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Comparative Study of Low Dose Vs Regular Dose of Bupivacaine in Patients with Pregnancy Induced Hypertension undergoing Caesarean Section under Spinal Anaesthesia

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Abstract: ***Neuraxial administration of local anesthetics improves the quality of intraoperative analgesia and also provides postoperative pain relief for longer duration. The present study was conducted to study and compare the effects of low dose bupivacaine used intrathecally in parturients with PIH. 25 ASA grade II patients with PIH defined as blood pressure between 140-160 / 90-110 mmHg without proteinuria were selected and divided into 2 groups as Group (I)-Low Dose Bupivacaine and Group (II)-Regular Dose Bupivacaine-. Haemodynamic variables like systolic and diastolic blood pressure, heart rate were recorded every 2 minutes upto delivery of baby and then every 5 minutes until end of surgery. We conclude the low dose bupivacaine group does not cause any significant side effects and provides stable haemodynamic conditions without fetal or maternal compromise.***

1. Introduction

Spinal anaesthesia has been widely used for caesarean section in normal as well as preeclamptic parturients and has been found to be efficacious and safe. Although hypotension due to decrease in systemic vascular resistance resulting from the blockade of preganglionic sympathetic fibres remains a problem with all central neuraxial blocks; the action of local anaesthetics can be of great benefit in achieving adequate anaesthesia with lesser dose of local anaesthetics, thereby reducing chances and severity of hypotension.[9] Bupivacaine was the first local anaesthetic that produced adequate anaesthesia. Considering the above facts, we designed the present study using low dose bupivacaine to assess the hemodynamic stability, perioperative analgesia and neonatal outcome in pregnancy induced hypertensive patients

2. Materials and methods

25 ASA Grade II patients with pregnancy induced hypertension scheduled for elective lower segment caesarean section under spinal anaesthesia were included in the study. Patients were thoroughly explained regarding nature of the study. Pregnancy induced hypertension was defined as blood pressure between 140 –160 / 90 – 110 mm Hg without proteinuria. Patients with singleton uncomplicated pregnancy was included.

Patients with eclampsia, coagulation abnormalities, thrombocytopenia, patients in labour and those with foetal distress requiring emergency caesarean section, any drug allergy, spinal deformity or any other standard contraindication to spinal anaesthesia were excluded from the study. Patients were randomly allocated to 2 groups of 25 each.

Group I received 1.8 Or 2 ml of 0.5 % hyperbaric bupivacaine.

Group II received 2.2 ml of 0.5 % hyperbaric bupivacaine,

All the patients received premedication 45 minutes prior to scheduled surgery. Baseline systolic blood pressure, diastolic blood pressure, heart rate and oxygen saturation was recorded with the patient in semi recumbent position.

Patients were placed in sitting position and under all aseptic precautions; lumbar puncture was performed with 25 gauge Quincke spinal needle at L_3-L_4 intervertebral space. Free flow of CSF was confirmed. Patients were randomly allocated to either of the two groups and received either 2 ml of 0.5% hyperbaric bupivacaine or 1.8 ml of 0.5% hyperbaric bupivacaine. Hemodynamic variables like systolic blood pressure, diastolic blood pressure and heart rate were recorded every 2 minutes up to delivery of baby and then every 5 minutes until the end of surgery. Hypotension (MAP decrease of $\geq$ 20%) was recorded and treated by mephentermine 3mg and Bradycardia (HR<50bpm) with atropine 0.3mg boluses. Sensory testing was performed using a 21 gauge needle in a cephalad to caudal fashion. Dermatome level was tested every 2 minutes until the level stabilized for 3 consecutive tests. A sensory blockade up to T_5 was considered adequate to allow surgery to proceed. The time taken from intrathecal injection to attainment of the highest level of sensory block was recorded. The time for sensory regression to T_{12} from highest sensory level was also noted. Motor block was assessed as per Bromage scale. Duration of motor block was recorded from onset up to cessation of grade I block.

Side effects such as pruritis, nausea and vomiting, shivering, respiratory depression and urinary retention were recorded every 5 min for first 30 min, then at 10 min interval for remainder of the operation. Thereafter, patient was followed in post-operative ward for assessment of motor block, sensory regression and duration of complete analgesia. Rescue analgesia was given at a VAS score of 3 or more. Pain was evaluated using a standard 10 cm linear visual analog scale with 0 corresponding to no pain and 10 to the worst pain possible.

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3. Results

All the patients in the 2 groups were comparable with respect to age, weight, baseline SpO2 in the two groups. (Table 1)

Figure 1

Table 1: Comparison of Age and Weight and SpO2 of the Studied Parturients in Group I and Group II

	Control (Group I)				Study (Group II)				p value
	Min	max	Mean	SD	min	Max	Mean	SD	
Age (Years)	22	31	26.8	2.8	21	31.0	26.3	2.7	0.538 (NS)
Weight (Kg)	57	82	68.6	6.2	61	80.0	69.8	6.3	0.485 (NS)
SpO2 (%)	94	98	96.6	1.2	94	98	96.5	1.1	0.771 (NS)

NS: Not-significant

An adequate surgical block was documented before start of surgery and the time taken to reach this level was comparable between the two groups. Although there was no significant difference in the onset of sensory block and height of maximum sensory blockage between the two groups.

There was a significant difference (p value 0-000) in the time to regression of sensory anaesthesia below T12 dermatome. It was 162.6 ±10.5 min in group I and 209.9 ±11.6 min. in group 2. Time to achieve maximum motor block and the degree of motor block was comparable.

And all patients achieved motor block within 10 min. Time to complete resolution of motor block did not differ between the two groups (Table 2)

Figure 2

Table 2: Spinal Block Characteristics

	Control Group	Study Group
Time to sensory block to T4 (min)	6.5 ± 1.5	6.3 ± 1.5
Time to complete motor block (min)	7.3 ± 3	7.7 ± 2.2
Time taken for sensory regression to T12 (min)	162.6 ± 10.5	209.9 ± 11.6
Time to complete regression of motor block (Bromage 0)	170.0 ± 19.7	170.0 ± 13.9
Time from injection to 1st dose of supplemental analgesia	234.7 ± 32.9	326.1 ± 50.0

There were no significant changes in BP in the two groups till 4 min. after giving spinal block. Thereafter there was a fall in BP in both the groups at 4 and 6.min. However this was not < 20% of baseline in all patients. The fall was comparable between the two groups and did not vary significantly between the two groups. (Table 3)

The total requirements of mephentermine and i.v. fluids were similar in the two groups. One patient in the study group and three in the control group required mephentermine.

Figure 3

Table 3: Haemodynamic data

Blood Pressure (mmHg)	Control Group	Study Group
Highest Systolic (Pre- operative)		
Mean Systolic	138.9 ± 9.7	136.4 ± 10.1
Absolute Systolic	156	154.0
Highest Diastolic (Pre- operative)		
Mean Diastolic	91.3 ± 4.9	88.4 ± 6.9
Absolute Diastolic	100	100
Lowest Systolic (Intra operative)		
Mean Systolic	119.7 ± 12.4	123.8 ± 5.7
Absolute Systolic	90	88
Lowest Diastolic (Intra operative)		
Mean Diastolic	77.1 ± 5.6	79.0 ± 3.2
Absolute Diastolic	50	60

Duration of postoperative analgesia measured by the time to first dose of diclofenac was significantly longer in study group (326.1min.) compared to control group (234.7 32.9min.)[p=0-000].

Figure 4

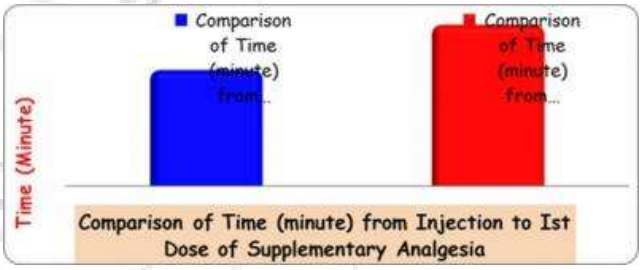

Figure 5

Two patients in the control group and one in the study group had bradycardia, the statistical difference being insignificant. None of the patients complained of pruritis, respiratory (maternal / neonatal) or urinary retention. Incidence of nausea and vomiting in the control group was 3 times more than the fentanyl group but on application of students t-test the p value >0.05 showed insignificant statistical difference.

Table 4: Comparison of Side Effects in Group I and Group II.

	Control (Group I)		Study (Group II)		p value
	N	%	N	%	
Hypotension	3	12.0	1	4.0	0.302 (NS)
Bradycardia	2	8.0	1	4.0	0.556 (NS)
Pruritis	0	0.0	0	0.0	1.000 (NS)
Nausea/ Vomiting	3	12.0	1	4.0	0.297 (NS)
Shivering	1	4.0	0	0.0	0.312 (NS)
Respiratory Depression (Maternal)	0	0.0	0	0.0	1.000 (NS)
Urinary Retention	0	0.0	0	0.0	1.000 (NS)
Respiratory Depression (Neonatal)	0	0.0	0	0.0	1.000 (NS)

NS: *Not-significant*

Figure 6

Table 5: Neonatal outcome

	Control Group	Study Group
Birth Weight (gms)	3218 ± 393	3282 ± 408
1 min Apgar Score ≤ 7	9/25 (36%)	8/25(32%)
5 min. Apgar Score > 7	25/25 (100%)	25/25 (100%)

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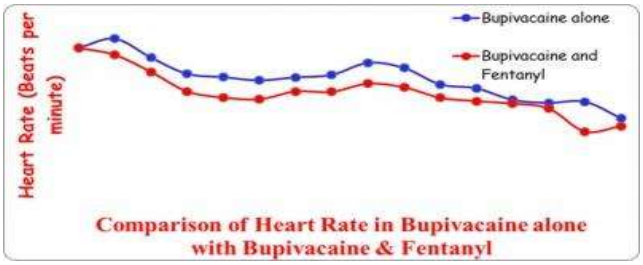

Figure 7

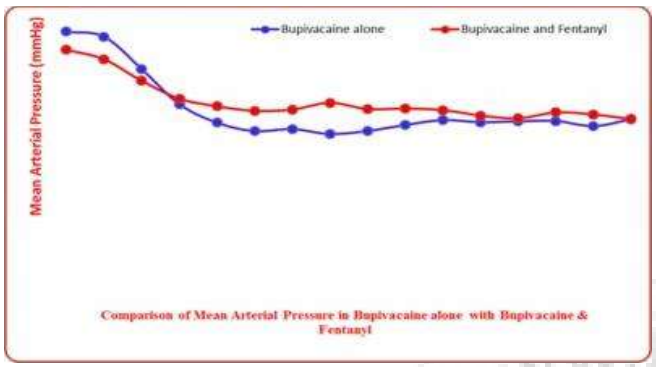

Figure 8

4. Discussion

Pre-eclamptic parturient patients present a challenge to the anesthetist because of problems that pre-eclampsia poses to the fetus and mother. The mother may develop cardiopulmonary and cardiorespiratory emergencies in addition to acute renal failure, severe thrombocytopenia and activation of the coagulation cascade [13] Efficacy and safety of spinal anesthesia with Bupivacaine has been studied by various investigators in preeclamptic patients for caesarean section with varying doses of bupivacaine

1 patient in the study group and 2 in the control developed bradycardia (HR < 50bpm), the incidence on comparison being insignificant. the findings being in accordance with similar studies [7,20,21]

Parturients in both our groups showed a significant fall in MAP by 4-6 minutes, this fall was less than 20% of the baseline and was comparable in both the groups. Hypotension was defined as a decrease in mean arterial blood pressure by ≥ 20% and treated with mephenteramine 3mg boluses. One patient in study and 3 in control group developed hypotension; the incidence was insignificant as found. Similarly when diastolic blood pressure and mean arterial blood pressure were compared at all time intervals the results were statistically insignificant p value.>0.05.

Wallace etal[2] used higher dosage of Bupivacaine (11.25mg) as compared to our study but their patients had a greater fall in MAP (25%). This may be due to the inclusion of laboring patients, who have pain and a relatively elevated MAP which produce exaggerated apparent decrease in BP after spinal anaesthesia[22].We excluded laboring patients from our study.

The time taken for sensory regression to, T_{12} in study group was 209.9 ± 11.6 min while in control group it was 162.6 ± 10.5 min. Onset of motor block and regression of motor blockade were comparable in both the groups.

The side effect profile of this study revealed nausea and vomiting in 3 patients of control and 1 in study group. No incidence of pruritis, maternal and fetal respiratory depression or urinary retention was reported in our study.

Although studies have shown poor correlation between the degree of hypotension during regional anaesthesia and neonatal umbilical acid-base status and uteroplacental perfusion[32], one of the limitations of this study was that umbilical pH and blood gas status could not be done for evaluation of fetal outcome.

5. Conclusion

The low dose Spinal bupivacaine resulted in lesser intraoperative hypotension in pregnancy induced hypertension patient compared to regular dose. Postoperative complications were also less with low dose bupivacaine in PIH patients.

Figure 9

Table 6: Comparison of Observed Parameters between the following studies

	Our study	B N Biswas et al	Mahajan R et al	Harbhej Singh et al
Highest sensory level achieved	T_4	T_5	T_4	T_7
Time to highest sensory level (min)	6.3 ± 1.5	7 ± 2.4	3.8 ± 2.1	7.5 ± 3.2
Time for sensory regression (min)	To T_{12}: 209.9 ± 11.6	To L_1: 151 ± 7.33	To T_{12}: 240 (mean)	To L_1: 141 ± 37
Onset of Grade III motor Block (min)	7.7 ± 2.2	5.4 ± 1.1	9.1 ± 7.6	8.6 ± 4.1
Recovery time to Bromage grade 0 (min)	170 ± 13.9	127 ± 7.1	128 ± 19.26	169 ± 37
Time taken from injection to Ist dose of supplemental analgesia (min)	326.1 ± 50	248 ± 11.76	358.8 ± 114	-
Hypotension	4%	30%	-	43%
Bradycardia	4%	20%	-	14%
Pruritis	0%	0%	-	2%
Nausea/ Vomiting	4%	5%	-	0%
Shivering	0%	5%	-	0%
Respiratory Depression (Maternal)	0%	0%	-	0%
APGAR Score 1 Min	7 – 9	7 – 9	<7 (2 out of 14 patients)	-
5 Min	9 – 10	9 – 10	<7 (1 out of 14 patients)	-

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