



## A Comparison of Intrathecal Bupivacaine With Fentanyl to Bupivacaine Alone for Elective Caesarian Section

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### ABSTRACT

*Background-* This study was designed to evaluate effect of adding 25 µg of fentanyl to 0.5% intrathecal bupivacaine for elective caesarean section.

*Methods-* The study was conducted on 40 ASA I & II women posted for elective caesarean section. Patients were randomized into two groups and lumbar subarachnoid block performed with bupivacaine and fentanyl, or bupivacaine alone. The time of onset, upper level of block, duration of sensory and motor block, systolic blood pressure, heart rate and respiratory rate were recorded and analysed.

*Results-* It was observed that fall in blood pressure and sedation showed significant differences between the groups. None of the other variables differed.

*Conclusion-* Addition of fentanyl to bupivacaine resulted in faster onset of action and effective spinal anaesthesia with a lower dose of bupivacaine. The duration of block was similar in both groups. The most striking feature was the greater hemodynamic stability with the addition of fentanyl.

**Keywords :** intrathecal fentanyl, bupivacaine, subarachnoid block, comparison, caesarean section

### INTRODUCTION

For decades, lignocaine has been the local anaesthetic of choice for spinal anaesthesia. Its advantages are rapid onset of action, and good motor block manifested as good muscle relaxation. Its use is limited by short duration of action and reports of lignocaine induced Transient Neurological Symptoms or Radicular Irritation.<sup>1,2,3</sup>

Bupivacaine which is more potent than lignocaine and has a longer duration of action, has been used for this purpose since 1963. Its disadvantages are a slow onset of action and decreased motor block.

Neuraxial administration of opioids in conjunction with local anaesthetics improves the quality of intraoperative analgesia and prolongs the duration of post-operative analgesia<sup>4</sup>. Animal studies have also demonstrated synergism between intrathecal opioids and local anaesthetics during visceral and somatic nociception<sup>5,6,7,8,9,10,11</sup>, theoretically permitting dose reduction. The synergism would also provide rapid onset of analgesia and better hemodynamic stability

The adverse effects of opioids when used intrathecally are – pruritus, nausea and vomiting, respiratory depression (early or delayed); rarely bradycardia, allergy, urinary retention and ileus.<sup>12</sup>

Fentanyl is a lipophilic synthetic opioid analgesic, various doses of which have been used intrathecally with lignocaine and bupivacaine for labour analgesia, caesarean section, urological and limb surgeries. The advantage of combining bupivacaine with fentanyl should permit reduction in dose, augmentation of analgesia, faster onset, hemodynamic stability and increased duration of analgesia.

This randomized double-blind study was designed to evaluate the effect of adding 25µg of fentanyl to 0.5% bupivacaine

given intrathecally for elective caesarean section. Patients receiving intrathecal bupivacaine alone were compared with those receiving bupivacaine with fentanyl. The onset of action, level of blockade, intra-operative hemodynamic changes, duration of sensory and motor blockade and post-operative complications were studied.

### METHODS

The study was conducted on forty ASA I & II women posted for elective caesarean section. Ethics Committee approval was obtained. All patients were examined preoperatively and informed consent was obtained.

Patients having spinal deformities, contra-indications to spinal anaesthesia, < 150cm and >180 cm in height were excluded.

Patients were intravenously premedicated with metoclopramide 10mg + ranitidine 50mg half-hour before the procedure and preloaded with isotonic saline 15ml/kg. Pre-induction monitors were connected.

Patients were randomized into two groups.

- Group 1 receiving 1.0ml 0.5% hyperbaric bupivacaine (5.0mg) combined with 25 microgram of fentanyl intrathecally in 8% dextrose solution, made up to 1.6ml with CSF (Fentanyl group).
- Group 2 receiving 1.6ml 0.5% hyperbaric bupivacaine (8.0mg) in 8% dextrose solution intrathecally (Control group).

A lumbar subarachnoid block was performed under strict aseptic precautions with the patient in the lateral position in L3 L4 space.

Blood pressure was recorded every 2 minutes for the first 30 minutes and thereafter every 5 minutes for the rest of the operation. If systolic blood pressure decreased by 30% of

baseline, a fluid bolus was rapidly infused; if still uncorrected, incremental doses of 6mg intravenous mephentermine were given.

Heart rate was monitored continuously. Bradycardia ( $\leq 60$  bpm) was noted. Injection atropine was given if the rate went below 50 bpm.

Time to sensory blockade, upper level of block, duration of sensory and motor block, systolic blood pressure, heart rate, respiratory rate and postoperative complications were recorded.

**OBSERVATION AND ANALYSIS**

The data collected were entered into a master chart and necessary statistical tables constructed. The "Students' t test" and "Chi Square test" were applied.

The variables age and height of the patients did not vary between the groups.

The time to onset of sensory block is just at the required significance limit at 0.058. (Table 1).

All the other variables and Visual Analog Scale scores (VAS) did not have any significant differences. (Tables 2, 3, 4)

Applying Chi-square test, it was observed that BP fall was more significant in group 2 than group 1 (Table 5).

None of the other variables were found to have any significant changes between the two groups.

**DISCUSSION-**

Forty ASA I and II female patients posted for elective caesarean section were randomised into two equal groups:

Group 1 (Fentanyl) and group 2 (control)

Onset time of sensory block was studied by noting the time from administration of drug to loss of pinprick sensation at T<sub>6</sub> dermatome. It was found that patients receiving a combination of fentanyl and bupivacaine had a statistically significant faster onset of action. This corresponded with the study done by Hunt et al.<sup>14</sup>

Though most patients in the fentanyl group had a higher level of block (median - T<sub>3</sub>) than the control group (median - T<sub>4</sub>) this was not statistically significant. Similar result was obtained in studies by Patterson et al<sup>15</sup> with 20µg fentanyl added to isobaric bupivacaine.

The quality of spinal anaesthesia was further studied by noting the duration of sensory and motor block. Duration of sensory block was studied as (i) Time from onset of sensory block at T<sub>6</sub> level to the time of regression of the block to T<sub>10</sub> level or below and (ii) Time from onset of sensory block to time to first parenteral rescue analgesic. In fentanyl group the mean time for regression to T<sub>10</sub> or below was 171.45 minutes when compared to 125.05 minutes in the control group. These results corresponded with studies by Korhonen et al and<sup>16</sup> Martyr et al<sup>17</sup>. Thus the study showed that an equal duration of sensory block with a lesser dose of bupivacaine can be achieved with the addition of fentanyl. Following studies using the same dose of bupivacaine with and without fentanyl showed significant increase in duration of sensory block with the addition of fentanyl; Liu et al<sup>18</sup>, Chilvers et al<sup>19</sup>, Singh et al,<sup>20</sup> Ben David et al<sup>21</sup>

Duration of motor block was studied by noting the time from onset of motor block (Bromage Score  $\geq 2$ ) to regression of motor block (Bromage Score  $\leq 1$ ). The study showed similar duration of motor block in both groups. Fentanyl does not prolong motor blockade of bupivacaine as shown in studies by Singh et al<sup>20</sup>, Ben David et al<sup>21</sup> Liu et al<sup>18</sup> and Chilvers et al.<sup>19</sup> However, fentanyl added to low dose bupivacaine can

provide excellent surgical anaesthesia without motor blockade - Korhonen et al<sup>16</sup>.

Intraoperative monitoring of blood pressure, heart rate and respiratory rate were studied to assess the hemodynamic and respiratory effects of intrathecal fentanyl. Fall in systolic blood pressure from baseline value was recorded and categorised into  $<30\%$  fall from initial value and  $\geq 30\%$  fall from initial value. Fall in blood pressure  $\geq 30\%$  was taken as hypotension. The study showed a very low incidence of hypotension (10%) in the fentanyl group when compared to patients receiving bupivacaine alone (65%). Chi-Square test showed that this result was statistically significant. The synergism between intrathecal opioids and local anaesthetics may allow a reduction in the dose of local anaesthetics and reduce hypotension while maintaining adequate analgesia. This result corresponded with studies done by Ben David et al, Belzarena et al and Shende et al<sup>22 23 24</sup>. Chakrabarathi et al showed that bupivacaine administered intrathecally causes a similar dose dependent inhibition of both A $\delta$  and C mediated somatosympathetic reflexes and there is no selectivity between its effect on afferent and efferent pathways; and intrathecal fentanyl selectively enhances the effects of intrathecal bupivacaine on the afferent nociceptive pathway, but without an effect on the efferent sympathetic pathway. Thus effectiveness of spinal analgesia with bupivacaine can be enhanced if it is supplemented with fentanyl, which acts synergistically with the local anaesthetic on the afferent pathway without causing further inhibition of the efferent sympathetic activity.<sup>6</sup>

Incidence of bradycardia (heart rate  $\leq 60$  beats per minute) was similar in both groups: 5% in the control group and 15% in the fentanyl group. However bradycardia in the control group was associated with hypotension and had to be treated with atropine. Similar results were demonstrated by Singh et al, Belzarena et al and Liu et al.<sup>18 20 23</sup>

Respiratory depression was assessed by noting the rate of breaths per minute. Rate  $\leq 10$  was taken as sign of respiratory depression. There was no incidence of respiratory depression in both groups, intraoperatively and in the post-operative period. No respiratory depression was demonstrated in studies by Liu et al, Varrassi et al and Singh et al.<sup>18 20 25</sup>

Complications like pruritus, nausea and vomiting, headache, neurologic problems and shivering were studied for a period of 24 hours post-operatively. Incidences were similar in both groups. Pruritus is a common side effect of intrathecal fentanyl but it was observed only in 1 out of 20 patients who received fentanyl.<sup>8 26</sup>

**CONCLUSION:**

1. Addition of fentanyl hastens the onset of spinal anaesthesia with bupivacaine.
2. Addition of fentanyl to bupivacaine can help to reduce the dose of bupivacaine without compromising the anaesthetic effects.
3. The hemodynamic stability achieved with the fentanyl - bupivacaine combination is beneficial to parturients, vulnerable to hemodynamic fluctuations.

**Table 1: Comparison of onset of sensory block**

Sl No	Sensory onset (min)		F	p
	Group 1	Group 2		
1	1	5		
2	2	7		
3	1	7		
4	1	5		
5	1	5		
6	1	5		
7	2	4		
8	3	3		
9	3	5		
10	2	5	3.835	0.058
11	2	5		

12	2	6		
13	2	0		
14	1	6		
15	2	7		
16	2	3		
17	2	7		
18	2	7		
19	1	5		
20	1	5		

**Table 2: Comparison of duration of sensory block**

Sl No	Sensory duration (min)		F	p
	Group 1	Group 2		
1	240	120		
2	210	120		
3	240	90		
4	240	60		
5	270	120		
6	240	120		
7	240	105		
8	270	90		
9	240	210		
10	240	180	0.851	0.362
11	210	180		
12	90	210		
13	210	180		
14	270	180		
15	180	180		
16	180	180		
17	120	120		
18	240	0		
19	240	180		
20	270	150		

**Table 3: Comparison of duration of motor block**

Sl No	Motor duration (min)		F	p
	Group 1	Group 2		
1	150	150		
2	120	150		
3	180	120		
4	120	120		
5	150	180		
6	120	180		

7	120	150		
8	120	150		
9	120	240		
10	180	210	2.62	0.114
11	120	240		
12	0	255		
13	120	225		
14	180	210		
15	120	240		
16	120	210		
17	90	150		
18	90	60		
19	180	210		
20	120	195		

**Table 4: Comparison of VAS**

Sl No	VAS (min)		F	p
	Group 1	Group 2		
1	50	75		
2	30	80		
3	70	90		
4	40	70		
5	50	80		
6	50	70		
7	40	80		
8	25	70		
9	25	90		
10	40	60	1.2	0.28
11	25	80		
12	30	50		
13	40	90		
14	20	80		
15	25	60		
16	30	75		
17	40	60		
18	10	80		
19	50	75		
20	50	90		

**Table 5: Chi-square distribution of fall in BP**

Group		Fall in BP		Total (%)
		Yes	No	
Group	1	0	20	20 (50)
	2	13	7	20 (50)
Total (%)		13 (32.5)	27 (67.5)	40 (100)

Significant at 0.001 level

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