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ORIGINAL ARTICLE

The effect of addition of intrathecal sufentanil to hyperbaric bupivacaine in cesarean section- a prospective randomized study

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ABSTRACT

Aim: Present study was done to evaluate the influence of addition of sufentanil to bupivacaine 0.5% heavy, on various characteristics of subarachnoid block, when given to parturients.

Methodology: The present prospective randomized clinical study of 60 patients was carried out in the Department of Anesthesiology, Government Medical College and SSG Hospital, Baroda. Spinal anesthesia was given in lumbar intervertebral space L3-L4, with midline approach, using 23 G spinal needle. Patients were randomly divided into two groups, to receive either inj bupivacaine heavy 0.5% (Group B) or inj bupivacaine heavy 0.5% plus 10 µg sufentanyl (Group BS). Various parameters monitored were vital parameters, sensory block, motor block, neonatal outcome, intra-operative complications, postoperative analgesia and postoperative complications.

Results: The mean time for onset of sensory block was 78.46 ± 2.32 sec in Group B and 37.93 ± 1.39 sec in Group BS. The mean onset of motor block in Group B was 59.2 ± 2.76 sec while in Group BS it was 51.93 ± 1.48 sec. The difference was statistically significant. Patients in Group B were alert (grade 0) intra-operatively whereas majority of patients in Group BS had grade II sedation, denotes that they were sleepy but arousable.

Conclusion: Addition of 1ml (10 µg) sufentanil to 2 ml of bupivacaine heavy (0.5%) intrathecally hastens the onset and prolongs the duration of sensory and motor blockade. Hemodynamic parameters are not affected with the inclusion of sufentanil.

Key words: Bupivacaine; Hemodynamic parameters; Pain; Respiratory rate; Sufentanil

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INTRODUCTION

Researchers Acute pain is by far one of the commonest and distressing symptoms of the disease, and is still quite inadequately managed because of a wide variety of myths, reasons and fears.[1,2] The development of better methods of drug delivery and most importantly, the increased awareness among the general public has improved the practice of pain management.[3,4] Continued unrelieved pain following lower segment cesarean section is very disturbing as the mother has added responsibility of nursing and looking after her newborn.

Regional analgesia techniques using opiates have certain advantages. It offers analgesia without motor or autonomic changes, analgesia is very intense, with fairly quick onset and long duration, depending on the drugs used with fewer side effects than associated with other methods. But some of the drugs used as adjuvants have been associated with side effects like nausea, vomiting, itching and sedation.[5-7]

Different local anesthetic agents have been tried for spinal anesthesia since its introduction into obstetric practice by Kreis in 1900. The most commonly used agents in our country are lignocaine and bupivacaine. However, as a controversy exists regarding the use of spinal lignocaine and the occurrence of transient neurological symptoms, we chose bupivacaine for intrathecal use in our study.[8,9]

Sufentanil is a potent opioid analgesic with a very high receptor affinity and specificity, high lipid solubility, marked protein binding and a shorter elimination half-life than fentanyl. It is twice lipid soluble than fentanyl hence has quick onset of action. Due to very high mu receptor affinity it is five times more potent than fentanyl as far as analgesic activity is concerned.[10]

Looking to its properties, sufentanil has been used along with bupivacaine or xylocaine intrathecally in patients undergoing cesarean section, total hip replacement, genitourinary surgery, extracorporeal shock wave lithotripsy and painless labor, by many workers.

We carried out this study to evaluate the effect of addition of sufentanil to bupivacaine 0.5% heavy on various characteristics of subarachnoid block, when given to parturients.

METHODOLOGY

The present prospective randomized clinical study of 60 patients was carried out in the Department of Anesthesiology, Government Medical College and SSG Hospital, Baroda. Ethical approval was taken from the ethical committee of the Government Medical College and SSG Hospital Baroda, according to Declaration of Helsinki at the beginning of the study and written informed consent was taken from the all of the participants.

Inclusion criteria were: mothers presenting for cesarean section, ASA physical status II, planned or emergency cesarean section, willing to participate in the study, able to understand test for pain assessment.

Exclusion Criteria were: mothers not willing to participate in the study, any contraindications for a spinal anesthesia like – bleeding disorders, local infection, anatomical abnormalities of vertebral column, psychiatric illness, neurologic deficits, history of epilepsy, history of drug allergies, alcohol or substance abuse.

All the mothers had had pre-anesthesia checkup which included history, examination and investigations. They were explained in detail about the procedure, advantages of sufentanil and the possible side effects. Informed written consent was taken.

Premedication was given in the form of atropine 0.5 mg 45 min before the operation in planned cases and t the table in emergency cases. Inj. ranitidine 50 mg and inj. metoclopramide 10 mg were given to all patients 15 min prior to the cesarean section.

Procedure:

After taking the parturient in the operation room, BP monitor and pulse oximeter were applied. Baseline pulse rate, BP, oxygen saturation and respiratory rate were recorded.

Spinal drugs were used as follows;

Group B: (n = 30) parturients received bupivacaine 0.5% heavy 2 ml + normal saline 1 ml.

Group BS: (n= 30) received bupivacaine 0.5% heavy 2 ml + sufentanil 10 μg (1 ml)

The parameters monitored were vital parameters, sensory block, motor block, neonatal outcome, intra-operative complications, postoperative analgesia and postoperative complications.

Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. Descriptive statistics were calculated. Qualitative data were expressed as percentages and proportions. Quantitative data were expressed as mean ± standard deviation. The differences between two groups with respect to continuous variables were analyzed using t-test while categorical variables were analyzed using chi-square test.

RESULTS

Table 1 shows the demographic profile of patients in both the groups. The maximum numbers of patients

Table 1: Demographic profile (Mean ± SD)

Parameters	Group B	Group BS	p value
Age (years)	22.16 ± 2.71	23.93 ± 2.68	> 0.05
Weight (kg)	51.16± 4.8	52.8± 4.07	> 0.05
Height(cm)	152.96± 4.8	154.8± 4.6	> 0.05
ASA Physical Status II	30 (100 %)	30 (100 %)	
Duration of surgery(min.)	50.66± 4.49	50.16± 4.99	> 0.05

Table 2: Comparative data of sensory block in two groups

Parameters	Group B	Group BS	p value
Onset of sensory block (sec) Mean ± SD	78.46 ± 2.32	37.93 ± 1.39	< 0.001
Highest Sensory Level Achieved	T6 (T6-T8)	T4 (T4-T6)	
Time to Achieve Peak Sensory Level (Sec.) Mean ± SD	328.53 ± 3.70	146.93 ± 1.01	< 0.001
Two Segment regression time from Highest Sensory level (Min.) Mean ± SD	113.33 ± 2.73	134.00 ± 1.00	< 0.001
Time for Sensory regression to L1 from Highest Sensory level (Min.) Mean ± SD	138.50 ± 4.50	288.87 ± 3.09	< 0.001

Table 3: Comparative data of motor block in two groups

Parameters	Group B	Group BS	p value
Onset of motor block (sec.) Mean±SD	59.2±2.76	51.93±1.48	< 0.05
Maximum Bromage score attained	III	III	
Time to achieve grade III (sec) Mean±SD	224.5 ±2.46	202.73 ± 1.17	< 0.05
Recovery of Bromage grade 0 (min) Mean±SD	176.1 ± 2.29	185.57 ± 1.67	< 0.05

were in the age group of 18 – 25 years. There was no significant difference between two groups.

All of the patients in both groups were ASA grade II. The mean time for onset of sensory block was 78.46 ± 2.32 sec in Group B and 37.93 ± 1.39 sec in Group BS. Thus onset of sensory block was faster in Group BS and the difference was statistically highly significant ($p \leq 0.05$) (Table 2).

Table 3 gives the assessment of motor block after the spinal anesthesia. The mean onset of motor block in Group B was 59.2 ± 2.76 sec while in Group BS it was 51.93 ± 1.48 sec. The difference was statistically significant ($p \leq 0.05$).

Table 4) shows the changes in mean pulse rate after the spinal anesthesia. On inter-group comparison between Group B and Group BS there was no significant difference in mean pulse rate throughout study ($p > 0.05$).

Table 5 shows the changes in mean systolic blood pressure (SBP) after the spinal block. In Group B the intra-group comparison showed that fall in SBP started at 3 min after spinal

Table 4: Comparative change in mean pulse rate in two groups

Time	Group B		Group BS		Inter group comparison p value
	Pulse rate (per min)	Intra group comparison p value	Pulse rate (per min)	Intra group comparison p value	
Preoperative	88.06 ± 2.04		87.34 ± 3.67		> 0.05
Intra operative					
1 min	86.66 ± 5.48	> 0.05	86.3 ± 5.84	> 0.05	> 0.05
3 min	84.13 ± 5.32	< 0.05	83.26 ± 4.25	< 0.05	
5 min	80.2 ± 4.05	< 0.05	79.46 ± 3.19		
10 min	76.32 ± 3.56	< 0.001	78.06 ± 3.21		
15 min	74.13 ± 3.58	< 0.001	76.6 ± 3.08	< 0.001	
30 min	78.5 ± 1.55	< 0.05	79.53 ± 3.52	< 0.05	
1 hour	85.8 ± 1.78	> 0.05	84.73 ± 1.46	> 0.05	
Post-operative					
Immediate	88.73 ± 2.61	> 0.05	86.26 ± 1.99	> 0.05	> 0.05
30 min	89.6 ± 5.56		87.8 ± 1.51		
1 hour	89.2 ± 5.61		89.66 ± 2.92		
2 hour	90.6 ± 4.79		89.46 ± 2.86		
3 hour	91.13 ± 4.51	< 0.05	87.33 ± 2.78		
4 hour	89.66 ± 3.43	> 0.05	89.86 ± 2.02		
5 hour	90.12 ± 1.89		90.13 ± 1.81	< 0.05	

Table 5: Comparative change in mean SBP in two groups

Time	Group B		Group BS		Inter group comparison p value
	SBP (mm Hg)	Intra group comparison p value	SBP (mm Hg)	Intra group comparison p value	
Preoperative	118.73 ± 6.06		119.13 ± 5.42		> 0.05
Intra operative					
1 min	117.66 ± 5.58	> 0.05	118.4 ± 5.73	> 0.05	> 0.05
3 min	109.26 ± 4.21	< 0.05	108.06 ± 5.03	< 0.05	
5 min	100.06 ± 6.77	< 0.001	104.66 ± 4.46	< 0.001	
10 min	101.26 ± 2.65	< 0.001	103.06 ± 3.65	< 0.001	
15 min	105.33 ± 2.48	< 0.001	103.04 ± 3.39	< 0.001	
30 min	107.2 ± 2.49	< 0.05	109.13 ± 2.55	< 0.05	
1 hour	116.13 ± 3.43	> 0.05	118.33 ± 2.78	> 0.05	
Postoperative					
Immediate	117 ± 2.23	> 0.05	119.4 ± 5.23	> 0.05	> 0.05
30 min	118.53 ± 3.73		119.66 ± 3.67		
1 hour	118.26 ± 3.61		120.33 ± 3.10		
2 hour	120.66 ± 3.21		121.53 ± 2.38		
3 hour	119.66 ± 2.79		121.86 ± 3.59		
4 hour	120.06 ± 2.80		121.53 ± 1.94		
5 hour	120.27 ± 2.39		121.53 ± 1.71		

Table 6: Comparative change in mean DBP in two groups

Time	Group B		Group BS		Inter group comparison p value
	DBP (mmHg)	Intra group comparison p value	DBP (mmHg)	Intra group comparison p value	
Preoperative	80.33 ± 2.68		78.86 ± 6.28		> 0.05
Intra operative					
1 min	75.46 ± 3.67	< 0.05	77.08 ± 4.64	> 0.05	> 0.05
3 min	74.4 ± 2.94		76.16 ± 3.37	> 0.05	
5 min	72.33 ± 3.53		74.53 ± 3.19	< 0.05	
10 min	71.93 ± 1.61	< 0.001	72.26 ± 2.01	< 0.001	
15 min	74.46 ± 2.34	< 0.05	72.86 ± 1.45	< 0.001	
30 min	76.8 ± 2.32	< 0.05	73.05 ± 2.14	< 0.05	
1 hour	79.4 ± 1.90	> 0.05	78.26 ± 3.55	> 0.05	
Postoperative					
Immediate	80.4 ± 3.16	> 0.05	78.86 ± 4.06	> 0.05	> 0.05
30 min	82.86 ± 3.85		79.86 ± 4.09		
1 hour	81.46 ± 3.59		79.53 ± 3.84		
2 hour	80 ± 2.67		80.26 ± 4.05		
3 hour	81.06 ± 2.21		80.93 ± 2.5		
4 hour	83.06 ± 1.35		80.2 ± 2.5		
5 hour	82.66 ± 1.74		80.73 ± 1.77		

Table 7: Incidence of complications

Parameters	Group B N (%)	Group BS N (%)
Hypotension	2 (6.66)	2 (6.66)
Nausea	4 (13.2)	1 (3.3)
Vomiting	3 (10)	1 (3.3)
Pruritus	-	10 (33.3)

anesthesia which persisted till 30 min and recovered back by one hour.

Table 6 shows the changes in mean diastolic blood pressure (DBP) after spinal anesthesia. In Group B the intra-group comparison showed that fall in DBP started at 1 min after block which persisted till 30 min and recovered at 1 hour near preoperative value.

Table 7 shows the changes in mean respiratory rate after spinal anesthesia. There was no change in respiratory rate in both of the groups, in intra-operative or postoperative period. The difference was statistically insignificant.

There was no significant change in mean oxygen saturation from its pre-operative value at any given time in the study. Sedation score in Group B were alert (Grade 0) intra-operatively whereas majority of patients in Group BS had Grade II sedation (sleepy but arousable).

Regarding complications, hypotension was seen in 2 patients in both groups. Nausea was noted in 4 patients in Group B and in only 1 patient in Group BS. Vomiting was seen in 3 patients in Group B and in only 1 patient in Group BS. Pruritus was seen in 10 patients in Group BS, but no pruritus in Group B.

DISCUSSION

Present study was a prospective randomized comparative study which consisted of 60 obstetric parturients of ASA grade II, full term and having no contraindications for spinal anesthesia and opioid administration.

The amount of sufentanil to be added to bupivacaine is important. Courtney M.A. et al[11] used three different doses of sufentanil 10 μg, 15 μg and 20 μg along with bupivacaine intrathecally for elective cesarean delivery and reported that the incidence of side effects were increased with increasing the dose of sufentanil. JK Lu et al.[12] used 12.5 μg and higher doses of sufentanil intrathecally and found that doses larger than 12.5 μg did not improve the speed of onset, magnitude, or duration of analgesia.

In our study, we gave 500 ml of Ringer's Lactate, which is in resemblance with the study of JMJ Valentine et al.[13] and Karvellas CJ al.[14]

The mean time for onset of sensory block was 78.46 ± 2.32 sec in Group B and 37.93 ± 1.39 sec in Group BS, the difference being statistically highly significant. Quick onset of sensory block with sufentanil-bupivacaine group has also been reported by Campbell DC et al.[15] and Braga AF et al.[16]

The time to achieve this peak sensory level was significantly more in Group B (328.53 ± 3.70 sec) compared to that in Group BS (146.93 ± 1.01 sec). Cohen SE et al.[17] and Campbell DC et al.15 also found similar results in their study.

The duration of sensory anesthesia, as assessed by two segment regression time was highly significantly prolonged in Group BS (134.00 ± 1.00 min) compared to Group B (113.33 ± 2.73 min). The time for sensory regression to L1 from highest sensory level was also highly significantly prolonged in Group BS (288.87 ± 3.09 min) as compared to Group B (138.50 ± 4.50 min). Our results in this regard are again in resemblance to those of Sapate M et al.[18]

The duration of motor block in Group B was 176.1 ± 2.29 min and in Group BS was 185.57 ± 1.67 min. This was statistically highly significant. M. Sarkar et al.[19] also had similar results.

In our study, we gave injection ringer lactate 10 ml/ kg for preloading. All 3 parameters; pulse, SBP and DBP decreased after spinal anesthesia in our study, and it took about one hour for these parameters to return to their pre-block values. This fall in values, though statistically significant on intra-group comparison, was well within 20% of pre-block values. [20,21]

Respiratory rate and oxygen saturation were also observed in both groups. The range for respiratory rate was 16-18 / min and for oxygen saturation it was 97-99%. S. Karaman et al.[23] also observed no fall in respiratory rate and oxygen saturation in parturients while using intrathecal sufentanil.

Sedation is a common side effect of opioids and is probably due to its interaction with GABA receptors in the CNS. Our results in this regard are in resemblance to some earlier studies.[17,24,25]

The duration of effective analgesia in Group BS was 302.1 ± 1.79 min and in Group B was 168.83 ± 4.24 min; the difference was statistically highly significant. All patients had nausea after administration of inj methylergometrine and the above parameters did not influence the occurrence of this complication. Inj ranitidine 50 mg IV was given, but within few minutes, the 3 patients from Group B and one from

Group BS had vomiting. Inj metoclopramide 10 mg was given IV. High incidence of pruritus varying between 20% to 90% has been reported following the use of sufentanil intrathecally in some of the studies.[11,15,16]

CONCLUSION

Addition of 1 ml of sufentanil (10 μg) to 2 ml of bupivacaine heavy (0.5%) intrathecally hastens the onset and prolongs the duration of sensory and motor blockade. Hemodynamic parameters are not affected with the inclusion of sufentanil. Effective analgesia is significantly prolonged in sufentanil group. Except mild pruritus, no major side effects were seen with intrathecal 10 μg sufentanil.

Conflict of interest: None declared by the authors

Authors' contribution:

NJ: Concept of the study, manuscript drafting

DBM: Data collection, manuscript drafting

DP: Statistical analysis

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