

A Randomized Double - Blind Study to Compare the Effect of 0.5% Bupivacaine with Buprenorphine and 0.5% Bupivacaine with Fentanyl in Lower Limb Surgeries under Epidural Anaesthesia

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Abstract: Background: For lower abdominal and lower limb surgeries, regional anaesthesia is preferred over General anaesthesia. Epidural anaesthesia is useful as a primary anaesthetic, but most commonly, it is used as a pain management adjuvant. We evaluated compare the effect of 0.5% bupivacaine with buprenorphine and 0.5% bupivacaine with fentanyl in lower limb surgeries under epidural anaesthesia. Material and methods: A randomized double blind study was conducted in 90 patients of either gender divided in three groups. In Group A (n=30) patients were received 0.5% bupivacaine 15 ml with 0.5 ml Buprenorphine with 0.5 ml and normal saline made to a total 16 ml. in Group B (n=30) patients were received 0.5% bupivacaine 15 ml with 1 ml fentanyl and in Group C (n=30) patients were received 0.5% bupivacaine 15 ml with 1 ml normal saline for epidural anaesthesia. These groups were compared using one - way analysis of variance (ONE -WAY ANOVA) and difference between the groups compared using unpaired T - Test. Results: Duration for analgesia was more with epidural Buprenorphine. Conclusion: We concluded that epidural Buprenorphine is better in providing prolonged satisfactory postoperative analgesia as compared to Fentanyl.

Keywords: Isobaric Bupivacaine, Buprenorphine, Fentanyl, Epidural

1. Introduction

Epidural anaesthesia is useful as a primary anaesthetic, but most commonly, it is used as a pain management adjuvant. It can be a single shot or a continuous infusion for long - term pain relief. Aside from the benefit of potentially providing excellent analgesia, its use reduces the exposure to other anaesthetics and analgesics, decreasing side effects. It has also shown to decrease cortisol levels, expedite the return of bowel function, decrease the incidence of PE and DVT in the postoperative period, and shorten lengths of in - hospital stay. ⁽¹⁾⁽²⁾⁽³⁾

Different local anaesthetics are used for epidural anaesthesia, most popular in India being lidocaine and bupivacaine. The drawback of lidocaine is its intermediate duration of action. Bupivacaine is the most commonly used drug in epidural anaesthesia ⁽⁴⁾. A local anaesthetic and an opioid combination can provide superior analgesia during perioperative and postoperative periods. Buprenorphine is a mu - receptor partial agonist and antagonist. Fentanyl is a phenylpiperidine derivative synthetic opioid agonist ⁽⁵⁾. The present study was designed to compare between epidural bupivacaine combined with buprenorphine vs fentanyl for lower limb surgeries.

2. Material and Methods

After obtaining hospital ethical committee approval, 90 Patients of either gender, age 18 to 60 years belonging to American Society of Anesthesiologists physical status I to II scheduled for elective Lower limb surgeries and lower abdominal surgeries in the department of orthopaedics and general surgery were selected and written informed consent was obtained. Patient with Localised skin infection, refusing for an epidural block, on anticoagulation therapy or with bleeding disorders, pregnancy and lactating mothers, cardiopulmonary dysfunction, neurological and psychological illnesses, hypersensitivity to the study drugs, BMI >35, metabolic disorders, renal and hepatic disorders, inadequate sensory and motor blockade beyond 30 minutes after subarachnoid block were excluded from the study. The procedure was explained to the patients during pre - anaesthetic visit. Continuous monitoring of heart rate, BP, respiratory rate and spo2 were done by a nurse in the preoperative room. The patients were randomly divided into 3 groups with 30 patients in each group, using computer generated random number. A total sample size of 90 cases divided in 3 groups (30 each). In Group A (n=30) patients were received 0.5% bupivacaine 15 ml with 0.5 ml Buprenorphine with 0.5 ml and normal saline made to a total 16 ml. in Group B (n=30) patients were received 0.5%

bupivacaine 15 ml with 1 ml fentanyl and in Group C (n=30) patients were received 0.5% bupivacaine 15 ml with 1 ml normal saline for epidural anaesthesia. Vitals were checked every 5 minutes for the first 30 minutes then every 10 minutes till surgery and then every 30 minutes for 6 hours postoperatively. Arterial pressure supported within 20% of the baseline by the infusion of crystalline. If the systolic BP dropped below 90 mm of hg, patients was supported with iv mephentermine in small doses. When an adequate block was achieved, the time from the end of epidural injection to readiness for surgery recorded. Then the patients were positioned for planned surgery.

Patients were monitored, and different time intervals was noted to calculate the onset and duration of sensory, motor blockade and analgesia. When a patient has a VAS > 3, it will be considered that analgesic action of the drugs was terminated and rescue analgesic injection paracetamol 1g iv was given. After completion of surgery patients was shifted to post - operative ward and duration of analgesia was noted.

The comparison of the variables which were quantitative in nature were analysed using ANOVA and post hoc comparison was done using Bonferroni correction and the variables which were qualitative in nature were analysed using the Chi - Square test. If any cell had an expected value of less than 5 then Fisher’s exact test was used and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 25.0.

3. Results

The demographic data of the three studied groups are summarized in Table 1, statistical analysis revealed nonsignificant differences between the three groups as regards age, height and weight. No patients were excluded after inclusion to the study.

Table 1: Demographic Data

| | | Group K | Group M | Group C | P value |
|----------------|--------|---------------|---------------|---------------|---------|
| Age (Years) | | 36.07 ± 13.62 | 35.97 ± 13.25 | 38.87 ± 11.44 | 0.611 |
| Weight (Kg) | | 74.9 ± 10.21 | 76.2 ± 11.09 | 74 ± 12.15 | 0.746 |
| Sex N, (%) | Male | 23 (76.67) | 15 (50) | 21 (70) | 0.077 |
| | Female | 7 (23.33%) | 15 (50%) | 9 (30%) | |
| ASA grade I/II | | 16/14 | 18/12 | 22/8 | 0.266 |

Data are presented as mean±SD or ratio of patients. P>0.05 is considered statistically nonsignificant. SD=Standard deviation.

Significant difference was seen in onset and duration time sensory block onset time (minutes), motor block onset time (minutes), duration of motor blockade (minutes), duration of

analgesia (minutes), duration of sensory blockade (minutes) between group A, B and C. (p value <.05) (Table 2)

Table 2: Comparison of onset and duration time between group A, B and C

| Onset and duration time | Group A (n=30) | Group B (n=30) | Group C (n=30) | P value |
|--|----------------|----------------|----------------|---|
| Sensory block onset time (minutes) | 13.27 ± 1.29 | 9.3 ± 1.06 | 14.07 ± 1.95 | <.0001 [‡] A vs B: <.0001 A vs C: 0.039 B vs C: <.0001 |
| Motor block onset time (minutes) | 18.53 ± 1.04 | 19 ± 1.98 | 25.13 ± 2.46 | <.0001 [‡] A vs B: 0.349 A vs C: <.0001 B vs C: <.0001 |
| Duration of motor blockade (minutes) | 516.27 ± 26.94 | 182.67 ± 20.4 | 152.57 ± 26.03 | <.0001 [‡] A vs B: <.0001 A vs C: <.0001 B vs C: <.0001 |
| Duration of analgesia (minutes) | 586.33 ± 5.44 | 311.1 ± 5.36 | 218 ± 1.58 | <.0001 [‡] A vs B: <.0001 A vs C: <.0001 B vs C: <.0001 |
| Duration of sensory blockade (minutes) | 566.77 ± 23.58 | 234.5 ± 29.29 | 188.5 ± 4.22 | <.0001 [‡] A vs B: <.0001 A vs C: <.0001 B vs C: <.0001 |

Significant difference was seen in post operative heart rate (per minute) at 15 minutes, at 90 minutes, at 2 hours, at 3 hours, at 4 hours, at 5 hours, at 8 hours, at 10 hours, at 15 hours, at 24 hours between group A, B and C. (p value <.05) (Figure 1)

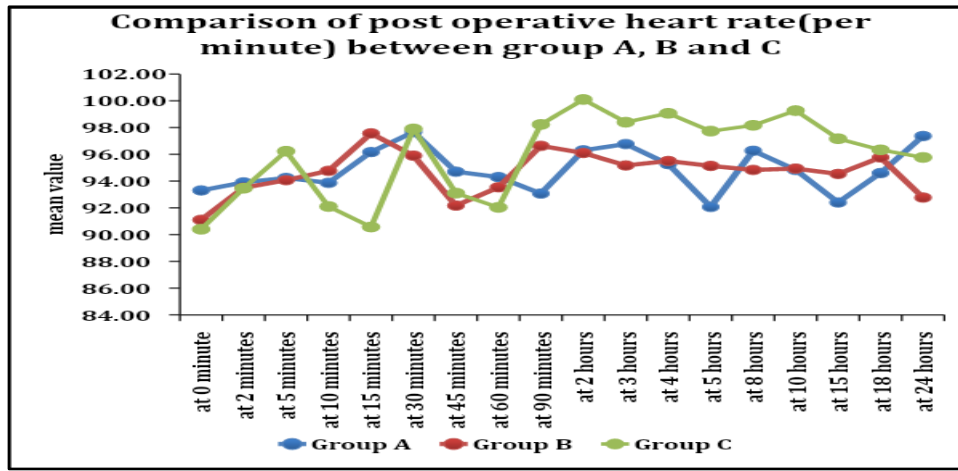


Figure 1: Comparison of trend of post operative heart rate (per minute) at different time intervals between group A, B and C.

Significant difference was seen in post operative heart rate (per minute) at 0 minute, 5 minutes, 10 minutes, 15 minutes, at 90 minutes, at 2 hours, at 5 hours, at 8 hours, at 10 hours, at 15 hours, at 18 hours, at 24 hours between group A, B and C. (p value <.05) (Figure 2)

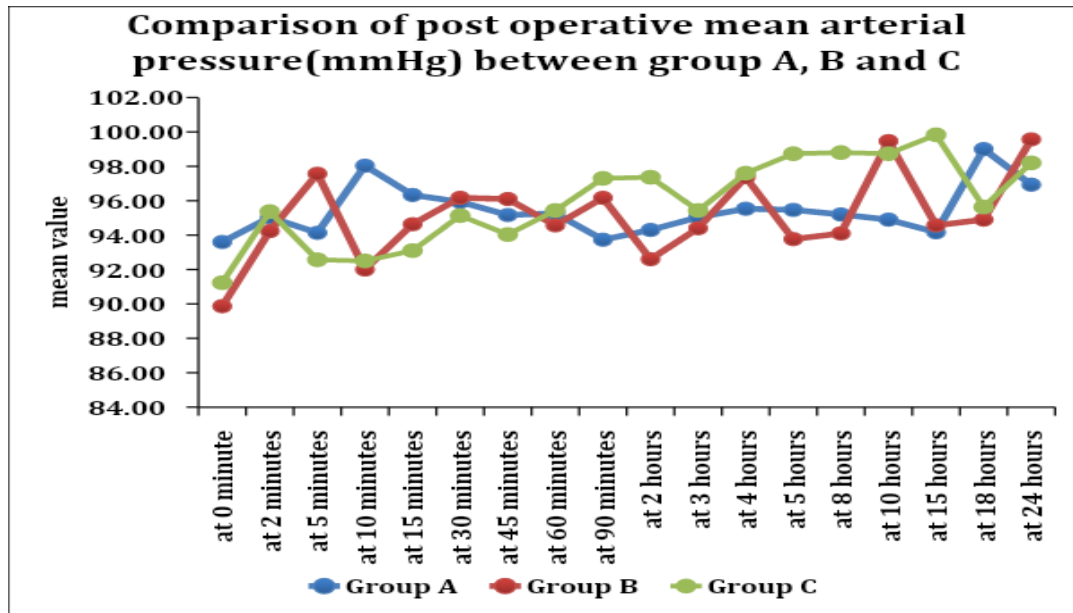


Figure 2: Comparison of trend of post operative mean arterial pressure (mmHg) at different time intervals between group A, B and C.

On qualitative analysis, no significant difference was seen in pain between group A, B and C at 0 minute, 2 minutes (p value=0.326), 5 minutes, 10 minutes (p value=1), 15 minutes (p value=1), 30 minutes (p value=1), 45 minutes, 60 minutes (p value=0.326), 90 minutes (p value=1). Significant difference was seen in pain at 2 hours, 3 hours, 4 hours, 5 hours, 8 hours, 10 hours, 15 hours, 18 hours, 24 hours between group A, B and C (p value<0.05). (Figure 3)

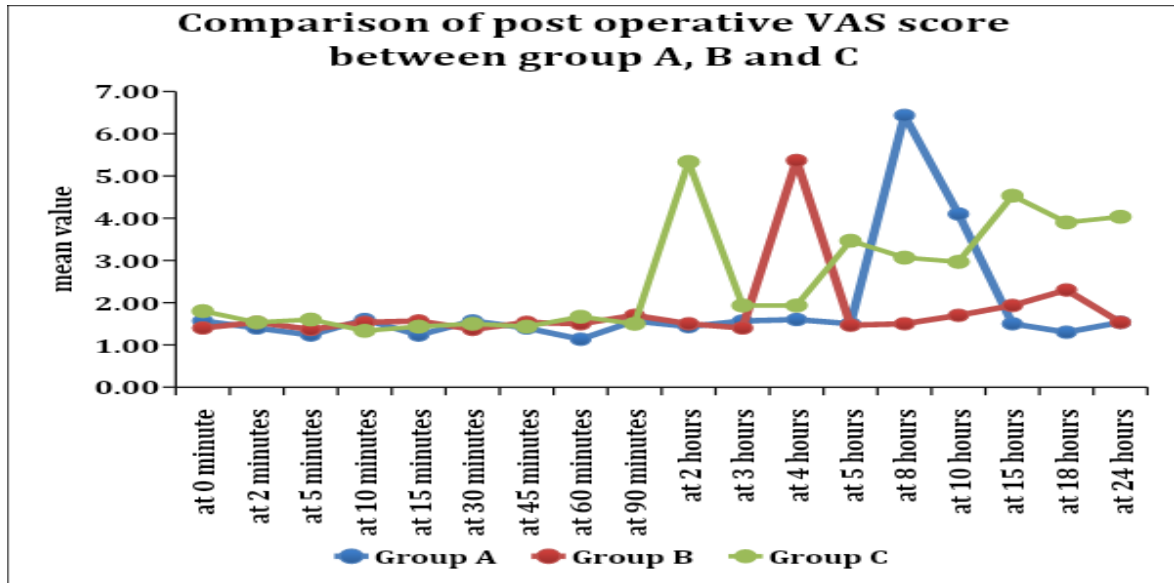


Figure 3: Comparison of postoperative VAS score between group A, B and C.

Post operative rescue analgesia was demanded at 2 hours in group C, 4 hours in group B and 8 hours in group A. So, demand for rescue analgesia was significantly prolonged in group A as compared to group B (p value<.0001) and

group C (p value<.0001) and demand for rescue analgesia was significantly prolonged in group B as compared to group C (p value<.0001) (Figure 4)

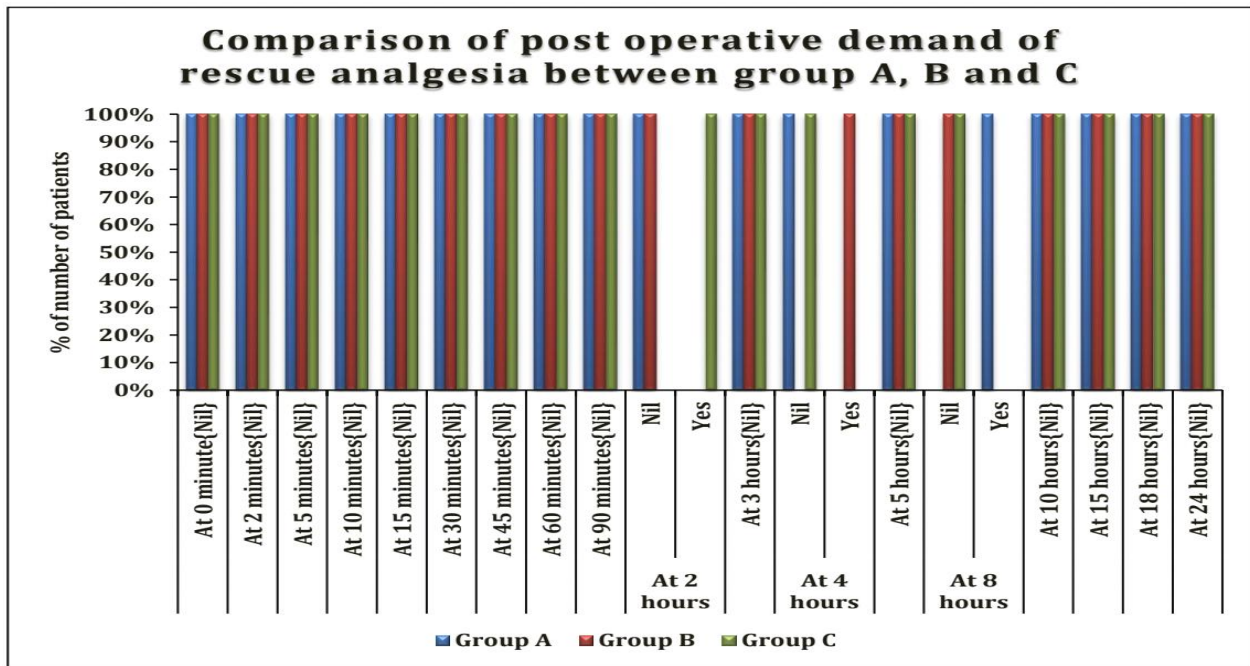


Figure 4: Comparison of postoperative demand of rescue analgesia between group A, B and C.

None of the patients had bradycardia, hypotension, seizures, Hallucinations, Nystagmus in all three groups. Pruritus was significantly higher in group B as compared to group A (p value<.0001) and C (p value<.0001). Headache and other

complications were significantly higher in group A and group B as compared to group C. (p value<.0001) Nausea was significantly lower in group B (60%) as compared to group C (86.67%) (p value=0.039) (Figure 5)

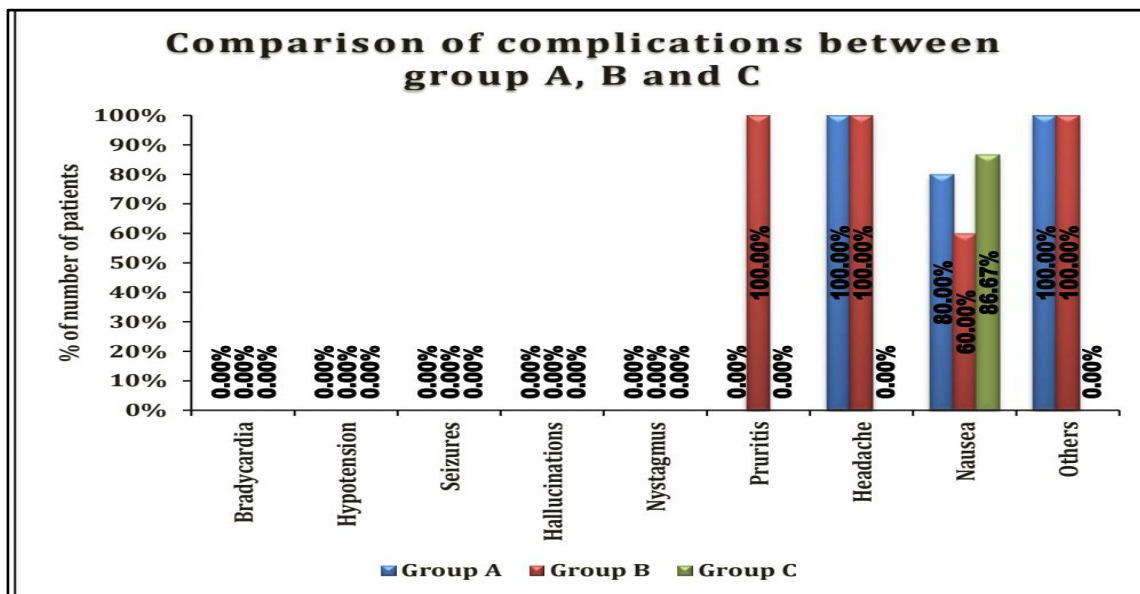


Figure 5: Comparison of complications between group A, B and C.

4. Discussion

This study showed that the onset of sensory block was earlier in the Buprenorphine group (13.27 ± 1.29 minutes) compared to Fentanyl group (9.3 ± 1.06 minutes) and the control group (14.07 ± 1.95 minutes) was statistically significant. The onset of the motor blockade was also earlier in the Buprenorphine group (18.53 ± 1.04 minutes) compared to the Fentanyl group (19 ± 1.98 minutes) and the control group (25.13 ± 2.46) and was statistically significant. Thus, this shows that addition of Buprenorphine as an adjuvant to bupivacaine will help in fastening the onset time of motor blockade, addition of Fentanyl as an adjuvant to bupivacaine will help in fastening the onset time of sensory blockade. This was consistent with the previous studies. The studies done by Shibani P et al 2016⁽⁶⁾ show similar results. Regarding the duration of sensory blockade, addition of Buprenorphine as an adjuvant to bupivacaine helps in prolonging the duration with (566.77 ± 23.58 minutes) and (234.5 ± 29.29) in the Fentanyl group and (188.5 ± 4.22 minutes) in the control group. The duration of motor blockade was (516.27 ± 26.94 minutes) in the Buprenorphine group, compared to (182.67 ± 20.4 minutes) in the Fentanyl group and (152.57 ± 26.03 minutes) in the control group. The results for the duration of the sensory and motor blockade were statistically significant favouring the Buprenorphine group. The studies done by Shibani P et al 2016⁽⁶⁾, PatilDSetal 2018⁽⁷⁾, Muppala B M et al 2020⁽⁸⁾ show similar results.

The duration of analgesia was also favouring the Buprenorphine group with 586.33 ± 5.44 minutes versus 311.1 ± 5.36 minutes in the Fentanyl group and 218 ± 1.58 minutes in the control group, which was statistically significant, thus concluding that the addition of Buprenorphine as an adjuvant to bupivacaine helps in prolonging the duration of analgesia and reducing the dose of rescue analgesia required in the postoperative period.

The studies done by Shibani P et al 2016⁽⁶⁾, PatilDS et al 2018⁽⁷⁾, Muppala B M et al 2020⁽⁸⁾ conclude that the addition

of Buprenorphine as an adjuvant to bupivacaine helps in prolonging the duration of analgesia and reducing the dose of rescue analgesia required in the postoperative period.

None of the patients had bradycardia, hypotension, seizures, Hallucinations, Nystagmus in all three groups. Pruritus was significantly higher in Fentanyl group as compared to Buprenorphine group and control group. Headache and other complications were significantly higher in the Buprenorphine group and Fentanyl group as compared to the control group. Nausea was significantly lower in the Buprenorphine and Fentanyl group as compared to the Control group. The studies done by Dr Santosh Ket al 2014⁽⁹⁾, Shibani P et al 2016⁽⁶⁾ show similar results.

5. Future Scope

Adjuvants are used with isobaric bupivacaine in epidural anaesthesia to prolong the duration of action of the block. Combination of multiple adjuvants like Buprenorphine (longer duration) and Fentanyl (lesser side effects) with different mechanisms of action with isobaric bupivacaine can help in better regional anaesthesia.

6. Conclusion

We concluded that epidural Buprenorphine is better in providing prolonged satisfactory postoperative analgesia as compared to Fentanyl. Regarding the side effects, the incidence of nausea and vomiting was more in Buprenorphine as compared to Fentanyl group but it is statistically insignificant. Hence Buprenorphine is a better drug.

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