

Efficacy of Low Dose Intrathecal Fentanyl Added to Bupivacaine in Cesarean Section: An Observational Study

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Abstract

Context: Potentiating of the effects of intrathecal Local anesthetics by addition of Opioids for intra-abdominal surgeries is a well established fact. *Aims:* To study effects of low dose fentanyl (12.5mcg) on the spinal block characteristics, quality of intraoperative surgical anesthesia and requirement of rescue analgesia in immediate post period. *Settings and Design:* A prospective, randomized, controlled study undertaken at Jawaharlal Nehru Medical College, Wardha during January 2014- January 2015. *Methods and Material:* Ninety full term parturients posted for elective Caesarian Section were included after written informed consent. These 90 parturients were divided into two groups of 45 each, Group BF and Group BC. Group BF received intrathecal 2cc of 0.5% hyperbaric Bupivacaine + 0.25cc (12.5mcg) of preservative free Fentanyl (Total volume 2.25cc). Vital signs at every 2 minutes for first 10 minutes, at 15 minutes for first 1hour and thereafter at 30 minutes interval until the patient complains of pain, sensory and motor block characteristics with side effects were observed throughout. *Statistical Analysis Used:* Means and SD, unpaired t test. *Results:* Time of onset of sensory analgesia was rapid in Fentanyl (BF) group than only Bupivacaine (BC) group [1.9±0.56 vs 2.46±0.79]. Two segment regression time group [129.11±31.26 vs 99.78±17.69], Complete sensory recovery [277.2±33.3 vs 185.0±29.8] and Total duration of effective analgesia [259.4±35.3 vs 165.0±29.8] were prolonged in BF and statistically significant as compared with BC group. Total duration of Grade III motor block was also significantly prolonged in BF group [137±33.4 vs 119±18.5]. However, incidence of side effects and APGAR scores were comparable in both the groups. *Conclusions:* Low dose intrathecal fentanyl markedly improves intraoperative analgesia, with insignificant hemodynamic effects significantly reduces the demand of analgesics in immediate postoperative period, therefore provides great maternal satisfaction and equal APGAR score in both groups compared.

Keywords: Intrathecal; Fentanyl; Bupivacaine.

Introduction

Subarachnoid block is the most preferred anaesthesia techniques in caesarean section by modern day regional anaesthesiologist; it is simple to perform, economical, of rapid onset and provides complete muscle relaxation. It carries high efficacy, requires lesser Local Anaesthetic dosage, carries minimal neonatal depression risk, provides awake mother with almost nil complication compared to General Anaesthesia such as aspiration pneumonia. There is also provision of good analgesia in immediate

postoperative period [1]. However, it also produces a fixed duration of anaesthesia, post dural puncture headache, hypotension and lesser control of the block height [2]. Bupivacaine, an amide type of local anaesthetic, has high potency, slow onset (5-8 minutes) and long duration of action (1.5-2hours). For caesarean section intrathecal dose of hyperbaric bupivacaine is 12-15mg [3]. Caesarean delivery leads to traction on peritoneum and handling of intraperitoneal organs, resulting in intraoperative visceral pain. With higher dosage of hyperbaric bupivacaine higher block can be achieved [4] and hence, the incidence of intraoperative visceral pain is

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reduced [5] Opioids have been a choice in regional (Spinal and Epidural) anesthesia to improve the antinociceptive effect of local anesthetic. Morphine [6] and fentanyl [7] are being used intrathecally, together with local anesthetic in cesarean section.

This study was designed to evaluate the effects of intrathecally administered fentanyl (12.5mcg) on the onset and duration of hyperbaric bupivacaine bupivacaine induced sensory motor block, quality of intraoperative surgical anesthesia and requirements of analgesics during early postoperative period.

Subjects and Methods

This prospective, randomized controlled study was performed on 90 full term parturients of ASA grade II and III. The study was cleared with institutional ethical committee of Jawaharlal Nehru Medical College, Wardha and was conducted during January 2014- January 2015.

The study population consists of 90 parturients posted for elective caesarean section delivery under spinal anesthesia. Parturients were divided into the two groups, group BF (2 cc of 0.5% hyperbaric bupivacaine+ 0.25cc of preservative free fentanyl) and group BC (2ml of 0.5% hyperbaric bupivacaine + 0.25cc of CSF) consisting of 45 patients each. Parturients with contraindications to spinal block were excluded.

All the parturients were premedicated with IV. Metoclopramide 10mg and IV. Ranitidine 150mg. Preloading was done with 500ml of Lactated Ringers saline over 15 minutes. Monitors were connected and baseline readings of heart rate, noninvasive blood pressure, SpO₂, respiratory rate and fetal heart sounds were noted. Spinal block was given in left lateral position with 25G spinal needle.

Group BF received 2cc of 0.5% hyperbaric bupivacaine (10mg) + 0.25cc (12.5mcg) of preservative free fentanyl (Total 2.25cc) intrathecally.

Group BC received 2cc of 0.5% hyperbaric bupivacaine (10mg) + 0.25cc of CSF (Total 2.25cc) intrathecally.

Immediately after block each parturient was placed with 10cm wedge under right hip. Four liters of O₂ was given on face mask till extraction of the baby. All the parturients were assessed for, the time of onset of sensory anesthesia at T₁₀ segment, maximum level of sensory anesthesia achieved, time taken to attend maximum level of block, degree of motor blockade by modified Bromage scale, duration of effective

analgesia and time of rescue analgesic demand. Hemodynamic monitoring and side effects like nausea, vomiting, respiratory depression, shivering and pruritus were also noted.

Sensory block was tested by pinprick at the mid clavicular line till the block reached T₆, then the surgical incision was allowed. Intraoperative pain was checked on complaint of discomfort or pain and expression as VAS (VAS 0-100). If VAS exceeded 30 then 50mcg of fentanyl was given IV. Muscle relaxation was assessed clinically and rated as poor, fair, good or excellent and score of 1, 2, 3 or 4 was given for each.

Hemodynamic monitoring was done at 2 minutes for first 10 minutes, at every 15 minutes upto 1 hour and at every 30 minutes thereafter till the sensory block regresses to L₁. Pulse rate less than 60/min was treated with IV Glycopyrrolate 0.2mg. Systolic blood pressure less than 90 mmHg or 30% drop below baseline value was considered as hypotension and treated with IV fluid bolus and IV. Mephentermine 6mg. APGAR score was recorded at 1 and 5 minutes. All the patients were observed for 24 hours and any postoperative complications were noted.

Results

This study was performed on 90 full term parturients undergoing elective caesarean section deliveries under spinal anesthesia. Group BF received 2cc of 0.5% hyperbaric bupivacaine (10mg) + 0.25cc of preservative free fentanyl (12.5mcg) and Group BC received 2cc of 0.5% hyperbaric bupivacaine (10mg) + 0.25cc of CSF.

Both the groups were almost of same age (mean 24±5 years), weight (62±3kgs) and in duration of the surgery (63±8min). Onset of analgesia at T₁₀ was rapid and statistically significant in BF group as compared to BC group (1.9±0.56 vs. 2.46±0.79 min). The mean time taken to achieve the highest level of sensory anaesthesia was less in BF group as compared to BC group (3.9±1.63 vs. 5.3±1.92 min). The difference in the mean time taken for two segment regression in two groups was statistically significant and was more with BF group (129.11±31.26 vs. 99.78±17.69 min). The time taken for complete sensory recovery was prolonged in BF group than in BC group (277.2±33.3 vs. 185.0±29.8 min) The muscle relaxation was excellent (degree 4) in both groups, however, difference in the mean time of total duration of motor block was statistically significant among them (137±33.4 vs. 119±18.5 min). APGAR score was

comparable and statistically insignificant among the groups.

Incidence of hypotension was 44.4% of BF group and 40% of BC group and was comparable in both the groups, mostly before delivery of the baby, it was treated with fluid bolus and lateral uterine shift. Bradycardia was also comparable and statistically insignificant in both the groups (8.8% in BF vs. 11.1% in BC). Respiratory depression was not noted in any

participant of this study. Nausea and vomiting was noted in 13.3% of the BF group and in 17.8% of BC group which was insignificant. Parturients of BC group complained of shivering (20%) more than BF group (6.6%) which is statistically significant. Pruritus was complained only (6.7%) of BF group but it was of short duration, self limiting and subsided without any treatment. None patients had post dural puncture headache or any neurological complications.

Table 1: Age distribution

Age(years)	Group BF		Group BC	
	N	%	N	%
18-21	14	41.1	14	31.1
22-25	17	37.7	15	33.3
26-29	7	15.5	6	13.3
30-33	6	13.3	8	17.7
34-37	1	2.2	2	4.4
Total	45	100	45	100

Mean age (years)	
Group BF	24.10±4.20
Group BC	24.75±4.49

p>0.05(not significant)

Table 2: Weight distribution (Kilograms)

Weight	Group BF	Group BC
	Number of patients	Number of patients
58-60	16	12
61-63	18	18
64-66	8	13
67-69	3	2
Total	45	45

Mean weight	
Group BF	61.9±2.5
Group BC	62.5±2.6

p>0.05 (not significant)

Table 3: Duration of Surgery (minutes)

Duration of surgery	Group BF		Group BC	
	No. of Patients	%	No. of Patients	%
40-49	2	4.44	2	4.44
50-59	14	31.11	10	22.22
60-69	23	51.11	20	44.44
70-79	5	11.11	8	17.77
80-89	1	2.22	2	4.44
Total	45	100	45	100

Mean time of duration of surgery (minutes)

Group BF	62.56 ± 7.93
Group BC	63.20 ± 9.95

p>0.05

Table 4: Time of onset of sensory anaesthesia at T₁₀

Time of onset of sensory anaesthesia at T ₁₀ (min)	Group BF		Group BC	
	No. of Patients	%	No. of Patients	%
1-2	26	57.8	13	28.9
2-3	17	37.8	23	51.1
3-4	2	4.4	9	20
Total	45	100	45	100

Mean time of onset of sensory anaesthesia at T ₁₀	
Group BF	1.9 ± 0.56
Group BC	2.46 ± 0.79

P<0.05 (significant)

Table 5: Time taken to achieve highest level of sensory anaesthesia(minutes)

Time taken to achieve highest level	Group BF		Group BC	
	No of patients	%	No of patients	%
1-2	4	8.8	1	2.2
3-4	32	71.11	18	40.00
5-6	6	13.3	13	28.8
7-8	2	4.4	12	26.6
9-10	1	2.2	1	2.2
Total	45	100	45	100

Mean time taken to achieve the highest level of anaesthesia(minutes)	
Group BF	3.9 ± 1.63
Group BC	5.3 ± 1.92

P<0.05 (significant)

Table 6: Time taken for 2 segment sensory regression (minutes)

Time of 2 segment sensory regression	Group BF		Group BC	
	No of Patients	%	No. of Patients	%
60-79	0	0	4	8.8
80-99	7	15.5	22	48.8
100-119	15	33.3	13	28.8
120-139	9	20	5	11.1
140-159	7	15.5	1	2.2
160-179	2	4.4	0	0
180-199	4	8.8	0	0
200-219	1	2.2	0	0

Mean time taken for 2 segment sensory regression (minutes)	
Group BF	129.11 ± 31.26
Group BC	99.78 ± 17.69

P<0.05 (significant)

Table 7: Total duration of Grade III motor block (minutes)

Grade III motor block	Group BF		Group BC	
	No. of Patients	%	No. of Patients	%
90-119	18	40	26	57.8
120-149	13	28.9	18	40
150-179	6	13.3	0	0
180-209	8	17.8	1	2.2
Total	45	100	45	100

Mean duration of grade III motor block	
Group BF	137 ± 33.4
Group BC	119 ± 18.5

P<0.05 (significant)

Discussion

Subarachnoid block among regional anesthesia is the most preferred choice of technique by the obstetric anaesthesiologists. However, it is not without risks. Death in regional anesthesia is primarily related to excessive high blocks and local anaesthetic toxicity. Reduction in doses, improvement in technique to avoid higher block levels and heightened awareness to the toxicity of LA have contributed to the reduction of complications related to regional anaesthesia [8]. Spinal anesthesia among the neuroaxial blocks in obstetric patients needs more strict dose calculations as the drugs are directly instilled in intrathecal space. With minimum doses the chances of complications and side effects are drastically reduced [2].

Above mentioned factors promoted us the impetus to conduct this study. Now a days 0.5% hyperbaric bupivacaine is the drug of choice in regional anesthesia. It was decided to combine it with intrathecal fentanyl to provide adequate depth of anesthesia with lesser dose of bupivacaine [9]. Fentanyl is a lipophilic opioid and hence having rapid onset with short duration of action with advantage of no respiratory depression. Our results of onset of time of sensory to T_{10} corresponds with that of Randalls et al [10] which states that the onset of sensory block to T_{10} gets faster with increasing bupivacaine doses, whereas, it differs from the observations of Singh et al [11]. The time taken to achieve highest sensory level in our study was comparable to the study conducted by B.N. Biswas et al [12] and that of Catherine O' Hunt et al [13]. In present study the time taken for two segment regression was prolonged in fentanyl group as compared to only bupivacaine group. Our results are comparable with the findings of Harbhej Singh et al [11], and that of Catherine O' Hunt et al [13] as well as Uma Srivastava et al [1], Belzarena Serio et al [14] and Benhamou Dan et al [15]. Complete analgesia lasted longer in fentanyl group as compared to bupivacaine group (227.2±33.2 vs 185.0±29.8 min). Present study shows similar trends with the studies of B.N. Biswas et al [12], Belzarena et al [14] and Singh et al [13]. The addition of fentanyl to bupivacaine did not affect the motor block characteristics as noted in the studies of Harbhej Singh et al [11] Catherine O' Hunt et al [13] and of B.N. Biswas et al [12].

It is evident from the results that the depth of anesthesia in fentanyl group is more than that of bupivacaine group. This proves that by adding fentanyl, adequate depth of spinal anesthesia can be achieved at much lower doses of bupivacaine.

Incidence of hypotension increases with the dose of bupivacaine. However, no significant difference was noticed in the fentanyl group compared to the bupivacaine group. Bradycardia results from the blockade of sympathetic cardio accelerator fibers and decreased venous return to the heart. In our study bradycardia occurrence was overall 4.5% with no significant intergroup variation. This is in accordance with Harbhej Singh et al [11]. About 70-80% of patients become drowsy but easily arousable with intrathecal fentanyl addition as compared to those without. But, study conducted by Harbhej Singh et al [11] showed similar trends. We noticed significant reduction in the incidence of nausea and vomiting in fentanyl group though statistically insignificant. Shivering was less and statistically significant in fentanyl group, which is in concurrence with the observations of Theodore et al [16]. Though pruritus was complained by fentanyl (6.7%) population it was self limiting and was tolerated well and subsided without any treatment, similar like in the studies by Sahar M Siddiq et al [7] and Catherine O' Hunt et al [13]. In present study, follow up to up to 24 hours in postoperative period did not reveal symptoms suggestive of any neurological complications. None of the patient needed general anesthesia. APGAR score was comparable in groups, similar to the studies conducted by Shende et al [18], Catherine O' Hunt et al [13] and B.N. Biswas et al [12].

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Conclusion

From the above study it can be concluded that addition of low dose (12.5mcg) fentanyl to intrathecal hyperbaric bupivacaine can be safely employed in the patients undergoing caesarean section delivery without any significant hemodynamic changes and adverse effects. It would markedly improve the quality of intraoperative anesthesia and significantly reduce the demand of postoperative analgesics hence, may lead to better maternal satisfaction and foetal well being.

Key Messages

Fentanyl is the most commonly used new opioid

intrathecally along with long acting and potent agent like heavy Bupivacaine. Different doses of fentanyl are being used by researchers which showed better outcomes in different settings, however, the optimal dose of intrathecal fentanyl is yet to be established, hence, this study was undertaken which resulted in better outcomes with improved maternal satisfaction.

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