

COMPARISON OF HAEMODYNAMIC STABILITY WITH 0.5% AND 0.75% HYPERBARIC BUPIVACAINE DURING SPINAL ANAESTHESIA IN WOMEN UNDERGOING CAESAREAN SECTION

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ABSTRACT

Objective: To compare the effect of 0.5% and 0.75% hyperbaric Bupivacaine on haemodynamic stability in terms of mean systolic blood pressure and heart rate recorded at 4 min in patients undergoing caesarian section in spinal anaesthesia.

Study Design: Quasi experimental study.

Place and Duration of Study: Department of Anaesthesiology, Combined Military Hospital, Malir, from Jul to Dec 2018.

Methodology: The patients were assigned in two groups (A and B) using lottery method. Group A received 0.5% hyperbaric Bupivacaine solution. Group B received 0.75% hyperbaric Bupivacaine solution. Spinal anaesthesia was given, blood pressure and heart rate were recorded. Data were analyzed in SPSS version 23. Both groups were compared for mean systolic blood pressure and heart rate by using independent sample t-test.

Results: The mean age of patients was 29.62 ± 6.21 years in 0.75% Bupivacaine group while 29.31 ± 6.20 years in 0.5% Bupivacaine group. The mean systolic blood pressure of patients was 111.63 ± 5.96 mmHg in 0.75% Bupivacaine group while 117.16 ± 7.12 mmHg in 0.5% Bupivacaine group. The difference was significant in both groups (p -value <0.05). The mean heart rate of patients was 92.27 ± 4.71 beats per min (bpm) in 0.75% Bupivacaine group while 97.68 ± 4.58 bpm in 0.5% Bupivacaine group. The difference was significant in both groups (p -value <0.05).

Conclusion: 0.5% hyperbaric Bupivacaine was better than 0.75% hyperbaric Bupivacaine solution in spinal anaesthesia during caesarean section.

Keywords: Caesarean section, Heart rate, Hyperbaric bupivacaine, Spinal anaesthesia, Systolic blood pressure.

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INTRODUCTION

Spinal anaesthesia is one of the anaesthetic modalities used for cesarean section. This technique abolishes sensory and motor functions of several groups of spinal nerves temporarily. The advantages of spinal anaesthesia include rapid onset of action, symmetrical sensory and motor blockade, and cost effectiveness. There is minimal risk of complications related to systemic toxicity due to the small volume of the anaesthetic used in the procedure.¹

Bupivacaine is one of the most commonly used drugs for spinal anaesthesia. Spinal anaesthesia is used for any procedure below the umbilicus.¹ The most common problems associated with spinal anaesthesia include haemodynamic changes such as hypotension and bradycardia. Some of the other problems like nausea, vomiting, and dyspnea are related either directly or indirectly with haemodynamic instability. A successful intrathecal drug should produce adequate extent

and duration of block for proposed surgery without producing undesirable side effects such as profound hypotension and bradycardia.²

Baricity of local anaesthesia is an important determinant of the spread of local anaesthetic within subarachnoid space.³ Baricity of local anaesthetic can be more (hyperbaric), equal (isobaric) or less hypobaric than cerebrospinal fluid. A study concluded that hyperbaric Bupivacaine produces adequate sensory and motor blockade at the cost of haemodynamic stability as compared to isobaric Bupivacaine.⁴

A randomized double blind study showed more haemodynamic changes and subject feeling of nausea in hyperbaric group as compared to isobaric group.⁵ Another study showed both hyperbaric and isobaric Bupivacaine produces adequate block without any difference in haemodynamics.⁶

Not much work is done in comparing the hemodynamic effects of 0.5% and 0.75% hyperbaric Bupivacaine. There was no international study found by the researcher on the study topic. In Stan study was conducted in year 2009 which compared the haemodynamic

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changes between intrathecal administration of 0.5% and 0.75% hyperbaric Bupivacaine in patients undergoing cesarean section under spinal anaesthesia.⁷

In 0.75% Bupivacaine group mean systolic blood pressure at 4 min was 109.20 ± 21.17 and 0.5% group was 113.23 ± 20.27 . For heart rate Mean \pm SD for group I (0.75%) 104.57 ± 21.90 and for group 2 (0.5%) 100.40 ± 18.54 .

In our setup, 90% of the cesarean sections are done using 0.75% hyperbaric Bupivacaine. The rationale of this study was to compare the haemodynamic effects of 0.5% and 0.75% hyperbaric Bupivacaine so that the superior drug which would produce less haemodynamic effects can be implemented in our setups in the procedure of caesarean section in spinal anaesthesia.

METHODOLOGY

This quasi-experimental study was conducted at department of Anaesthesiology, Combined Military Hospital, Malir from July 2018 to December 2018. The sample size was calculated by keeping significance level = 5%, power of study = 80% and anticipated Population mean=109 and SD=20.5,7 n=830 (415 patients) in each group were equally divided. Patients were enrolled by applying non-probability, consecutive sampling technique as we had to follow the below stated selection criteria.

Inclusion Criteria: All females aged 18-40 years, with American Society of Anaesthesiology (ASA) physical status 1 and 2, undergoing elective caesarean section at term were included.

Exclusion Criteria: Females with any obstetric complication, evidence of fetal compromise, having cardiac, neurological, and spinal disease were excluded.

The patients were assigned in two groups (A and B) using lottery method. Detailed data of patients was collected including age, weight, gestational age and ASA status. Group A received 0.5% hyperbaric Bupivacaine solution. Group B received 0.5% hyperbaric Bupivacaine solution. Caesarean section was performed electively in the obstetric operation theatre of Combined Military Hospital Malir under spinal anaesthesia. Patients were preloaded with infusion of 500ml of Ringers lactate solution. Spinal anaesthesia was instituted in subarachnoid space at the level of L3-L4 interspace. After the spinal injection, patients were placed in supine position. The trainee recorded the haemodynamic parameters including systolic blood pressure, diastolic blood pressure and heart rate. Blood pressure

was monitored by standardized non-invasive blood pressure monitoring and heart rate was recorded by electrocardiogram. The values of systolic blood pressure and heart rate were recorded at 4th min after institution of spinal anaesthesia and these variables were filled up on the proforma.

Data were entered and analyzed through Statistical Package for the social sciences (SPSS) version 23. Quantitative variables like age, weight, systolic blood pressure and heart rate were presented as mean and SD. Qualitative variables like ASA status were presented as frequency and percentage. Both groups were compared for mean systolic blood pressure and heart rate by using independent sample t-test. The *p*-value of ≤ 0.05 was kept as significant.

RESULTS

In this study, total 830 patients were enrolled with the mean age of patients was 29.62 ± 6.21 years in 0.75% Bupivacaine group while 29.31 ± 6.20 years in 0.5% Bupivacaine group. There was no significant difference in both groups (*p*-value=0.471). In 0.75% Bupivacaine group, there were 254 (61.20%) patients with ASA I and 161 (38.80%) had ASA II. In 0.5% Bupivacaine group, there were 258 (62.20%) patients with ASA I and 157 (37.8%) had ASA II (*p*=0.775). The mean weight of patients was 70.66 ± 10.93 kg in 0.75% Bupivacaine group while 68.89 ± 12.23 kg in 0.5% Bupivacaine group (*p*=0.028). The mean systolic blood pressure of patients was 111.63 ± 5.96 mmHg in 0.75% Bupivacaine group while 117.16 ± 7.12 mmHg in 0.5% Bupivacaine group. The difference was significant in both groups (*p*-value <0.001). The mean heart rate of patients was 67.47 ± 4.54 bpm in 0.75% Bupivacaine group while 77.48 ± 4.62 bpm in 0.5% Bupivacaine group. The difference was significant in both groups *p*-value <0.001 (Table).

Table: Characteristics of the study groups.

Parameters	Study Groups		<i>p</i> -value
	0.75% Bupivacaine	0.5% Bupivacaine	
No. of Patients	415	415	
Age (Years)	29.62 ± 6.21	29.31 ± 6.20	0.471
American Society of Anesthesiologists			
I	254 (61.20)	258 (62.20%)	0.775
II	161 (38.80%)	157 (37.80%)	
Weight (kg)	70.66 ± 10.93	68.89 ± 12.23	0.028
Systolic Blood Pressure (mmHg)	111.63 ± 5.96	117.16 ± 7.12	<0.001
Heart Rate (bpm)	67.47 ± 4.54	77.48 ± 4.62	<0.001

DISCUSSION

Now-a-day, mostly caesarean sections are done under spinal anaesthesia.⁸ Bupivacaine is commonly

used for induction of spinal anesthesia during caesarean section. Hyperbaric 0.5% Bupivacaine and hyperbaric 0.75% Bupivacaine are two commonly used concentrations of Bupivacaine. Some studies have compared the effects of hyperbaric 0.5% Bupivacaine with hyperbaric 0.75% Bupivacaine on hemodynamics and have found no significant differences in both of these drugs and have recommended that 0.5% Bupivacaine is better than 0.75% hyperbaric Bupivacaine but on the basis of unclear evidences.^{7,9} Reduced doses of Bupivacaine can also reduce the occurrence of hypotension and other anesthesia related complications. This low dose of Bupivacaine may also be related to the better maternal cardiac output.^{8,10}

In our study, the mean systolic blood pressure of patients was 111.63 ± 5.96 mmHg in 0.75% Bupivacaine group while 117.16 ± 7.12 mmHg in 0.5% Bupivacaine group. There was significant difference between both groups ($p < 0.05$). The mean heart rate of patients was 67.47 ± 4.54 bpm in 0.75% Bupivacaine group while 77.48 ± 4.62 bpm in 0.5% Bupivacaine group. There was significant difference between both groups ($p < 0.05$). Thus 0.5% hyperbaric Bupivacaine is superior to 0.75% hyperbaric Bupivacaine, as the mean systolic blood pressure was near to normal blood pressure range, also the heart rate was near to normal with 0.5% hyperbaric Bupivacaine as compared to 0.75% hyperbaric Bupivacaine.

Goyal *et al*, also found significant difference in systolic blood pressure. In their study, systolic blood pressure after 5 minutes of spinal anesthesia was 109.20 ± 21.17 mmHg in 0.75% hyperbaric Bupivacaine patients and 113.23 ± 20.27 in 0.5% hyperbaric Bupivacaine patients.¹ In 0.75% Bupivacaine group mean systolic blood pressure at 4 min was 109.20 ± 21.17 and 0.5% group was 113.23 ± 20.27 . The mean heart rate for group I (0.75%) was 104.57 ± 21.90 bpm and for group 2 (0.5%) was 100.40 ± 18.54 bpm.⁷

However, another study found that mean systolic blood pressure was 108.30 ± 22.16 mmHg with 0.5% hyperbaric Bupivacaine while 112.33 ± 21.27 mmHg with 0.75% hyperbaric Bupivacaine. The difference was insignificant (p -value > 0.05). Similarly, mean heart rate was 101.50 ± 19.64 bpm with 0.5% hyperbaric Bupivacaine while 103.57 ± 22 bpm with 0.75% hyperbaric Bupivacaine. The difference was insignificant (p -value > 0.05).⁹

Rai *et al*, found that after 5 minutes of spinal anesthesia, systolic blood pressure significantly dropped in patients who received 0.75% hyperbaric Bupiva-

caine as compared to patients who received 0.5% Bupivacaine 107.95 ± 13.49 mmHg versus 112.76 ± 11.49 mmHg, respectively with p -value 0.007. After 10 minutes of anesthesia there was no difference in systolic blood pressure in both groups. There was significant difference in heart rate after 10 minutes of anesthesia and decrease in heart rate was more in group II (p -value=0.006). Nausea, vomiting occurred in 23% patients in group II and in only 1% patients in group I. Rescue ephedrine was given in 21% patients in group I and 35% patients in group II. Level of block was T6 in 25% patients in group I and 47% patients in group II (p -value=0.001). Thus 0.5% hyperbaric Bupivacaine has less haemodynamic instability and less chance of bradycardia, less need for rescue ephedrine or nausea and vomiting.¹¹

Seyedhejazi *et al* conducted a trial and observed that the mean 4 mg dose of ephedrine was required for hemodynamic stability with low dose Bupivacaine while 11.75mg with high dose of Bupivacaine (p -value = 0.006). The mean ratio of least systolic blood pressure achieved during procedure to the systolic blood pressure at baseline was 0.75 in low dose Bupivacaine while 0.65 in high dose Bupivacaine (p -value=0.04). Nausea & vomiting were observed in 10% patients in low dose Bupivacaine group while in 20% patients in high dose Bupivacaine group. Hence, the low dose of Bupivacaine offers a good spinal anaesthesia for caesarean sections with less chances of hypotension, nausea & vomiting.¹²

However, Rani *et al*, found that after 60 minutes, the mean heart rate was 76.90 bpm with low dose while 76.20 bpm with high dose, the mean systolic blood pressure was 127.60 mmHg with low dose while 128.32 mmHg with high dose of Bupivacaine and mean diastolic blood pressures was 84.18 mmHg with low dose and 84.24 mmHg with high dose of Bupivacaine.¹³

Another study, conducted by Solakovic *et al*, the haemodynamic features were compared in 0.5% hyperbaric versus isobaric Bupivacaine. Findings were statistically significant, showing that the baricity was very important effect on behavior of basic haemodynamic characteristics in decreasing the blood pressure and decelerating the pulse rate. Simultaneously, isobaric Bupivacaine showed little deviation in these characteristics.¹⁴

It has been observed that women undergoing caesarean section and receiving higher doses of Bupivacaine 12-15mg causing peripheral vasodilatation which may increase the maternal and neonatal morbidity, so

optimal spinal dose of Bupivacaine has to be sought for prevention of these risks.¹⁵⁻¹⁸

CONCLUSION

Thus 0.5% hyperbaric Bupivacaine was superior to 0.75% hyperbaric Bupivacaine for spinal anaesthesia during caesarean section. Now in future, we will use 0.5% hyperbaric Bupivacaine for spinal anaesthesia which produces less hemodynamic effects which can be implemented in our setups in the procedure of caesarean section done in spinal anaesthesia.

Conflict of Interest: None.

Authors' Contribution

HI: Study design, data collection, AA: Final approval, HUR: Drafting of manuscript, ZA: Tabulation of results, MAA: Literature review, ZH: Critical review, proof reading.

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