



Effects Fentanyl on Hyperbaric Bupivacaine in Spinal Anaesthesia for Caesarean Section

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ABSTRACT

Hyperbaric bupivacaine was the most common drug used in spinal anaesthesia for caesarean section. The aim of this study was to compare the effects of adding fentanyl to intrathecal bupivacaine on the onset and duration of spinal anaesthesia. Sixty healthy parturients with singleton pregnancy scheduled for elective caesarean section were randomly allocated to receive subarachnoid block with 2ml of 0.5% hyperbaric bupivacaine in control group C and 2ml of 0.5% hyper baric bupivacaine + fentanyl 20 mcg(0.4ml). Blood pressure, heart rate, respiratory rate, oxygen saturation, along with characteristics of spinal block were assessed throughout the surgery and in the postoperative ward until the patient requested for analgesia. Onset of sensory and motor block was comparable in both groups. Two segment regression (80.34±13.34 vs135.54±10.56 min) and the duration of analgesia (190.24±20.32 vs210.52±18.92 min) was significantly prolonged in fentanyl group. Addition of 20mcg fentanyl as adjuvant to 2ml of 0.5%hyperbaric bupivacaine intrathecally provides better surgical analgesia, prolongs the duration of analgesia, reduces the intra-operative need of analgesic supplement, delays time of postoperative rescue analgesia with minimal side effects.

Keywords-*Fentanyl, hyperbaric bupivacaine, spinal, anaesthesia, caesarean section.*

INTRODUCTION

Spinal anesthesia, providing an effective surgical anesthesia and postoperative analgesia by ensuring minimal maternal and neonatal side effects, had been reported to be more advantageous than general anesthesia for caesarean operations ^[1]. Intrathecal anesthesia in caesarean sections had become an established technique, and various local anaesthetics and opioids had been used, either alone or in combination. Smaller doses of local anaesthetics

supplemented by intrathecal opioids have been recommended for spinal anesthesia in parturients undergoing cesarean section delivery ^[2].

These days 0.5% heavy bupivacaine was used commonly for spinal and epidural anaesthesia. Bupivacaine was introduced by Eckenstam in1957 and used clinically by Telivno in 1963 ^[3]. Bupivacaine an amide type of local anaesthetic, had high potency, slow onset (5-8 minutes) and long duration of action^[4]. Although intratheca

bupivacaine alone offers good sensory blockade, a substantial number of patients experiences some pain and discomfort and may require analgesic supplements intra-operatively [5].

The adjuvants most commonly used in combination with bupivacaine were opioids and clonidine. Morphine had been used to control postoperative pain, as it is ionized and highly hydrophilic. On the other hand, the addition of fentanyl, a lipophilic opioid, reduces the onset time to blockade, improves perioperative analgesia, and extends postoperative analgesia up to 7 hours [6]-[8].

MATERIALS AND METHODS

This double-blinded, randomized, prospective study was conducted at the Mamata medical college, Khammam, Telangana state after taking permission from the hospital ethics committee. Sixty patients of ASA Grade I&II, female aged 21-35 years, weighing 50 to 70kg, with uncomplicated singleton pregnancy between 37-42 weeks undergoing elective Caesarean section were enrolled in the study after taking informed written consent form. Exclusion criteria were any contraindication to spinal anesthesia, allergy to local anaesthetics of the amide type and communication difficulties that would prevent reliable assessment and those women with diabetes mellitus, pre-eclampsia, psychiatric disease or history of drug abuse. All patients received ranitidine 150 mg orally 2h before the operation. In the operating room, all parturients received oxygen (4 litre min⁻¹) via a facemask and an i.v. infusion of 20 ml kg⁻¹ lactated Ringer's solution was administered over approximately 15 min. Oxygen saturation, electrocardiography and blood pressure were monitored. All parturients received a spinal technique in the left lateral decubitus position. Patients were divided into 2 groups: Group C received 2 ml 10 mg of 0.5% hyperbaric bupivacaine and normal saline (0.4 ml) and Group F received 2 ml 10 mg of 0.5% hyperbaric bupivacaine and 20 µg fentanyl (0.4 ml).

The study drug was prepared by an anaesthesiologist who was not involved in the

parturient assessment. The subarachnoid space was located using 25-gauge Quincke needle at the L4-L5 interspace. When a free flow of clear cerebrospinal fluid was obtained in the needle, the study drug was injected into the intrathecal space, over 10-15s. Immediately after the spinal injection, the patient was placed in the supine position, with left lateral tilt. Maternal heart rate and systolic and diastolic blood pressure were noninvasively recorded prior to induction of anesthesia and every 5 min from the time injection of local anaesthetic until the patient arrived in the recovery room.

The level of sensory anesthesia to pinprick was assessed bilaterally at midaxillary line. Motor block was assessed using a modified Bromage scale, where 1=complete block, unable to move feet or knees; 2=ability to move feet only; 3=just able to move knees; 4=detectable weakness of hip flexion; 5=full flexion of hips and knees while supine. These tests were performed at baseline and then every 5 min thereafter. Surgery was allowed to start when at least the T6 dermatomal level was obtained. For assessment of the onset of anesthesia, the time for sensory block to develop to maximum block height and the time to achieve maximum Bromage score were recorded. To assess the duration of the sensory block, the two-segment regression time from the maximum block height and time for regression to T10 were used. During this time the parturients were observed for side effects such as hypotension, bradycardia, nausea (0=no, 1=yes) and vomiting (0=no, 1=yes). Nausea and vomiting were treated with metoclopramide. Hypotension was defined as a 20% decrease in the mean arterial blood pressure when compared with the baseline values and treated, if necessary, with 5 mg IV boluses of ephedrine. Bradycardia (defined as heart rate <50/min) was treated with 0.5 mg atropine. Neonatal welfare was evaluated by Apgar scores at 1, 5 and 10 min after delivery and umbilical arterial blood-gas analysis was also performed.

Pain was assessed with a 10 cm linear visual analogue scale (VAS) at surgical incision, birth and peritoneal closure and at 15 min intervals after surgery. The duration of analgesia was documented

from the beginning of intrathecal injection time until time of request for additional analgesia. During the procedure, the surgeons evaluated muscle relaxation according to a four-point scale (1=poor, 2=fair, 3=good, 4=excellent). After the surgery, parturients were questioned about the quality of their anesthesia (1=poor, 2=fair, 3=good, 4=excellent).

Data were analyzed using a statistical software package (SPSS). The patient’s personal and obstetric data were represented as mean±sd. Statistical evaluation was performed using χ^2 test, Repeated Measure Variance Analysis, Shapiro Wilkas appropriate. Significance was set at the $p<0.05$ level. Power was given at 90% with a level of significance of 0.05.

RESULTS

The present study includes sixty patients. All patients experienced an adequate block of anesthesia. There were no significant differences in the patient’s demographic data, duration of anesthesia and surgery between the two groups (Table 1).

Table1. Demographic data

Parameter	Group C	Group F
Age (years)	25.6±6.43	24.3±7.36
Weight (kg)	64.5±8.52	66.4±10.54
Height (cms)	154.3±4.65	155.5±5.02
BMI(Kg/m ²)	27.5±2.32	29.1±3.43
Gestational week	38.2±1.23	38.3±1.34
Average Duration of surgery(min)	43.4±5.54	44.2±6.23
Average Duration of anesthesia (min)	50.32±4.51	51.54±6.24

Mean time to onset of sensory block, time to reach the maximum block height and maximum cephalic block between treatment groups were comparable. There was no significant difference in two groups. The onset of motor block and time taken for complete motor block were also statistically insignificant. All patients in both groups had complete motor block. The time for two segment regression and T10 regression time were significantly longer in fentanyl group than bupivacaine group. There were no significant

differences in groups for the maximum level of sensory block achieved (T4) and degree of motor block. The recovery time of motor block was prolonged in group F compared to group C. Duration of analgesia was evaluated as from time of spinal injection to the time when patient had discomfort or pain. The time to first analgesic request was also significantly longer in group F compared to group C (table.2).

Pain was assessed with a 10 cm linear visual analogue scale (VAS) at surgical incision, birth and peritoneal closure and at 15 min intervals after surgery. The pain scores (VAS) were less in group F compared to group C.

Table 2 Comparison of spinal block parameters in two groups

Parameter	Group C	Group F
Sensory block onset time (min)	2.32±.034	2.28±0.29
Time to reach max cephalic block(min)	9.52±1.32	9.05±1.54
Motor block onset time (min)	3.44±0.78	3.22±0.78
Time for complete motor block(min)	8.05±1.21	8.37±1.45
2 Segment regression time (min)	80.34±13.34	135.54±10.56*
T 10 regression time (min)	160.42±11.45	181.34±10.52*
Duration of first analgesic requirement	190.24±20.32	210.52±18.92*

Maternal heart rate and systolic and diastolic blood pressure were noninvasively recorded prior to induction of anesthesia and every 5 min from the time injection of local anaesthetic until the patient arrived in the recovery room. There were no differences in maternal blood pressure and heart rate values between the two groups. Pruritus was seen in 3 patients of fentanyl group but it was mild and not required any treatment. Postoperatively vomiting and nausea was complained by 3 members of group C and was treated with inj. metoclopramide 10mg. Other side effects such as shivering, itching, hypotension, bradycardia, respiratory depression, post-spinal headache, backache were not seen in both groups. The surgeons evaluated muscle relaxation according to a four-point scale and the score was 3 to 4 in both groups. After the surgery,

parturients were questioned about the quality of their anesthesia most them told fair to good in control group and good to excellent in fentanyl group.

DISCUSSION

Spinal anesthesia was the preferred means for cesarean section, being simple to perform, economical and produces rapid onset of anesthesia and complete muscle relaxation. It carries high efficiency, involves less drug doses, minimal neonatal depression, awake mother and lesser incidences of aspiration pneumonitis. However, it also produces a fixed duration of anesthesia, postdural puncture, headache, hypotension and lesser control of block height [9]. Most cesarean sections were performed with spinal anesthesia, which involves various combinations of anaesthetics and analgesics injected into the subarachnoid space.

Bupivacaine was the common drug used for spinal anaesthesia in caesarean section; the use of low dose bupivacaine (7.5 to 10 mg) has been proved insufficient to promote adequate perioperative analgesia, with pain incidence about 71%, a problem that can be minimized by adding adjuvants to local anaesthetic [9]. Combination of clonidine and opioids (morphine, fentanyl, sufentanil) with local anaesthetics has been a very common practice because it improves the quality of intraoperative analgesia and prolongs postoperative analgesia in addition to allowing the use of smaller doses of local anaesthetics, with reduced risk of maternal hypotension and harm to the foetus [10].

The addition of opioids to local anaesthetic agents reduces the dose and the incidence of side effects of local anaesthetics, due to the synergistic effects of opioids with local anaesthetics, without causing a sympathetic block [11]. It also ensures the occurrence of the effect in a shorter time and prolongs the duration of postoperative analgesia [12]. Use of local anaesthetic agent alone was reported to be inadequate in preventing visceral pain and nausea during uterine manipulation and closure of the visceral peritoneum [13]. The addition of intrathecal

opioid produces an antinociceptive effect in visceral and somatic pain [14]. The addition of lipophilic opioids to the local anaesthetics in spinal anesthesia increases the quality of the anesthesia without prolonging the duration of the motor block. The disappearance rate of a motor block increases with such combinations [15].

Fentanyl is lipophilic, has rapid onset of action and it does not tend to migrate to the fourth ventricle in sufficient concentration when administered intrathecally [16]. Fentanyl not only improves the quality of intraoperative analgesia but also reduces the need of supplemental sedation [17].

In this study the mean time for the onset of sensory analgesia and maximum cephalic spread were similar in both groups. Peak analgesic block attained varied between T5-7. The addition of fentanyl to bupivacaine did not alter the onset of sensory analgesia or height of the block and in comparison with previous results [18],[19]. Onset of motor blockade was comparable in both the groups and fentanyl has no action on motor blockade [16],[20]. Better degree of analgesia in Group F seen in our study was due to synergism of fentanyl and bupivacaine and effectiveness of fentanyl in abolishing visceral pain. Jaishri Bogra et al [18] found in their study that bupivacaine alone could not completely remove the visceral pain. Bupivacaine-Fentanyl combination was effective in abolishing visceral pain.

Only 2 patients had bradycardia in group F and these patients responded to injection atropine 0.6mg IV. Hypotension may develop with sympathetic blockade of bupivacaine [21], in present study 8 patients of group C and 6 of group F had hypotension and were comparable, these patients were treated with 6mg of IV mephentermine and rapid infusion of IV fluids.

Dhumal et al [22] assessed intra operative comfort score by using V A S and this was slightly better in bupivacaine plus fentanyl group. Shende et al [23] observed that quality of intraoperative surgical anesthesia improved significantly in fentanyl group compared with control group. Comfort scores were better in fentanyl group compared with control

group. This is due to efficacy of fentanyl in abolishing visceral pain better quality of surgical analgesia, good hemodynamic stability and fewer complications like nausea, vomiting and shivering.

CONCLUSION

Addition of 20mcg fentanyl as adjuvant to 2ml of 0.5% hyperbaric bupivacaine intrathecally provides better surgical analgesia, prolongs the duration of analgesia, reduces the intra-operative need of analgesic supplement, delays time of postoperative rescue analgesia with minimal side effects.

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