MEDICAL CHANNEL

Original Article

A STUDY TO ASSESS THE QUALITY OF SPINAL ANESTHESIA AND TO OBSERVE HEMODYNAMIC CHANGES OCCURING DURING CESAREAN SECTION WITH SPINAL ANESTHESIA, COMPARING 0.5% ISOBARIC BUPIVACAINE AND 0.75% HYPERBARIC BUPIVACAINE IN SAME VOLUME AND DOSE.

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ABSTRACT

Objective: of this study is to assess the quality of spinal anesthesia block and observe hemodynamic changes occurring during c-section, comparing two different baricities of bupivacaine i.e. 0.5% isobaric and 0.75% hyperbaric in same doe and volume.
Design: Quasi experimental study.
Place and Duration of Study: Department of Anesthesiology and ICU, Shalamar Hospital, Lahore, from April 2007 to October 2007.
Patients and Methods: Sixty, adult patients of ASA I and II, undergoing elective lower segment cesarean section were included in this study. The patients were randomly divided into two groups, Group-I received isobaric 0.5% bupivacaine 2.5 ml (12.5 mg) and group-II received Hyperbaric 0.75% bupivacaine 2 ml in which 1 ml of CSF was added and then 2.5 ml injected (12.5 mg), so that both groups receive equal volume and dose of bupivacaine but different baricities.
Quality of block was assessed by pin prick and Bromage Scale for sensory and motor block respectively. Hemodynamic changes were compared with the base line readings. .
Results: No significant difference was found between the two groups regarding the quality of block but there were significant hemodynamic differences, in group-I, initial maximum increase in heart rate and decreases in MAP were observed at 2 minutes. While in group-II, maximum increase in heart rate was observed immediately after injection and maximum decrease in MAP was at 2 minutes. This shows that there was immediate decrease in MAP, which may be due to faster onset of sensory block in group-II, when compared with group-I.
Conclusion: No significant differences were found between the two groups regarding the quality of block. But the rapid onset of sensory block with 0.75% hyperbaric bupivacaine in group 11 produced more hypotension, when compared with 0.5% isobaric bupivacaine in group 1 but it was not statistically significant.

Key words: Spinal anaesthesia, Bupivacaine, isobaric, hyperbaric, block quality, hemodynamic change in c- section after spinal.

INTRODUCTION

Spinal anaesthesia is a common technique used for most of the lower abdominal and lower extremity surgeries[1]. Many researches have been done on spinal anaesthesia to understand the cause of block failure or inadequate block and to produce good quality block[2, 3, and 4]. In this study two different baricities of bupivacaine are compared to assess the quality

of spinal block and hemodynamic changes occurring during cesarean section.

Total numbers of 60 patients were included in the study, for lower segment cesarean section. Making two groups, group-I (n=30) received isobaric 0.5% bupivacaine 2.5 ml (12.5 mg) and group-II received hyperbaric 0.75% bupivacaine 2 ml in which 1 ml of CSF was added and then 2.5 ml injected (12.5 mg), so that both groups receive equal volume and dose of bupivacaine, but different baricities.

Quality of block was assessed by pin prick and Bromage Scale for sensory and motor blocks respectively. Hemodynamic changes were compared with the base line readings.

PATIENTS AND METHODS

This quasi experimental study was conducted in the department of anesthesiology and ICU, Shalamar hospital Lahore. After satisfying inclusion and exclusion criteria and after approval from research and ethical committee, 60 patients were included in this study. Patients were allocated into two groups, group I (n=30) received 0.5% isobaric bupivacaine and patient in Group II (n=30) received 0.75% hyperbaric bupivacaine for spinal anaesthesia. Both groups were comparable in respect to age, weight and base line hemodynamic status and underwent lower segment cesarean section.

Preoperative evaluation included, detailed history, general, physical and systemic examination. Examination of spine and airway. Routine laboratory investigation included; complete blood count, blood sugar, PT and APTT if indicated. Preoperative vital signs were recorded in the ward during preoperative visit. All patients received 1.5 ml/kg/hour ringer's solution since NPO.

Upon arrival in operation theater all patients were monitored with ECG lead II, NIBP monitor and pulse oximeter. A 2nd 18 g intravenous cannula was inserted on arrival in OR. All patients were preloaded with 500 ml ringer's solution. Hemodynamic variables were allowed to stabilize before base line data were collected. Two base line readings of blood pressure and heart rate were taken before spinal anesthesia. Spinal anesthesia was performed using 25 G spinal needle in sitting position at L_{3-4} interspace.

Patients divided into 2 groups by using random numbers table.

Group I: - Received 0.5% bupivacaine 2.5 ml (12.5mg).

Group II: - Received 0.75% Bupivacaine 2 ml in which 1 ml of CSF was added and then 2.5 ml was injected (12.5 mg). Thus we injected equal volume and dose of bupivacaine in both groups. Patients were then made to lie supine. Height of analgesia, motor power in legs, heart rate and blood pressure were assessed by a single observer, who was unaware of the type of drug injected. Assessments were made at 2 minutes interval initially for first 10 minutes, then at 5 minutes interval until the end of procedure and every 15 minutes until recovery of block in post anaesthesia unit. Motor block assessed by modified Bromage Scale. Sensory block assessed by cutaneous pinprick and patient satisfaction by dividing them into three groups; unsatisfied, satisfied and good. Fall in systolic arterial pressure of more than 25% from base line was treated with Ringers solution. If hypotension persisted ephedrine was given.

Patients were discharged from recovery room after meeting the following criteria;

Oriented with stable vital signs, with no surgical complications, adequate pain control and resolution of motor and sensory block at or below $S_{3.}$

The results were analyzed using Student's test, to see if there was a significant difference between the two groups regarding quality and height of block.

All collected information was entered into SPSS version 11 and was analyzed through its statistical package. Data was expressed as mean ± SD where appropriate.

Statistical analysis of data, which include age, weight, height, onset of sensory and motor block, height of block, recovery of block, duration of surgery, change in pulse and mean arterial blood pressure and ephedrine given was performed by student "t" test. Categorical variable such as height of block was compared using the chi-square test. Probability value (p-value) less than 0.05 was considered as statistically significant.

Inclusion criteria.

- Candidates for elective cesarean section.
- Patients willing for spinal anesthesia.
- ASA physical status I and II.
- Patients having no medical problem.
- Age between 20 to 40 years.
- Normotensive.
- Normal height and stature.

Exclusion criteria.

- Emergency c- section
- Refusal of patient for spinal anesthesia.
- ASA physical status I and II.
- Patients having history of hypertension or hypotension.
- Patient with pre-existing cardiac or pulmonary disease.
- Patient with abnormality of spine.
- Patients with bleeding disorder.
- Patients on anticoagulant therapy.
- Patients having infection at the site of lumbar puncture.
- Patients having allergy to local anesthetics,
- Patients with untreated hypovolemia.

RESULTS

All the 60 cases under gone lower segment cesarean section.

The demographic data was compared among the two groups. Statistically no significant difference between the two groups was observed with respect to age, weight and height.

Quality of block was comparable in both groups and no significant difference found between the two groups.

Onset of sensory block (minutes) in group-I was 5 ± 2 and in group-II 4.8 ± 2 (p 0.5). **Onset of motor block** (minutes) in group-I was 8 ± 2 and group-II 7.97 ± 2 (p 0.71).

Recovery of block (minutes) in group-I, 134 ± 31 and group-II, 129 ± 28 (p 0.5). **Duration of surgery** (minutes) in group-I, 42 ± 12 and in group-II, 44 ±14 (p 0.56)

DISCUSSION

This study, was conducted to assess the quality of spinal anesthesia and hemodynamic changes occurring during cesarean section comparing two different baricities of bupivacaine that is 0.5% isobaric (group-I) and 0.75% hyperbaric (group-II). Increased incidence of failed block or inadequate block and hemodynamic instability led many researchers to work on spinal anesthesia[5, 6, 7]; this study is one of them. The aim is to improve the quality of block and reduce hemodynamic instability.

The technique was standardized with respect to age, weight and height of patient. L3-4 interspace was selected in all patients. 25 G (BD) spinal needle was used and 12.5 mg (2.5 ml) of bupivacaine

TABLE 1.
PROCEDURE DATA SHOWS QUALITY OF BLOCK.

	n	Minimum	Maximum	Mean± SD	n	Minimum	Maximum	Mean± SD	P
Onset of Sensory block in minutes	30	2	9	5±2	30	2	11	4.8±2	0.5
Onset of Motor block in minutes	30	5	11	8±2	30	5	13	7.97±2	0.71
Recovery of block in minutes	30	95	210	134±31	30	100	200	129±28	0.51
Duration of Surgery	30	25	65	42±12	30	23	75	44±14	0.56

Data are expressed as extreme [min-max] or as mean ± SD.
There is no significant difference between the groups.
Height of block was comparable in both groups and no significant difference found between the two groups (p 0.91)

TABLE 2.
PROCEDURE DATA SHOWS HEIGHT OF BLOCK.

GROUP-I			GROUP-II		
Height of block	**Frequency**	**Percent**	**Height of block**	**Frequency**	**Percent**
T_4	19	63	T_4	19	63
T_6	7	23	T_6	7	23
T_8	2	6.7	T_8	3	10
T_{10}	2	6.7	T_{10}	1	3
Total	30	100	Total	30	100

Data are expressed as percentage of patients.

Motor block was assessed by using modified Bromage scale. All patients had complete motor block. Hemodynamic changes were compared in both groups. Heart rate initially increased in both groups, which was statistically significant. The maximum increase in heart rate after injection of local anaesthetic was 10.6% at 2 minutes in group-I ($p<0.001$) and 11% immediately after injection of local anaesthetic in group-II ($p <0.001$).
Mean arterial pressure (mmHg) decreased in both groups and was statistically significant. The maximum decrease was 18.6 % at 2 minutes in group-I ($p < 0.001$) and 20 % reduction at 2 minutes in group-II ($p <0.001$) (Table 3 & 4).

0.5 % in group-I and 0.75 % bupivacaine in group-II given in subarachnoid space. So that equal amount and dose given in both groups.
The observations in our study regarding the quality of block showed no significant difference between the two groups. Although the onset of sensory and motor block was quicker with 0.75% hyperbaric bupivacaine i.e. group11 but it was not statistically significant.
These observations were supported in the study performed by Xu L et al 2005[8]. The onset time of peak sensory block in group 11 was shorter when compared with group 1. A study performed by Rene Martin in 2000 [9], concluded that motor and sensory block develops more rapidly (five minutes) in the isobaric group ($P <$ 0.05). But both isobaric and hyperbaric bupivacaine produced adequate upper levels of analgesia for surgery. In this study significant drop in mean arterial blood pressure was observed in both groups being more severe in hyperbaric group11, when compared with isobaric group1. 33.3 % of patients required treatment with ephedrine to treat hypotension in isobaric group and 66.6 % patients in hyperbaric group11.
A study done by Critchley et al 1999[10] supports this observation. The onsets of hemodynamic and sensory changes were more rapid when using heavy bupivacaine intrathecally. This leads to a higher and earlier incidence of hypotension and needs treatment.
Regarding the height of block no significant difference was found between two groups. All of our patients had complete block and patients were satisfied regarding the block.
Sarvela PJ 1999 study shows similar levels achieved with isobaric and hyperbaric bupivacaine (T5) [11]
Malinovsky JM 1999 concluded that a greater maximal cephalad spread of anaesthesia was obtained with diluted isobaric bupivacaine but was not associated with more hypotension.[12]
Hallworth SP et al 2005 [13] reported higher levels with isobaric solution achieving a median maximum sensory level to T2 compared with T3 for the hyperbaric solution.
Recovery of sensory and motor block was early in hyperbaric group when compared with isobaric group but statistically it was

TABLE 3.
PROCEDURE DATA SHOW CHANGE IN MAP (MMHG).

GROUP-I					
Time	**n**	**MAP Mean±SD**	**Difference Mean**	**Percent Difference**	**P**
Base Line	30	85.8±9.5			
After Injection	30	77±11	8.4	9.9	<0.001
After 2 minute	**30**	**70±10**	**15.9**	**18.6**	**<0.001**
After 4 minutes	30	78.6±8	7	8	0.01
After 6 minutes	30	77.7±10	8	9.5	0.007
After 8 minutes	30	80.7±7	5	5.9	0.018
After 10 minutes	30	80±8	5.7	6.7	0.005
After 15 minutes	30	81±10.6	4.6	5.4	0.08
After 20 minutes	30	80±10.2	5.8	6.7	0.04
After 30 minutes	30	81±8.5	4.3	5	0.11
After 45 minutes	30	80±7	6.9	7.8	0.12

Data are showed as mean ± SD.

TABLE 4.
PROCEDURE DATA SHOW CHANGE IN MAP (MMHG).

GROUP-II					
Time	**n**	**MAP Mean±SD**	**Difference (Mean)**	**% Difference**	**P**
Base Line	30	84±8.7			
After Injection	30	74±7	9.7	11.5	<0.001
After 2 minutes	**30**	**67±12.6**	**16.9**	**20**	**<0.001**
After 4 minutes	30	73±11	10.8	12.9	<0.001
After 6 minutes	30	75.9±12	8.2	9.7	0.003
After 8 minutes	30	77.9±10	6	7.3	0.01
After 10 minutes	30	77.9±8.2	6	7.3	0.005
After 15 minutes	30	79.2±9	4.8	5.8	0.015
After 20 minutes	30	81.6±9.5	2.4	2.9	0.32
After 30 minutes	30	78±10	5.9	6.9	0.008
After 45 minutes	30	79±11	5	5.9	0.12

Data are showed as mean ± SD.

In group-I, (33.3 %) 10 patients out of 30 received ephedrine.
In group-II, (66.6 %) 20 patients out of 30 received ephedrine.
Significant difference observed between the two groups (p 0.01).

not significant.

CONCLUSION

This study has demonstrated that both isobaric and hyperbaric bupivacaine can produce adequate level of anaesthesia for surgery. Although the rapid onset of sensory block with hyperbaric bupivacaine produced more hypotension when compared with isobaric bupivacaine but it was not statistically significant.

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AUTHORS CONTRIBUTION

Author 1st is principle Author and overall investigator, involving in planning and drafting. Author 2 is subject specialist, Author 3, 4, 5 work involved in designing, data analysis and interpretation & data analysis.