantly less in hypertensive patient than in healthy pregnant women. In addition, vasopressor requirements were also less in hypertensive parturients and neonatal outcome was comparable between the two groups.

Therefore, SAB is an acceptable technique to perform in hypertensive parturients due to its virtue of simplicity, rapidity, cost-effectiveness, and intensity of block.

REFERENCES

1. Rodgers A, Walker N, Schug S, McKee A, Kehlet H, van Zundert A, *et al*. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: Results from overview of randomised trials. BMJ 2000;321:1493.
2. Karpel E, Marszołek P, Pawlak B, Wach E. [Effectiveness and safety of unilateral spinal anaesthesia]. Anestezjol Intens Ter 2009;41:33-6.
3. Ward RJ, Bonica JJ, Freund FG, Akamatsu T, Danziger F, Englesson S. Epidural and subarachnoid anesthesia. Cardiovascular and respiratory effects. JAMA 1965;191:275-8.
4. Sharwood-Smith G, Clark V, Watson E. Regional anaesthesia for caesarean section in severe preeclampsia: Spinal anaesthesia is the preferred choice. Int J Obstet Anesth 1999;8:85-9.
5. Khalil RA, Granger JP. Vascular mechanisms of increased arterial pressure in preeclampsia: Lessons from animal models. Am J Physiol Regul Integr Comp Physiol 2002;283:R29-45.
6. Burns SM, Cowan CM, Wilkes RG. Prevention and management of hypotension during spinal anaesthesia for elective Caesarean section: A survey of practice. Anaesthesia 2001;56:794-8.
7. Riley ET, Cohen SE, Macario A, Desai JB, Ratner EF. Spinal versus epidural anesthesia for cesarean section: A comparison of time efficiency, costs, charges, and complications. Anesth Analg 1995;80:709-12.
8. Ueyama H, He YL, Tanigami H, Mashimo T, Yoshiya I. Effects of crystalloid and colloid preload on blood volume in the parturient undergoing spinal anesthesia for elective cesarean section. Anesthesiology 1999;91:1571-6.
9. Cunningam FG, MacDonald PC, Gant NF. Hypertion disorders in pregnancy. In: Cunningam FG, MacDonald PC, Gant NF, editors. Williams Obstetrics. 18th ed. Norwalk, CT: Appleton & Lange; 1989. p. 653-94.
10. Sibai BM, Mabie BC, Harvey CJ, Gonzalez AR. Pulmonary edema in severe preeclampsia-eclampsia: Analysis of thirty-seven consecutive cases. Am J Obstet Gynecol 1987;156:1174-9.
11. Hawkins JL, Koonin LM, Palmer SK, Gibbs CP. Anesthesia-related deaths during obstetric delivery in the United States, 1979-1990. Anesthesiology 1997;86:277-84.
12. Miller RD. Miller's Anesthesia. 7th ed. Philadelphia, PA: Churchill

Livingstone, Elsevier; 2010. p. 1616-18, 2226-30.
13. Aya AG, Vialles N, Tanoubi I, Mangin R, Ferrer JM, Robert C, *et al*. Spinal anesthesia-induced hypotension: A risk comparison between patients with severe preeclampsia and healthy women undergoing preterm cesarean delivery. Anesth Analg 2005;101:869-75.
14. Aya AG, Mangin R, Vialles N, Ferrer JM, Robert C, Ripart J, *et al*. Patients with severe preeclampsia experience less hypotension during spinal anesthesia for elective cesarean delivery than healthy parturients: A prospective cohort comparison. Anesth Analg 2003;97:867-72.
15. Santos AC, Birnbach DJ. Spinal anesthesia in the parturient with severe preeclampsia: Time for reconsideration. Anesth Analg 2003;97:621-2.
16. Emmett RS, Cyna AM, Andrew M, Simmons SW. Techniques for Preventing Hypotension During Spinal Anaesthesia for Caesarean Section (Cochrane Review). Chichester, United Kingdom: The Cochrane Library, John Wiley & Sons, Ltd.; 2003.
17. Saha D, Ghosh S, Bhattacharyya S, Mallik S, Pal R, Niyogi M, *et al*. Comparison of hemodynamic response and vasopressor requirement following spinal anesthesia between normotensive and severe preeclamptic women undergoing caesarean section: A prospective study. J Obstet Anaesth Crit Care 2013;3:23-6.

How to cite this article: Jain A, Maravi GS. Comparison of Hemodynamic Response and Vasopressor Requirement Following Spinal Anesthesia between Normotensive and Hypertensive Women Undergoing Elective Cesarean Section. Int J Sci Stud 2020;8(2):121-129.

Source of Support: Nil, **Conflicts of Interest:** None declared.