



EVALUATION OF EFFECTS OF LOW DOSE FENTANYL WITH DIFFERENT DOSES OF HYPERBARIC BUPIVACAINE FOR SUBARACHNOID BLOCK IN LOWER LIMB SURGERY

Anaesthesiology

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ABSTRACT

Introduction: Subarachnoid anaesthesia is commonly employed for lower limb surgery. Bupivacaine is the commonly used local anaesthetic for lower limb surgery. Intrathecal Bupivacaine alone may be sometimes insufficient to provide complete analgesia despite the high sensory block. The larger dose of bupivacaine is required to obliterate the visceral and somatic pain but such large doses are associated with high level of block and undesirable side effects. The use of intrathecal opioids may enhance the analgesia produced by local anaesthetic through direct binding with the specific spinal opioid receptors. Hence the present study was done to compare the synergistic effect of intrathecally administered Fentanyl 25 µg with 7.5 mg and 10 mg of 0.5% hyperbaric Bupivacaine on sensory and motor block characteristics, recovery profile and also quality of intraoperative and postoperative analgesia. **Methods:** Sixty patients belonging to ASA class I and II for lower limb surgery, who have no contraindication for subarachnoid anaesthesia were selected. They were randomly divided into two groups of 30 patients each.

Group I – received 7.5mg of 0.5% hyperbaric Bupivacaine with 25µg Fentanyl

Group II – received 10mg of 0.5% hyperbaric Bupivacaine with 25µg Fentanyl.

Total volume of the drug injected was made equal to 2.25 ml by adding normal saline. The patients were observed intraoperatively for the onset of sensory block, degree of motor block, quality of anaesthesia and total duration of analgesia. **Results** Onset of sensory and motor block increased with increasing doses of 0.5% hyperbaric Bupivacaine (10 mg) and Fentanyl (25µg) combination groups in comparison to low dose hyperbaric Bupivacaine (7.5 mg) and fentanyl (25mcg) combination group. Total duration of analgesia (time from injection of drug to first requisite for analgesics) lasted longer in group II (257.03±8.46) when compared to group I (206.00±11.80). Quality of anaesthesia was excellent in both groups. The intraoperative haemodynamic changes were similar in both groups. Incidences of other side effects were not significant.

KEYWORDS

Bupivacaine; Fentanyl; Subarachnoid anaesthesia; Lower limb surgery.

INTRODUCTION

Subarachnoid block (SAB) is the anaesthesia technique of choice and is the gold standard for lower limb surgeries because of the ease, effectiveness as well as the rapidity in establishing adequate levels of analgesia.

Bupivacaine, an amide type of LA was introduced by Ekenstam in 1957 and first used clinically by Telivuo in 1963.¹ It is the most commonly employed LA intrathecally for lower limb surgeries. It is well known that the dose of the drug influences the duration of sensory as well as motor blockade and has a significant effect on the degree of hypotension.²

However, intrathecal Bupivacaine alone may be insufficient to provide complete analgesia despite high sensory block. Large doses are associated with higher block during spinal anaesthesia and undesirable side effects.^{3,4,5} Hence adjuvants are added to decrease the dose of LA required.⁶ Smaller doses of Bupivacaine supplemented by intrathecal opioids have been recommended for spinal anaesthesia in patient undergoing lower limb surgeries.^{7,8,9} Neuraxial administration of opioids in conjunction with LAs improves the quality of intraoperative analgesia and also enhances the duration of postoperative analgesia.¹⁰

Fentanyl, a lipophilic opioid, has rapid onset of action after intrathecal administration. It does not tend to migrate to 4th ventricle in sufficient concentrations to cause delayed respiratory depression when administered intrathecally.¹¹ After intrathecal (IT) Fentanyl administration, it diffuses into epidural space and subsequently into the plasma, suggesting that IT Fentanyl not only act through spinal opioid receptors but also act systemically. Therefore Fentanyl provides better intraoperative analgesia. Dose of 25µg of Fentanyl added to low dose Bupivacaine intrathecally provides better surgical anaesthesia and increased reliability of block than intrathecal Fentanyl 7.5 or 10µg.¹²

Due to availability of minimal data on comparison of different doses of LA combined with fixed dose of an opioid, the present study was planned to compare the effect of Fentanyl 25µg when mixed with 7.5mg and 10 mg of 0.5% hyperbaric Bupivacaine for subarachnoid block in lower limb surgeries.

MATERIAL AND METHODS

Study Area :

The study was conducted at Govt. Medical College and Attached Hospital, Kota from March 2021 to July 2022 after clinical approval of Institutional Ethical Clearance Committee.

Sample Size :

60 patients of ASA class I and II posted for lower limb surgery, were selected on the basis of simple random sampling method. They were randomly divided into two groups of 30 patients each.

Inclusion Criteria

1. Age group of 20-50 years
2. ASA class I and II

Exclusion Criteria

1. Patients with co-morbid conditions like diabetes mellitus, asthma, hypertension, etc.
2. Patients belonging to ASA class III and above.
3. Patient's refusal for the procedure.
4. Patient with known hypersensitivity to the drugs used in study.

Pre Anaesthetic Assessment:

Standard protocol was followed for pre anaesthetic assessment of patients.

Procedure

Informed and written consent was taken from each patient after complete explanation about the study protocol and the procedure. With patient in lateral or sitting position, midline lumbar puncture was performed at L2-L3 or L3-L4 interspace with 25G Quincke's spinal needle. After confirming free and continuous flow of Cerebrospinal Fluid (CSF), the test drug was injected intrathecally, over 30 seconds.

Drug And Dosage

Group I – received 7.5 mg of 0.5% hyperbaric Bupivacaine plus 25 µg of Fentanyl

Group II – received 10 mg of 0.5% hyperbaric Bupivacaine plus 25 µg of Fentanyl

Total volume of agents administered was made equal to 2.5 ml by adding normal saline. Immediately after spinal injection, patients were placed in supine position.

Monitoring

Heart rate and BP were recorded immediately after subarachnoid block, then at 2 min interval for first 10 min, later at 3 min interval till completion of surgery. Sensory level block was measured by pin prick at the mid clavicular line on both sides with a blunt 25G needle every minute, until the block reached T10 dermatome. Thereafter, the level was checked every 2 minutes, until the maximal sensory block achieved.

Quality of Anaesthesia

- Excellent - no discomfort or pain,
- Good - mild pain, no need for analgesics,
- Fair - pain that required supplemental analgesics and
- Poor - severe pain that needed conversion to general anaesthesia

Muscle relaxation was assessed by surgeon and rated as poor, good or excellent.

Modified Bromage Scale

- 0- No motor blockade, able to lift leg at the hip.
- 1- Able to flex the knee but not lift leg extended
- 2- Able to move the foot only
- 3- Unable to move even the foot (complete blockade)

Motor block in the lower limb was graded according to Modified Bromage Scale.

Outcome Variables

1. Time of onset of sensory analgesia to T10
2. Time taken to achieve highest level of sensory analgesia
3. Total duration of analgesia
4. Time of onset of grade 3 motor block
5. Total duration of motor block
6. Quality of anaesthesia
7. Cardiovascular parameters
8. Side effects.

RESULTS

Table 1 - Time of onset of sensory analgesia to T10

Group I	2.59±0.43 min
Group II	2.23±0.32 min

The mean time of onset of sensory analgesia to T10 in group I was 2.59±0.43min and in group II was 2.23±0.32min which was statistically significant among the groups ($p<0.000$).

Table 2 - Time taken to achieve highest level of sensory analgesia

Group I	5.12±0.52 min
Group II	4.60±0.59 min

The mean time taken to achieve highest level of sensory analgesia in group I was 5.12±0.52min and in group II was 4.60±0.59min which was statistically significant among the groups ($p<0.000$).

Table 3 - Total duration of analgesia

Group I	206.00±11.80 min
Group II	257.03±8.46 min

The mean time of total duration of analgesia in group I was 206.00±11.80min and in group II was 257.03±8.46min which was statistically significant among the groups ($p<0.000$).

Table 4 - Time of onset of grade 3 motor block

Group I	5.86±0.63 min
Group II	4.62±0.57 min

The mean time of onset of grade III blockade in group I was 5.86±0.63min and in group II was 4.62±0.57min which was statistically significant among the groups ($p<0.000$).

Table 5 - Total duration of motor block

Group I	106.90±10.92 min
Group II	132.93±12.06 min

The mean time of total duration of motor block in group I was 106.90±10.92min and in group II was 132.93±12.06min which was

statistically significant among the groups ($p<0.000$).

Cardiovascular Parameters

There were no significant haemodynamic alterations in in both groups during the study period.

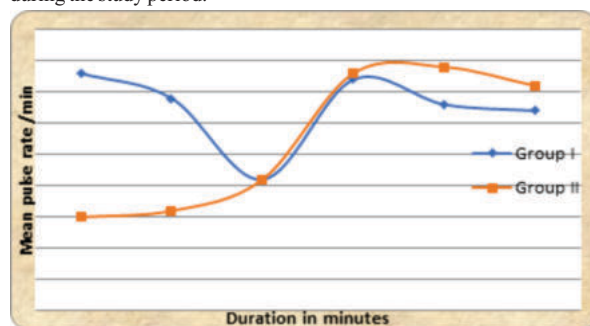
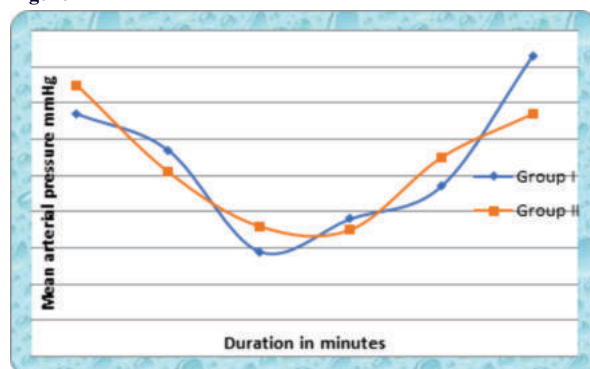


Figure 1



Side effects.

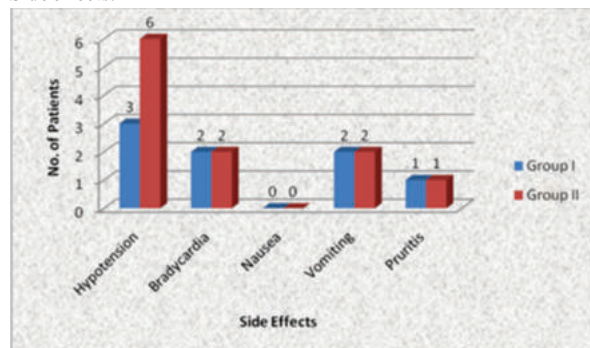


Figure 2

DISCUSSION

The last two decades have seen an increase in the incidence of lower limb surgeries. Spinal anaesthesia is the preferred mode of anaesthesia for lower limb surgeries.

Bupivacaine is the local anaesthetic used routinely for lower limb surgeries because of its high potency and minimal neurological symptoms. The larger dose of Bupivacaine is required to obliterate the visceral and somatic pain but such large doses are associated with high levels of block and undesirable side effects.

Opioids are well known to improve the analgesic potency of local anaesthetic if opioids administered intrathecally. Opioids which have lipophilic properties is known to augment the quality of subarachnoid block.

Our study was conducted to compare 7.5mg and 10mg of 0.5% hyperbaric Bupivacaine with combination of 25µg of Fentanyl for spinal anaesthesia in lower limb surgeries.

Sensory Characteristics

In our study, results were consistent with Bogra J et al.¹⁵ study, mean time of onset of sensory analgesia to T10 in group I was 2.59±0.43min and in group II was 2.23±0.32min (Table 1), mean time taken to

achieve highest level of sensory analgesia in group I was 5.12 ± 0.52 min and in group II was 4.60 ± 0.59 min (Table 2), mean time of total duration of analgesia in group I was 206.00 ± 11.80 min and in group II was 257.03 ± 8.46 min (Table 3) which were statistically significant among the groups ($p < 0.000$).

Motor Characteristics

In our study, results were consistent with Choi DH et al.¹⁶ Study, mean time of onset of grade III blockade in group I was 5.86 ± 0.63 min and in group II was 4.62 ± 0.57 min (Table 4), mean time of total duration of motor block in group I was 106.90 ± 10.92 min and in group II was 132.93 ± 12.06 min (Table 5) which were statistically significant among the groups ($p < 0.000$).

Quality of Anaesthesia

No patients in any of the study group neither complained of pain nor required supplemental analgesics intraoperatively.

Cardiovascular Changes

Hypotension was observed 10% of patients in group I and 20% of patients in group II which was treated with 6mg boluses of mephentermine and was not significant among the groups. Bradycardia was noticed in 6.7% of patients in group I and 6.7% of patients in group II which was treated with 0.6 mg of IV atropine and was not significant among the groups.

Cardiovascular changes result concurs with Choi DH et al.¹⁶ study in which they noticed no significant difference among different Bupivacaine dose with fentanyl combination groups.

Other Side Effects

Nausea and vomiting was seen in 6.7% patients and pruritis in 3.3% patients in both groups.

CONCLUSION

0.5% hyperbaric Bupivacaine 10 mg with Fentanyl 25µg combination produced longer duration of analgesia when compared to Bupivacaine 7.5 mg with Fentanyl 25µg combination group which is advantageous both intra and postoperatively. But the same combination also produced longer duration of motor block which interferes with early ambulation.

Conflict Of Interest :

There is no conflict of interest between authors.

Abbreviations :

- ASA - American Society of Anaesthesiologists
- CSF - Cerebrospinal fluid
- LA - Local Anaesthetic
- MAP - Mean arterial pressure
- mg - Milligrams
- min - Minute
- ml - Milliliter

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