

Effect of Butorphanol as an Adjuvant in Epidural Analgesia for Inguinal Hernia Surgery

S Yogeshwaran¹, S Balasubramanian², K Sanmugapiriya³, Suneeth P Lazarus⁴, S S S Kartheek Hajeebu¹, A Arulmani¹

¹Post Graduate Student, Department of Anesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, ²Associate Professor, Department of Anesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, ³Senior Resident, Department of Anesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, ⁴Professor and Head, Department of Anesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India

Abstract

Background: The objective of the study was to compare the onset and duration of analgesia, hemodynamic parameters, sedation and the side effects between bupivacaine and bupivacaine with butorphanol in epidural anesthesia in patients undergoing inguinal hernia surgeries.

Materials and Methods: This prospective, randomized, double-blinded, controlled study. A total of 60 patients aged 18-60 years with the American Society of Anesthesiologist Grades I or II were enrolled into the study and were randomized to receive either plain bupivacaine or bupivacaine with butorphanol in epidural anesthesia. The hemodynamic parameters such as oxygen saturation, heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were recorded during and after the procedure. The onset and duration of analgesia, sedation score, and complications if any were noted during intra- and post-operative period.

Results: The two groups were comparable with regard to age, gender, and weight with the $P < 0.05$. There was a significant fall in SBP and DBP in group BS when compared to group BB. There was a significantly earlier onset of analgesia in group BB with a mean duration of 18.33 min, and significantly prolonged duration of analgesia with a mean duration of 151.67 min. The onset of motor blockade was significantly shorter with a mean duration of 9.33 min. There was a significant sedation noted in group BB. No obvious side effects like vomiting and pruritus were noted.

Conclusion: In our study, we concluded that addition of butorphanol of 4 mg with bupivacaine in epidural for inguinal hernia surgery showed significant quickened onset and provided prolonged duration of analgesia without side effects other than significant sedation as compared with bupivacaine alone.

Key words: Bupivacaine, Butorphanol, Diastolic blood pressure, Duration of analgesia, Heart rate, Systolic blood pressure

INTRODUCTION

Pain is an unpleasant sensation which is only experienced and not expressed. The concept of intra- and post-operative pain relief has improved in the recent years. Post-operative pain gives rise to various physiological and psychological phenomenon. Proper management of

post-operative pain remains the most important pressing issues in the society. Post-operative pain gives rise to prolong hospital stay; delayed return to normal activities.^{1,2} Inadequately treated pain may produce chronic persistent pain after hernia surgery. Literature review shows that 11% patients suffered from chronic pain after hernia repair. Multimodal approaches have been used to treat pain after hernia surgery but optimal evidence-based pain therapy remains unknown.

Spinal anesthesia is the most common anesthetic technique being used for hernia repair. Even though spinal anesthesia provides an excellent pain relief in the early post-operative period, which has limitation like delayed ambulation and urinary retention.³⁻⁷

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Corresponding Author: Dr. A Arulmani, 17, Piriyadarshini Street, Sri Mookambigai Nagar, Reddiarpalayam, Puducherry - 605 010, India. Phone: +91-9629945305. E-mail: drarulmani375@gmail.com

Epidural administration of various drugs like opioids in addition with local anesthetics gives better pain relief and also reduces the stress response during the surgery. However, epidural administration of opioids like morphine produces untoward side effects like pruritus, vomiting, respiratory depression and urinary retention. The search for the better epidural adjuvant drug is continued until date.⁸ Butorphanol, a kappa (κ) agonist with weak mu (μ) agonist/antagonist with relatively high lipid solubility and lesser side effects has been used effectively to produce long-term post-operative pain relief by epidural route.^{9,10}

Therefore, we did a prospective, randomized, double-blinded study to assess the effect of butorphanol as an adjuvant in epidural analgesia for the patients undergoing inguinal hernia surgeries.

MATERIALS AND METHODS

After obtaining proper informed consent and approval of the Institutional Ethical Committee, 60 American Society of Anesthesiologist I and II patients with age group 18-60 years of both genders scheduled for elective hernia surgeries were included in our study. Patients with bleeding disorders, neuromuscular disease, spinal deformities, and injection site infection were excluded from the study. 60 patients were randomly allocated into two groups by serially numbered sealed envelope technique. Group BB received 15 ml of 0.5% bupivacaine and 2 ml of butorphanol (4 mg). Group BS received 15 ml of 0.5% bupivacaine and 2 ml of normal saline.

All the health-care providers providing direct patient care, the subject were blinded to the epidural medications administered. All the medications were prepared by the anesthetist who is unrelated to the study, and the epidural placement of the drug was given by another anesthesiologist who was also blinded.

For all the patients of both the groups pre-anesthetic checkup was done before the surgery and kept fasting for 8 h. Premedication of tablet ranitidine 150 mg and tablet metoclopramide 10 mg was given orally 1 h before surgery. In the operating room, monitors were attached and the baseline reading of heart rate (HR), non-invasive blood pressure, electrocardiogram, and oxygen saturation (SpO_2) were recorded. Then, intravenous line was placed and patients were pre-loaded with 15 ml/kg of ringer lactate solution. With all aseptic precautions, 16 g epidural needle was placed at L3-L4 intervertebral space by loss of resistance technique. The epidural catheter of 18 G was inserted for 5-6 cm in cephalad direction and 3 ml of 2% Lignocaine with adrenaline 1:2,00,000 test dose was

given after confirming negative aspiration of blood or cerebrospinal fluid. Epidural drug administration was done based on the allocation of the group as described above.

All patients were monitored for sensory blockade using pin prick method. Once T6 level of sensory blockade achieved, then surgery was allowed to begin. Sensory blockade assessment was done for every 5 min for the first 1 h and then for every 30 min for the next 3 h. Motor blockade assessment was done by Bromage scale for every 5 min for the first 30 min after drug administration. Visual analog score (VAS) for pain was recorded 30 min interval after 1 h of surgery for 4 h. Rescue analgesia was given when VAS scale becomes more than 4. Hemodynamic parameters such as HR, systolic blood pressure (SBP) and diastolic blood pressure (DBP), mean arterial blood pressure (MAP), and SpO_2 were monitored at every 5 min interval until 120 min then 30 min interval for further 3 h. Intraoperative hypotension and bradycardia was treated with IV fluids and titrated doses of ephedrine 6 mg and atropine of 0.6 mg intravenously. Sedation level was monitored by Ramsay sedation score for first 1 h of drug administration at 10 min interval. Any complications like nausea, vomiting, purities and allergic reactions were noted and managed by standard protocols.

RESULTS

A statistical analysis was performed with Student's *t*-test, Mann-Whitney *U*-test. The quantitative data were expressed in terms of mean and standard deviation. The statistical analysis was performed using SPSS version 20. All the information about the case was recorded in the master chart. The mean standard deviation *P* values were calculated. The $P < 0.05$ noted as the level of significance.

The demographic data such as the age and weight were comparable in both the groups shown (Table 1). The difference in onset of sensory blockade in group BB was 18.33 min which was shorter when compared with group BS (25.67 min). It was statistically significant (Graph 1). The duration of analgesia was prolonged in group BB (151.67 min) then group BS (101.33 min) which was statistically significant (Graph 1). Similarly, the onset of motor blockade in group BB (9.33 min) was shorter than the group BS (15.17 min) which was statistically significant (Graph 1). However, there was no significant change in the completion of motor blockade in both the groups BB of 13.17 min, whereas in group BS of 11.83 min (Graph 2).

Patient in group BB was more sedated and which was statistically significant after 20 min (Table 2). Regarding hemodynamic parameters, there was slight fall in both HR

Table 1: Demographic data

Parameters	Group BB (n=30)	Group BS (n=30)
Age (years)	12.02	14.29
Weight (kg)	62.9	67.9

Table 2: Sedation score

Time (min)	Mean±SD		P*
	Group BB (n=30)	Group BS (n=30)	
0	2.00±0.00	1.93±0.254	0.154
10	2.30±0.466	2.17±0.379	0.226
20	3.20±0.610	2.73±0.450	0.002*
30	3.43±0.568	3.10±0.305	0.005*
40	3.77±0.430	3.30±0.466	<0.001*
50	4.00±0.00	3.73±0.450	0.003*
60	4.03±0.320	3.80±0.407	0.018*

SD: Standard deviation

and MAP in group BB which was not statistically significant (Graphs 3 and 4). None of the patients developed vomiting or pruritus in both groups. In group BB 13% of patients experienced nausea only which was treated with ondansetron 4 mg intravenously.

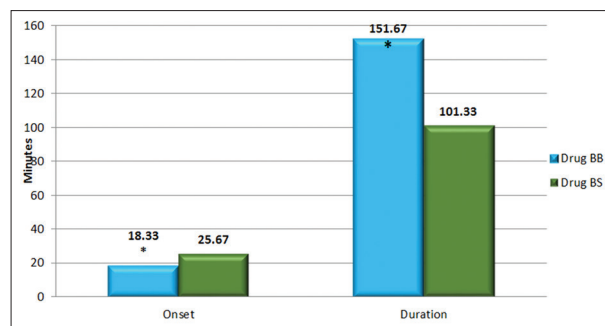
DISCUSSION

We conducted this prospective randomized double-blind study in an attempt to evaluate the effect whether administration of butorphanol with bupivacaine epidurally improves both the intra and post-operative analgesia in patients undergoing inguinal hernia surgeries.

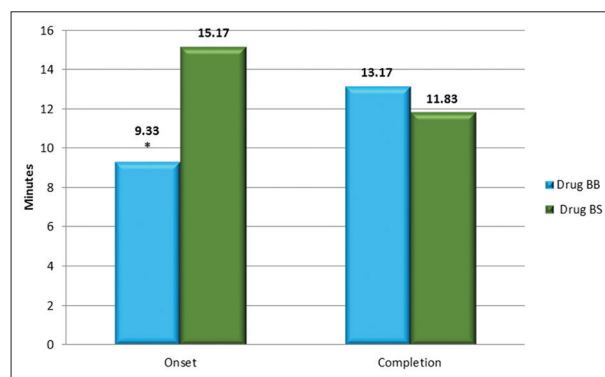
Effective pain control is essential and has been recognized as a prime concern for anesthesiologist. An epidural route is used extensively for post-operative pain control. Bupivacaine is the most commonly used local anesthetic in epidural analgesia, but recently studies show addition of opioids as adjuvants produces the early onset of action and prolonged duration of analgesia with better hemodynamic stability and also dose-sparing effects.

In our study, we found that addition of butorphanol to bupivacaine showed faster onset of both sensory analgesia (18.33 min) as well as motor blockade (9.33 min), whereas in plain bupivacaine group which showed the onset of sensory as (25.67 min) and motor analgesia (15.17 min). Similarly, Devulapalli *et al.*,¹¹ state that epidural butorphanol has faster onset of action at 14.66 min were as with epidural morphine the onset was 34.76 min.

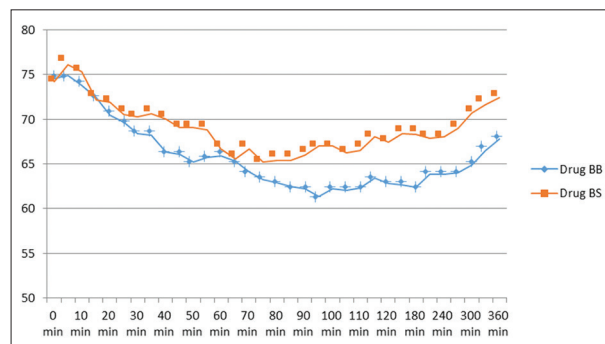
Hunt *et al.*¹² studied that epidural butorphanol-bupivacaine for analgesia during labor and delivery demonstrated that duration of complete analgesia is more with the addition



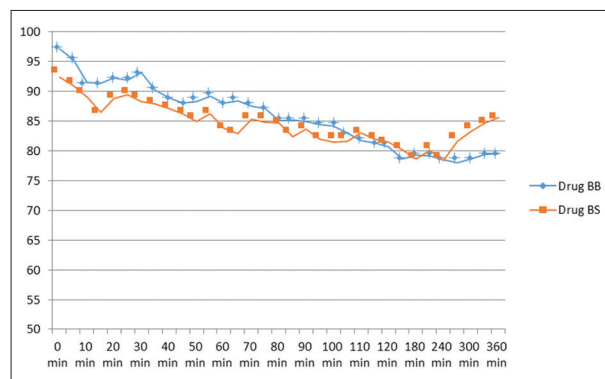
Graph 1: Comparison of onset and duration of sensory blockade. *Significant P < 0.05



Graph 2: Comparison of onset and completion of motor blockade. *Significant P < 0.05



Graph 3: Changes in the mean heart rate for both groups



Graph 4: Changes in the mean arterial pressure for both the groups

of 2 or 3 mg butorphanol to 0.25% bupivacaine than with plain bupivacaine group. In our study, we observe that duration of analgesia with group BB was 151.67 min which was significantly prolonged when compared with group BS of 101.33 min.

Agarwal *et al.*¹³ observed that combination of epidural buprenorphine with bupivacaine produces significant rapid onset of analgesia but has only shorter duration of analgesia. Gupta *et al.*¹⁴ observed that both butorphanol and tramadol were effective in relieving post-operative pain, however, quality of analgesia and patient satisfaction was more with butorphanol.

Regarding hemodynamics, epidural butorphanol produces only minimal cardiovascular changes even though there was a reduction in HR and blood pressure which was not statistically significant when compares with epidural bupivacaine group.

Opioids are well-known for its side effects such as pruritus, nausea, vomiting and respiratory depression. Delayed respiratory depression is due to poor lipid solubility nature. Hunt *et al.*¹² observed that there was a significant somnolence lasted approximately for 6 h in 13 out of 14 patients received more than 1 mg of butorphanol. In our study, we observed there was a significant sedation with group BB, but we observed only for 1 h as it needs more time to evaluate prolonged sedation scale. However, none of the patient went into respiratory depression. Mok *et al.*¹⁵ studied epidural butorphanol and morphine for relief of post-operative pain, they observed that butorphanol injected epidurally appeared to be safe, reliable method of providing prolonged pain relief and no clinical evidence of respiratory depression. The main advantage of butorphanol is its fewer side effects. Kaur and Bajwa,⁸ observed that fentanyl groups had a higher incidence of pruritus and vomiting when compared with butorphanol group were as nausea was present in both the groups. In our study, we observed nausea for few patients who received epidural butorphanol; we did not observe any other side effects such as vomiting and pruritus.

CONCLUSION

We conclude that the addition of butorphanol of (4 mg) with bupivacaine in epidural anesthesia significantly quickens the onset and prolongs the duration of analgesia, without any major side effects, except significant sedation as compared with bupivacaine alone.

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