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Research Article

COMPARISON OF BUPIVACAINE VERSUS BUPIVACAINE WITH FENTANYL INTRATHECALLY IN CESAREAN SECTION

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ABSTRACT

Objectives: The objectives of the study were to evaluate the efficacy and safety of fentanyl with hyperbaric bupivacaine in spinal anesthesia for caesarean section.

Methods: This prospective observational study was conducted in anesthesia department of tertiary care teaching hospital of Gujarat. Group A was given 2.0 ml of 0.5% hyperbaric bupivacaine with 0.25 ml of normal saline and Group B received 2.0 ml of 0.5% hyperbaric bupivacaine with 0.25 ml of injection fentanyl (12.5 μg). Characteristics of sensory blockade, motor blockade, analgesia, APGAR score, surgical variables, hemodynamic parameters, and complications were noted and compared in both the groups.

Results: There was no significant difference in onset of sensory block in both groups ($p>0.05$) but there was statistically significant difference present regarding duration of regression of sensory blockade ($p<0.05$). Time of motor onset and time to get Grade 0 from Grade 3 block were comparable in both groups ($p>0.05$). Duration of complete analgesia and duration of effective analgesia were significantly prolonged in Group B as compared to Group A ($p<0.001$). There was also no statistically significant difference observed in mean pulse rate, systolic blood pressure and diastolic blood pressure, and mean arterial pressure in both the groups during entire period of time ($p>0.05$).

Conclusions: The present study concluded that intrathecal fentanyl 12.5 μg with bupivacaine produce prolonged sensory block as well as post-operative analgesia compared to bupivacaine alone for cesarean section with insignificant hemodynamic changes without affecting neonatal outcome.

Keywords: Bupivacaine, Fentanyl, Intrathecally, Spinal anesthesia.

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INTRODUCTION

Cesarean section is one of the most common operations in the childbearing age of a woman [1]. Number of cesarean deliveries has increased these days. The advent of new instruments, drugs, and technique has made surgery and anesthesia safe. Regional anesthesia appears to be the preferred technique in cesarean section. It also keeps the mother awake to experience the childbirth.

Spinal anesthesia is preferred technique over epidural for caesarean section, being simple to perform, economical and produces rapid onset of anesthesia and complete muscle relaxation. It produces lesser maternal and neonatal side effects. However, it has some disadvantages including higher incidence of hypotension and a finite duration of anesthesia [2].

Bupivacaine is most popular drug for subarachnoid block for caesarean delivery in parturient. Intrathecal bupivacaine during cesarean section produces dose dependent sensory and motor block and cardiac toxicity [3]. It has been used in obstetric anesthesia with remarkable safety but has slow onset of action and less motor blockade [4,5]. Although hypotension due to decrease in systemic vascular resistance resulting from the blockade of preganglionic sympathetic fibers remains a problem with all central neuraxial blocks [6]; the synergistic action of local anesthetics with opioid can be of great benefit in achieving adequate anesthesia with lesser dose of local anesthetics.

A wide variety of non-opioids have also been used in epidural or subarachnoid space to achieve pain relief without the risk of respiratory depression [7]. If opioids are administered together with local anesthetic intrathecally, they have a potent synergistic analgesic effect.

Fentanyl, a lipophilic opioid after intrathecal administration diffuses into epidural space and subsequently into the plasma, suggesting that it acts not only through spinal opioid receptors but also systemically. It is a short acting opioid and has rapid onset of action. It enhances the effectiveness of intraoperative anesthesia and prolongs the duration of postoperative analgesia without increasing the sympathetic block [8]. The present study was planned to evaluate the efficacy and safety of fentanyl with hyperbaric bupivacaine in spinal anesthesia for cesarean section.

METHODS

This prospective comparative study was conducted in 50 adult females patients aged 18–35 years and ASA grade I/II undergoing elective caesarean section, only after taking approval from institutional ethics committee. Patients with contraindication to spinal anesthesia, patients with fetal abnormality, maternal complications such as placenta previa, abruption of placenta, and pre-eclampsia patients with history of allergy to study drug and patients with coagulation disorder were excluded out. These women were randomly divided into to two groups. Group A was given 2.0 ml of 0.5% hyperbaric bupivacaine with 0.25 ml of normal saline and Group B received 2.0 ml of 0.5% hyperbaric bupivacaine with 0.25 ml of injection fentanyl (12.5 μg). The total volume of drug in both groups was 2.25 ml.

Pre-operative evaluation

All patients were evaluated preoperatively with detailed history and examination done. Laboratory investigations such as Hb, TC/DC, blood sugar, renal function tests, liver function tests, serum electrolytes, ECG, and HIV/HBsAg were reviewed in all patients. Procedure was explained to all patients in their language. All patients were explained about visual analog scale (VAS) scale in detail from 1 to 10. Written informed consent was taken from patient and her relatives in their own language. All patients kept nil by mouth.

Procedure

ECG monitor, pulse oxymeter, and non-invasive blood pressure (BP) monitor were applied and baseline data were recorded. Intravenous line was taken and all patients were preloaded with Inj. Ringer Lactate 10 ml/kg. Patients were premedicated with inj. Ondansetron 0.08 mg/kg IV. Lumber puncture was performed under all aseptic precautions, with patient in the left lateral position after infiltration of the skin with local anesthetic solution with 2 ml of 1% injection lignocaine, through midline/paramedian approach with 23 gauges Quinke's spinal needle in intervertebral space L2-L3 or L3-L4. Once clean CSF is flowing freely selected drug was injected.

After completion of procedure, patient was immediately turned to supine position. Time of injection was noted. Continuous monitoring of vital parameters was carried out throughout the surgery and in post-operative ward. The sensory blockade was assessed using pinprick test at mid clavicular line. Loss of pin prick at level of T10 was taken as onset time of sensory block. The highest level of sensory block was recorded. Time taken for sensory regression to S2 dermatome level was noted. Motor blockade was assessed using Bromage scale and time to reach grade 3 of Bromage scale was noted as onset of motor blockage and time to recover to grade 0 was noted [9].

After the establishment of adequate sensory and motor level, surgery was started and corresponding time was noted. Pulse rate, systolic BP (SBP), diastolic BP (DBP), mean arterial pressure, respiratory rate, and SpO_2 were monitored per-operative and post-operative. Sedation was assessed by Campbell Sedation Score [10].

Total duration of surgery was noted. Time interval from induction to delivery of baby was noted and APGAR score of baby was noted at 1 min and at 5 min after delivery. Pain was assessed by VAS. Duration of complete analgesia (time from sensory onset time first feeling of pain) was recorded. Effective analgesia (time from sensory onset time to first dose of rescue analgesic) was recorded. First rescue analgesic was given when VAS score was ≥3 in post-operative period.

Any complications such as bradycardia, hypotension, nausea/vomiting, shivering, pruritus, and respiratory depression were monitored and treated accordingly. Patients were also observed for any complications postoperatively. Characteristics of sensory blockade, motor blockade, analgesia, APGAR score, surgical variables and hemodynamic parameters, and complications were noted and compared in both the groups.

Statistical analysis

The data obtained were statistically analyzed using SPSS software. Data were expressed as mean and standard deviation or number and percentages. Data were compared using unpaired t test and Chi-square test. $p<0.05$ was considered statically significant.

RESULTS

There was no statistically significant difference between two groups with regard to age, height and weight ($p>0.05$). Mean duration of surgery and mean time from induction to baby delivery were insignificant in both groups ($p>0.05$). APGAR score at 1 min and at 5 min was similar in both the groups. No adverse neonatal outcome was noted on addition of 10 µg fentanyl intrathecally for cesarean section (Table 1).

There was no significant difference in onset of sensory block in both groups ($p>0.05$). However, sensory regression to S2 segment was significantly prolonged in Group B compared to Group A ($p<0.001$). Time of motor onset and time to get Grade 0 from Grade 3 block were comparable in both groups ($p>0.05$). Duration of complete analgesia and duration of effective analgesia were significantly prolonged in Group B as compared to Group A ($p<0.001$) (Table 2).

There was no statistically significant difference in baseline hemodynamic parameters in both groups ($p>0.05$). There was also no statistically significant difference observed in mean pulse rate, SBP, DBP, and mean arterial pressure in both the groups during entire period of time ($p>0.05$) (Figs. 1-4).

Nausea and vomiting were more seen in Group A as compared to Group B. Pruritus was seen only in Group B. Occurrence of bradycardia was equal in Group A and Group B. Hypotension was little more in Group B than Group A. No patient was found extremely sedated in both the groups. Respiratory depression and neurological complications were not seen in any group (Table 3).

DISCUSSION

Effective analgesia may permit improved mother-child bonding, early ambulation, discharge, greater patient satisfaction, and early breastfeeding. After the discovery of opioid receptors in spinal cord and direct opioid action at this level, possibility of synergism between

Table 1: Demographic details and other characteristics of both the groups

Parameters	Group A (Mean±SD)	Group B (Mean±SD)	p-value
Age (years)	26.28±3.82	27.24±4.15	0.39
Height (cm)	160.2±5.31	158.08±6.35	0.20
Weight (kg)	59.2±5.28	61.28±5.37	0.17
ASA grade I/II	16/9	17/8	
Surgical variable			
Duration of surgery (min)	60.24±5.86	57.88±6.0	0.16
Induction to baby delivery time (min)	18.64±3.97	18.2±3.69	0.68
APGAR score			
1 min	8.84±0.89	8.64±0.86	0.42
5 min	8.92±0.70	8.84±0.8	0.70

Table 2: Characteristics of sensory block and motor block in both the groups

Block characteristics	Group A	Group B	p-value
Motor bock			
Time to get Bromage Grade 3 block (min)	4.22±0.61	4.34±0.58	0.51
Time to get Bromage Grade 0 block (min)	154.64±10.77	158.72±5.79	0.10
Sensory block			
Time of onset of block (min)	3.17±0.54	2.92±0.58	0.11
Highest sensory level	T4-T6	T4-T5	
Time for sensory regression to S2 level (min)	123.6±7.74	177.76±7.87	<0.001*
Duration of analgesia			
Duration of complete analgesia (min)	138.12±9.35	216.12±12.47	<0.001*
Duration of effective analgesia (min)	167.36±11.91	254.56±11.04	<0.001*

*significant

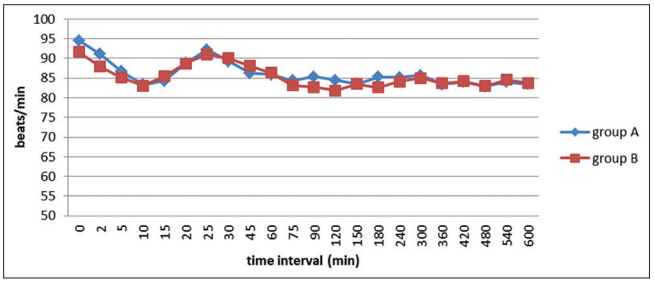

Fig. 1: Comparison of mean pulse rate between both the groups

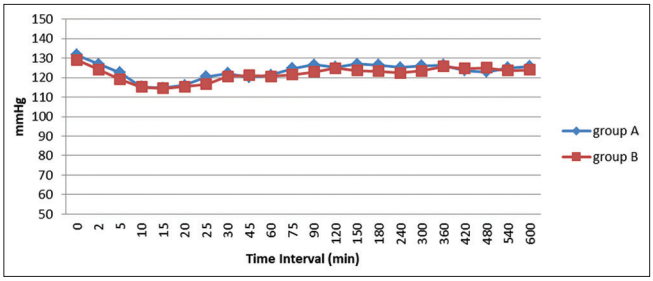

Fig. 2: Comparison of SBP in both the groups

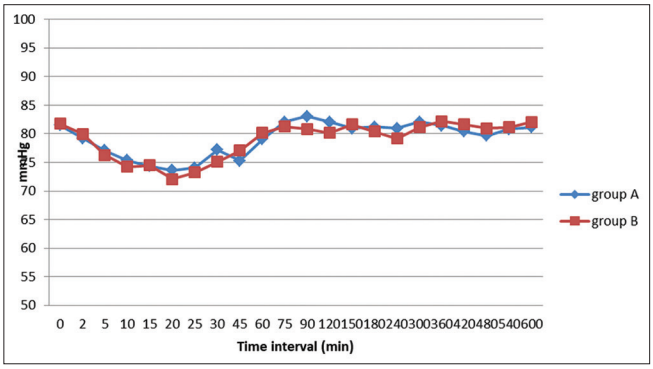

Fig. 3: Comparison of DBP in both the groups

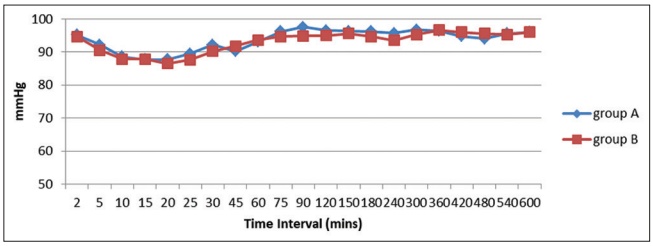

Fig. 4: Comparison of mean arterial pressure in both the groups

Table 3: Comparison of complications and sedation score in both the groups

Complications	Group A	Group B
	n (%)	n (%)
Bradycardia	1 (4)	1 (4)
Hypotension	2 (8)	3 (12)
Shivering	4 (16)	2 (8)
Nausea/Vomiting	5 (20)	3 (12)
Pruritus	-	2 (8)
Respiratory depression	-	-
Neurological complication	-	-
Campbell Sedation Score		
1	25 (100)	15 (60)
2	-	10 (40)
3	-	-
4	-	-

opioids and local anesthetics, co-administered intrathecally has been explored extensively in obstetric population undergoing caesarean delivery. Fentanyl has been tried along with bupivacaine due to its rapid onset and short duration of action [11].

In the present study, both the groups were demographically similar. There was no statistically significant difference in both groups regarding to onset of sensory blockage. Biswas *et al*. found no statistical significance in sensory onset in both groups when 12.5 µg fentanyl with 10 mg bupivacaine intrathecally [12]. Sheikh *et al*. also reported similar results [13]. In present study, T4-T6 was the highest sensory level in Group A, while it was T4-T5 level in group B. Biswas *et al*. also found that the highest sensory level attained was T5 [12]. Shende *et al*. study also showed that highest sensory level was T4 in both groups when 15 µg fentanyl with bupivacaine heavy 0.5% 2.5 ml and [14].

In the present study, there was statistically significant difference present regarding duration of regression of sensory blockade to S2 dermatome and it was 177.77.87 min for Group B and 123.67.74 min for Group A. Biswas *et al*. also observed in their study that time for sensory regression to L1 from highest sensory level was 116±14.39 min in control group and 151±7.33 min in fentanyl group [12]. Sheikh *et al*. also found significant difference in time taken for sensory regression to T12 in their study of 12.5 µg with 10 mg of bupivacaine [13].

In the present study, time of motor block onset was similar in both the groups. Sheikh *et al*. also concluded that onset of motor block were comparable and non-significant in both groups [13]. Hunt *et al*. studied that addition of fentanyl to bupivacaine 0.5% does not affect onset of motor blockage [15].

In the present study, time to grade 0 from Grade 3 was not statically significant. Choi *et al*. also studied 10 µg fentanyl adjuvant to three different doses of bupivacaine intrathecally in caesarean section and found motor recovery time did not change with additional fentanyl [16]. Biswas *et al*. and Sheikh *et al*. also showed similar results [12,17].

In the present study, duration of complete analgesia in Group B was significantly prolonged as compared to Group A. In comparison to Group A, the duration of effective analgesia was also significantly longer in Group B. Hence, both complete analgesia time and effective analgesia time in Group B were highly significant as compared to Group A. Sheikh *et al*. also observed that time from injection to first rescue analgesic was significantly prolonged in fentanyl group as compared to bupivacaine alone group [13]. Biswas *et al*. also found persisted longer full analgesia in Group B (the fentanyl group) in comparison to Group A (control group). The duration of effective analgesia (time from subarachnoid injection to rescue analgesia) was prolonged in Group B, as compared with Group A [12]. Bano *et al*. also found similar results [18]. This may be due the fact that fentanyl action on κ (Kappa) and δ (Delta) receptors cause spinal analgesia and it acts on µ (mu) receptor (agonist) at supraspinal site leading to analgesia that is also greater than morphine, pethidine, and alfentanyl.

In the present study, APGAR score at 1 min and 5 min after delivery in control group and fentanyl group was similar. Hence, there was no statistical significance difference among them. Other studies have also reported similar results and concluded that addition of fentanyl did not affect APGAR score [19-21].

In the present study, pre-operative pulse rate and BP were comparable in both groups which were statistically insignificant. Hemodynamic parameters were comparable among both groups preoperatively as well as postoperatively. Similar results reported by other research studies [13,22].

In the present study, 8% of patients in Group A and 12% of patients in group had hypotension, and bradycardia was seen in 4% patients in both the groups. In the present study, incidence of nausea and vomiting was 20% in Group A and it was 12% in Group B. Hence, the incidence of nausea and vomiting was much lower in Group B than in Group A. Rudra and Rudra also found that coadministration of fentanyl (12.5 µg) or midazolam (2 mg) intrathecally with bupivacaine avoid intraoperative discomfort during peritoneal traction and exteriorization of uterus and thereby reduces incidence of nausea and vomiting perioperatively and postoperatively [19]. Other studies have also concluded that incidence of nausea and vomiting was less in fentanyl group compared to bupivacaine group [12,13,23]. Fentanyl has antiemetic effect when

administered intrathecally which may be advantageous to parturient. Intraoperative nausea and vomiting occurs in as many as 66% of cesarean section with regional anesthesia mainly related to peritoneal traction and exteriorization of uterus.

In the present study, incidence of shivering was 24% in Group A compared to 8% in Group B. These findings were in correlation with the studies done by Sadegh *et al*. and Chu *et al*. which found the lower incidence of shivering in fentanyl group [24,25]. Shivering is one of the common problems in spinal anesthesia. It is uncomfortable for the patients and may interfere with the monitoring of ECG, BP, and SpO_2. Shivering increases O_2 consumption, lactic acidosis, and CO_2 production.

In the present study, the incidence of pruritus was 8% in Group B while none of the patient from Group A developed pruritus. It was treated with inj. pheniramine maleate intravenously. Herman *et al*. found 91% of patients with fentanyl developed pruritus [26]. Rudra and Rudra also found the 5% incidence of pruritus with 12.5 μg of fentanyl intrathecally [19]. Pruritus following intrathecal opioids is more common especially in pregnant patients. Pruritus is thought to be mediated through μ receptors present in the central nervous system.

In the present study, none of the patients from either groups had experienced any neurological complications and respiratory depression perioperatively and postoperatively. Biswas *et al*. and Sheikh *et al*. also found no respiratory depression in any patient in their study [12,13].

CONCLUSIONS

The the present study concluded that intrathecal fentanyl 12.5 μg with bupivacaine produce prolonged sensory block as well as post-operative analgesia compared to bupivacaine alone for caesarean section with insignificant hemodynamic changes without affecting neonatal outcome. Intrathecal fentanyl has better antiemetic action and produces less shivering in caesarean section; however, it is associated with pruritus.

AUTHORS' CONTRIBUTION

All the authors contributed to the preparation of the final manuscript.

CONFLICTS OF INTEREST

None.

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Nil

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