

Comparative Evaluation of Bupivacaine Plain Versus Bupivacaine with Fentanyl in Spinal Anaesthesia for Lower Abdominal and Lower Limb Surgeries.

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ABSTRACT

Introduction: Spinal anaesthesia is a safe, effective, and widely used technique for lower abdominal and lower limb surgeries. Bupivacaine, a long-acting amide local anaesthetic, provides satisfactory anaesthesia but limited postoperative analgesia. The addition of opioids such as fentanyl to intrathecal bupivacaine has been shown to enhance sensory blockade and prolong analgesia due to synergistic interaction at the spinal cord level without significantly affecting motor recovery or haemodynamic stability. **Objectives:** To compare the clinical efficacy of intrathecal plain bupivacaine and bupivacaine with fentanyl in terms of onset and duration of sensory and motor block, duration of postoperative analgesia, haemodynamic stability, and adverse effects in patients undergoing lower abdominal and lower limb surgeries. **Methodology:** Patients were divided into two equal groups. Group A received 2.5 mL of 0.5% hyperbaric bupivacaine with 0.5 mL of normal saline, while Group B received 2.5 mL of 0.5% hyperbaric bupivacaine with 25 µg (0.5 mL) of fentanyl intrathecally. Sensory and motor block characteristics, haemodynamic changes, and duration of analgesia were recorded. Data were analysed using Student's t-test and Chi-square test, with $p < 0.05$ considered statistically significant. **Results:** The onset of sensory and motor block was similar in both groups. The duration of sensory block and postoperative analgesia was significantly longer in the fentanyl group ($p < 0.01$). No significant difference was found in motor block or haemodynamic parameters. Minor side effects, including pruritus and nausea, were observed only in the fentanyl group, with no respiratory depression reported. **Conclusion:** The addition of 25 µg fentanyl to 0.5% hyperbaric bupivacaine prolongs sensory blockade and postoperative analgesia without increasing side effects or compromising haemodynamic stability, making it a superior combination for spinal anaesthesia in lower abdominal and lower limb surgeries.

Keywords: Spinal anaesthesia; Bupivacaine; Fentanyl; Intrathecal adjuvant; Postoperative analgesia; Haemodynamic stability

Introduction:

The use of EA is an integral part of Enhanced Spinal anaesthesia remains one of the most widely practiced regional anaesthetic techniques for lower abdominal and lower limb surgeries. It is preferred for its simplicity, rapid onset, high reliability, and profound sensory and motor blockade. The technique provides adequate surgical anaesthesia and effective muscle relaxation while avoiding the risks and recovery delays associated with general anaesthesia.

Bupivacaine, a long-acting amide local anaesthetic, is one of the most commonly used agents for spinal anaesthesia. It produces a dense motor blockade and prolonged sensory block suitable for a wide range of surgical procedures. However, a major limitation of bupivacaine alone is the relatively shorter duration of postoperative analgesia, which often necessitates early administration of systemic analgesics. In addition, increasing the dose or concentration of bupivacaine to prolong analgesia can heighten the risk of hypotension, bradycardia, and delayed motor recovery.

To enhance the quality and duration of spinal anaesthesia, various adjuvants have been studied in combination with local anaesthetics. The present study was undertaken to evaluate and compare the clinical effects of intrathecal 0.5% hyperbaric bupivacaine alone and in combination with 25 µg fentanyl in adult patients undergoing lower abdominal and lower limb surgeries. The study specifically aimed to compare the onset and duration of sensory and motor blockade, haemodynamic changes, postoperative analgesic requirements, and the incidence of side effects.

Methods:

After approval from institutional ethical committee and informed consent from patients a prospective, randomized, double-blind study was carried out in the Department of Anaesthesiology, Baby Memorial Hospital, Calicut. One hundred and sixty adult patients (ASA I–II), scheduled for elective lower

abdominal or lower limb surgeries, were randomly allocated into two groups (n=80 each):

- Group A: 2.5 mL of 0.5% hyperbaric bupivacaine + 0.5 mL normal saline.
- Group B: 2.5 mL of 0.5% hyperbaric bupivacaine + 25 µg fentanyl (0.5 mL).

Spinal anaesthesia was administered at the L3–L4 interspace using a 25G Quincke needle. Onset and regression of sensory and motor block were evaluated using pin-prick and Bromage scales respectively. Haemodynamic parameters (heart rate, systolic and diastolic blood pressure) were recorded at regular intervals. Postoperative analgesia was assessed using the Visual Analogue Scale (VAS) and time to first rescue analgesia.

STATISTICAL METHODS : Descriptive statistics were presented as mean \pm SD for normally distributed variables, median (IQR) for non-normal data, and frequency (%) for categorical variables. Data visualization included bar, pie, and box plots. Normality was assessed using histograms, Q-Q plots, and the Shapiro–Wilk test ($p > 0.05$ = normal). Independent t-test was used for normally distributed continuous variables; Mann–Whitney U test for non-normal data; and Chi-square or Fisher's exact test for categorical variables. A p-value < 0.05 was considered statistically significant. Analysis was performed using IBM SPSS v22.

Results:

A total of 160 patients were included and equally divided into Group A (Bupivacaine + Normal Saline) and Group B (Bupivacaine + Fentanyl 25 µg). The demographic characteristics were comparable between the two groups with respect to age, sex, ASA physical status, and body weight ($p > 0.05$).

Parameter	Group		P value
	A (N=80)	B (N=80)	
Age (in years)Median (IQR)	46 (31, 55)	40 (30, 48.75)	0.019
Height (in cm) (Mean \pm SD)	166.96 \pm 7.28	170.76 \pm 6.33	0.001
Weight (in kg) (Mean \pm SD)	67.91 \pm 9.18	70.63 \pm 8.90	0.060
Onset of action Sensory block (min)Median (IQR)	2 (1.5, 2.2)	2 (1.5, 2.2)	0.783
Onset of action Motor block (min)Median (IQR)	2.4 (2.2, 3)	2.35 (2.2, 2.5)	0.353
Time of two segment regression (in mints)Median (IQR)	55 (50, 60)	68 (60, 75)	<0.001
Time of full motor recovery (in mints)	155.8 \pm 10.74	158.15 \pm 7.11	0.105
Time of full sensory recovery (in mints)Median (IQR)	180 (170.5, 190)	270 (260, 280)	<0.001
Time of first pain medication (in mints)	220 (210, 230)	327.5 (315, 345)	<0.001
Quality of post op analgesia (Median IQR)			
3H	3 (2, 4)	0.5 (0, 1)	<0.001
6H	3 (2, 5)	1 (1, 2)	<0.001
12H	3 (1, 4)	4 (3, 5)	0.001

Table: Findings obtained in the study
Figure: Bar chart of comparison of time of two segment regression between the two groups (N=160)

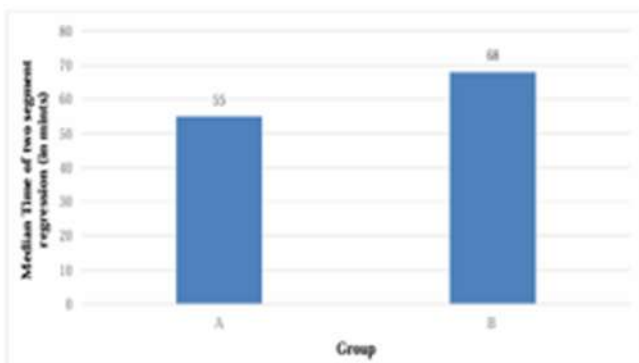
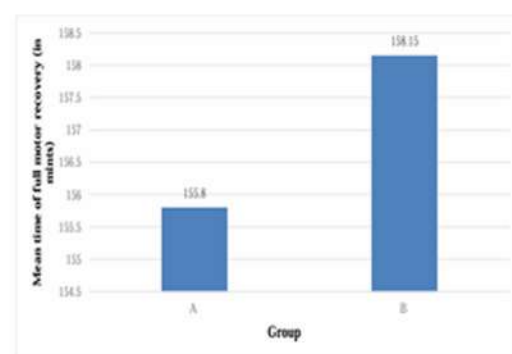


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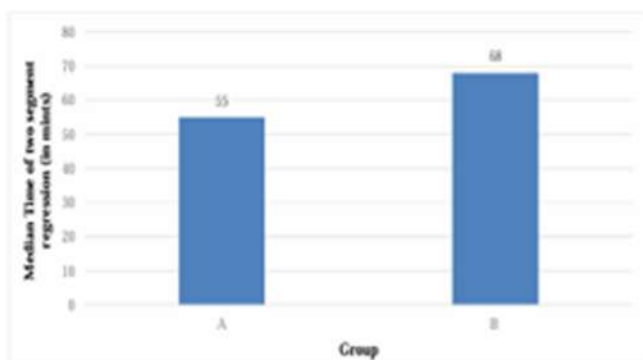


Figure: Bar chart of comparison of time of full motor recovery between the two groups (N=160)

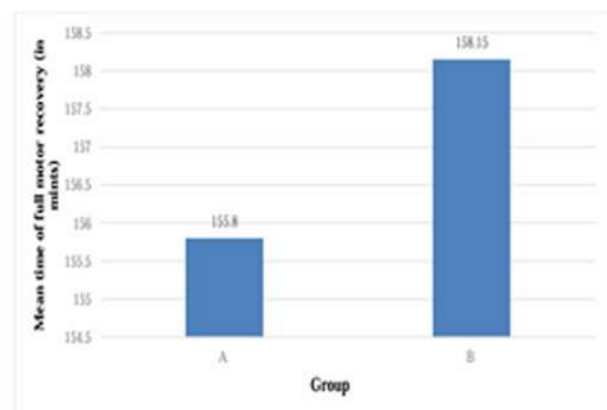


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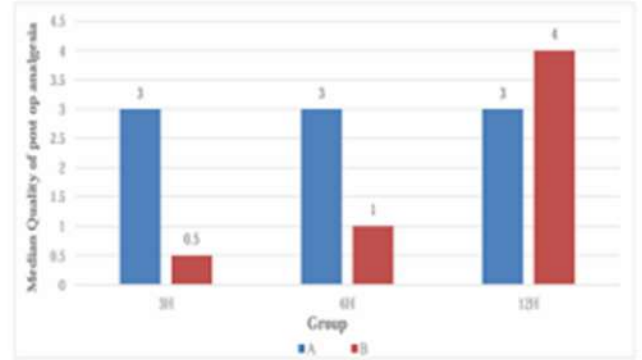
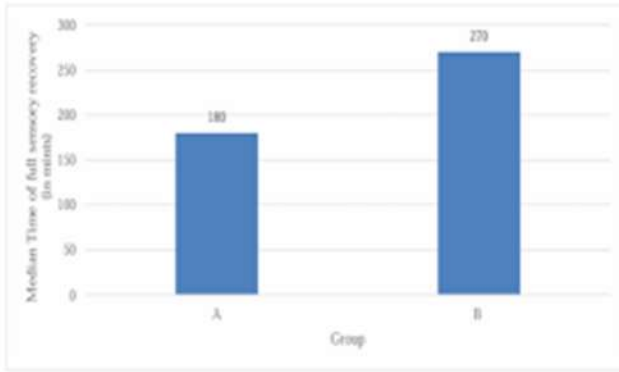


Figure : Bar chart of comparison of quality of post op analgesia between the two groups (N=160)

Haemodynamic Parameters: No statistically significant difference was observed between the groups in mean heart rate, systolic, or diastolic blood pressure at any intraoperative interval. Both groups maintained stable haemodynamic parameters throughout the procedure. Transient hypotension occurred in 4 patients in each group (5%), which responded to fluid bolus and mephentermine.

Table: Comparison of group with complications (N=160)

Complications	Group		Fisher's exact P value
	A	B	
Shivering			
Yes	1 (1.3%)	1 (1.3%)	1.000
No	79 (98.8%)	79 (98.8%)	
Urinary retention			
Yes	0 (0%)	6 (7.5%)	-
No	80 (100%)	74 (92.5%)	
Hypotension			
Yes	4 (5%)	4 (5%)	1.000
No	76 (95%)	76 (95%)	
Bradycardia			
Yes	1 (1.3%)	2 (2.5%)	
No	79 (98.8%)	78 (97.5%)	
Vomiting			
Yes	3 (3.8%)	1 (1.3%)	0.620
No	77 (96.3%)	79 (98.8%)	
Pruritis			
Yes	0 (0%)	3 (3.8%)	-
No	80 (100%)	77 (96.3%)	
Post Dural puncture headache	0 (0%)	0 (0%)	-
Other Neurological Complications	0 (0%)	0 (0%)	-

* No statistical test was applied due to 0 subjects in the cell

DISCUSSION:

Spinal anaesthesia is the most versatile block available which is being used for surgeries in the lower half of the body. Neuraxial opioids have been used widely and has gained popularity over last few years. It will augment the analgesia produced by local anaesthetics through direct binding with specific spinal receptors. It improves the quality of intraoperative analgesia and also provides post op pain relief for a much longer time period. We had done this study with the aim of knowing the effect of fentanyl added to hyperbaric bupivacaine in spinal anaesthesia for various elective surgical procedures.

In our study, in group A there were 56 males and 24 females and in Group B there were 64 males and 16 females. The mean height in Group A was 166.96 \pm 7.28 cms and that in Group B was 170.76 cms \pm 6.3. The mean weight in Group A was 67.91 kgs and that in Group B was 70.6 kgs. All the patients were of ASA I or ASA II status. The parameters were almost identical in both the groups.

There was no statistical significance with regards to onset of sensory block between both the groups. Jigna r shah et al in their prospective, randomized double blind study found that there was no significant difference in the onset of sensory block between bupivacaine alone and bupivacaine plus fentanyl. This conclusion was similar to the results we obtained.

There is no statistical significance with regards to the onset of motor block in both the groups. This observation was similar in study conducted by Jigna r Shah et al and Ben david et al who found that there was no significant statistical difference in onset of motor blockage in both the groups

In our study the 98 percentage of patients achieved a sensory blockade of T6 to T8 level in Group A and 97.5 percentage of patients achieved a blockade between T6 and T8 levels. The block height achieved in both the groups is comparable and

statistically insignificant. The time of two segment regression in study group A was 55 minutes and that in study group B was 68 minutes ($P < 0.001$). This observation was found to be similar to the study conducted by Jigna R Shah et al .

In our study the time for complete motor recovery was 155.8 \pm 10.74 minutes and that in group B was 158.15 \pm 7.11 minutes. (p value- 0.105). The observations we got in this study was similar to the observations in the study done by Jigna R Shah et al. we observed that there was no significant change in duration of motor block in both the groups.

In the study done by Jigna R Shah⁴⁰ they observed that the duration of complete sensory block was 180 min in Group A patients and that in Group B patients was 206 min which means that the duration of sensory recovery was prolonged in Group B and this study was similar to the observations we obtained in our study. The studies done by Khanna et al showed significant increase in the duration of recovery from sensory block.

Systolic and diastolic blood pressure in our study we found that there was no significant difference in the systolic and diastolic blood pressure in Group A and Group B in the intraoperative and the postoperative period. This suggests that there is no significant hypotension caused by addition of fentanyl along with bupivacaine in subarachnoid block.

Time of first pain medication in our study we observed that time of first pain medication in group A was 220 minutes and that in Group B was 327.5 minutes (p value < 0.01). This shows that there was significantly longer period of analgesia with intrathecal fentanyl. Study done by Jigna R Shah et al and Ben david et al also showed similar results.

Complications In our study we observed that 1 patient in Group A and 1 patient in Group B had shivering (1.3 % each). Urinary retention was present in 6 patients in Group B(7.5%). 4 patients in Group A (5%) and 4 patients in group B (5%) had hypotension. All the patients responded to bolus of intravenous fluid & single dose of Inj Mephentermine

CONCLUSION:

We concluded that the addition of intrathecal fentanyl to bupivacaine produced significantly prolonged sensory blockade and postoperative analgesia without prolonging motor recovery and haemodynamic were unaffected. Also addition of fentanyl produced minimal intraoperative and postoperative side effects and helps in preventing the side effects of intravenous medications.

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