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COMPARISON OF INTRATHECAL FENTANYL AND BUPRENORPHINE AS AN ADJUVANT TO 0.5% HYPERBARIC BUPIVACAINE FOR SPINAL ANESTHESIA

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ABSTRACT **Introduction:** Perioperative pain management is critical, and spinal anaesthesia is frequently employed during procedures. To prolong analgesia, numerous adjuvants, including opioids such as fentanyl and buprenorphine, are added. The purpose of this research was to compare the spinal anaesthetic effects of intrathecal fentanyl and buprenorphine when used in conjunction with hyperbaric bupivacaine. **Objectives:** To evaluate the efficacy, characteristics of block, hemodynamic effects, and side effects of intrathecal fentanyl and buprenorphine when used alongside hyperbaric bupivacaine for spinal anesthesia. **Methodology:** In this randomised controlled trial, eighty patients requiring spinal anaesthesia for surgical procedures participated. In contrast to Group A, which received intrathecal fentanyl accompanied by hyperbaric bupivacaine, Group B was administered buprenorphine under the identical anaesthetic conditions. A multitude of factors were evaluated, encompassing the duration and initiation of sensory and motor block, hemodynamics, and adverse effects. **Results:** Intrathecal fentanyl induced sensory blockage more rapidly than buprenorphine. Conversely, buprenorphine induced motor block more rapidly and prolonged analgesia. There were no notable disparities detected in terms of hemodynamics or respiratory rate between the two cohorts. **Conclusion:** Intrathecal fentanyl shortened the onset of sensory block, while buprenorphine hastened motor block onset and prolonged analgesia. Both opioids were safe, with no major complications observed.

KEYWORDS : spinal anesthesia, fentanyl, buprenorphine, hyperbaric bupivacaine, analgesia, sensory block, motor block, hemodynamics, adverse effects.

INTRODUCTION

"Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage," according to the International Association for the Study of Pain's taxonomy work group. It is from the Greek word poine (punishment) that the term "pain" is derived.1 Pain is an experience and a sensory modality. Surgical-associated discomfort is a prevalent phenomenon that all patients encounter during the perioperative phase.2 Ensuring prompt and efficient pain alleviation is crucial in mitigating nocioception-induced reactions such as endocrine-metabolic responses to surgery, autonomic reflexes that impair organ function, and reflexes that induce muscle spasms, among other undesired consequences.3 Currently, 0.5% hyperbaric bupivacaine is frequently used to administrate spinal anaesthesia during lower abdominal and lower limb operations. In order to extend the time that local anaesthesia provides analgesia, numerous adjuvants have been introduced via the central neuraxial pathway.4 Over time, the utilisation of local anaesthetic adjuvants has progressed from traditional opioids to an extensive variety of medications that encompass multiple classes and employ distinct mechanisms of action.5

In conjunction with local anaesthetic agents, intravenous adjuvants including dexmedetomidine, clonidine, ketamine, and analgesics are utilised to extend the duration of spinal anaesthesia. Among them, opioids like fentanyl and buprenorphine are the most prevalent.6 Buprenorphine exhibits a high degree of affinity at both κ and m opiate receptors, making it a mixed agonist antagonist narcotic. It is compatible with cerebrospinal fluid (CSF) and does not induce any adverse effects when administered intrathecally. When administered intrathecally, buprenorphine generates an adequate and prolonged duration of action with fewer side effects at low doses, making it an appropriate option.7 Fentanyl, on the other hand, is a synthetic opioid agonist derived from phenylpiperidine. Fentanyl is 75-125 times more efficacious than morphine as an analgesic. There have been no reports of neural toxicity. It has been shown that fentanyl administered epidurally provides adequate postoperative analgesia following significant abdominal surgery and caesarean section.4 Hence this study was undertaken to assess the effects of intrathecal fentanyl with bupivacaine compared to intrathecal buprenorphine with bupivacaine for spinal anesthesia.

Objectives

To evaluate efficacy, characteristics of block, hemodynamic effects and side effects of intrathecal fentanyl and buprenorphine as adjuvant to hyperbaric bupivacaine 0.5% for spinal anesthesia

Methodology

This study was a randomised controlled trial (RCT) conducted at a tertiary care hospital. It included a total of 80 patients who were separated into two groups. Group A was administered Intrathecal Fentanyl alongside 0.5% Hyperbaric Bupivacaine for spinal anaesthesia, whilst Group B was given Buprenorphine as an adjuvant to the same anaesthesia. A lumbar puncture was conducted with strict sterile precautions, with a single-use syringe and a 25-gauge spinal needle inserted through a midline approach. Prior to the administration of anaesthesia, the initial vital signs were recorded.

The study involved adult patients who were scheduled for surgical procedures that required spinal anaesthesia. These patients were required to meet the following criteria: being hemodynamically stable, being 18 years of age or older, weighing more than 40 kg, having a height greater than 150 cm, having an American Society of Anesthesiologists (ASA) physical status classification of I or II, and being capable of providing informed consent.

The exclusion criteria included pregnant or lactating women, individuals with contraindications to spinal anaesthesia or opioids, a history of opioid dependence or chronic pain requiring opioid therapy, significant comorbidities affecting cardiovascular, respiratory, renal, or hepatic function, and the inability to communicate or cooperate with study procedures.

The primary goals evaluated were the initiation and duration of sensory and motor blockades, the stability of hemodynamics, and the scores for postoperative pain. Additional outcomes encompassed adverse events such as hypotension, bradycardia, respiratory depression, and nausea/vomiting.

The acquired data was analyzed using suitable statistical techniques. Continuous variables were presented as means ± standard deviations, while categorical variables were given as frequencies and percentages. Mean difference was calculated using ANOVA. The study procedure was approved by the institutional ethics committee, and written informed consent was obtained from all participants, highlighting the importance of ethical considerations. The study rigorously upheld patient confidentiality and privacy.

RESULTS

Among 80 study participants, Group A was administered Intrathecal Fentanyl alongside 0.5% Hyperbaric Bupivacaine for spinal anaesthesia which were 40(50%) participants whilst Group B was given Buprenorphine as an adjuvant to the same anaesthesia which were 40(50%) participants. Among Group A, 30(75%) were males whereas in group B, 34(85%) as shown in Figure 1.

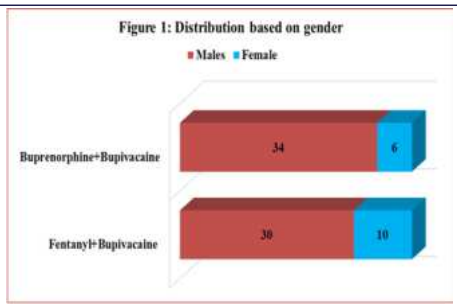

Figure 1: Distribution based on gender

Table 1 displays a comparison of two groups that received different adjuvants, namely Fentanyl with Bupivacaine and Buprenorphine with Bupivacaine. The comparison focuses on numerous metrics linked to spinal anaesthesia. The parameters consist of the mean, standard deviation (SD), and standard error of the mean (SEM) for age (in years), onset of sensory block (in minutes), time taken to reach the highest level of anaesthesia (in minutes), onset of motor block (in minutes), time taken for 2 segment regression (in minutes), time taken for L1 segment regression (in minutes), and duration of analgesia (in minutes). The statistical analysis employing ANOVA reveals significant ($p<0.05$) disparities between the two groups in all parameters, with the exception of the duration required to reach the maximum level of anaesthesia. The Buprenorphine+Bupivacaine group showed a quicker start of motor block, shorter periods for regression, and a considerably longer period of pain relief compared to the Fentanyl+Bupivacaine group.

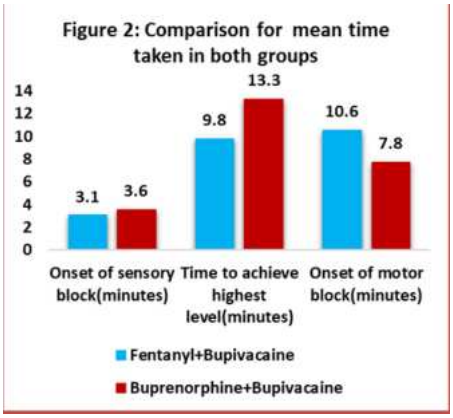

Figure 2: Comparison for mean time taken in both groups

The effects of fentanyl and bupivacaine, as well as buprenorphine and bupivacaine, on several spinal anaesthesia parameters are contrasted in the Figure 2. When compared to buprenorphine, fentanyl hastened the onset of sensory block (3.1 vs. 3.6 minutes) whereas it fastened the motor block (10.6 vs. 7.8 minutes). In contrast to fentanyl, buprenorphine showed a longer time to reach the maximum degree of anaesthesia (13.3 vs. 9.8 minutes) and a noticeably longer duration of analgesia (411.3 vs. 283.8 minutes).

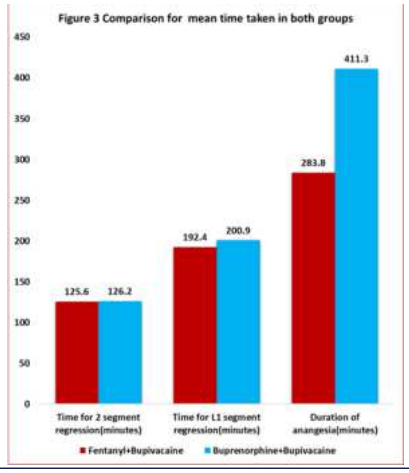

Figure 3: Comparison for mean time taken in both groups

Two groups are compared in the Figure 3, when fentanyl and Bupivacaine were combined, two-segment regression took somewhat less time (125.6 minutes) than when buprenorphine and Bupivacaine were combined (126.2 minutes). In contrast to Fentanyl with Bupivacaine (283.8 minutes), Buprenorphine with Bupivacaine demonstrated a longer time for L1 segment regression (200.9 minutes) and a much longer duration of analgesia (411.3 minutes).

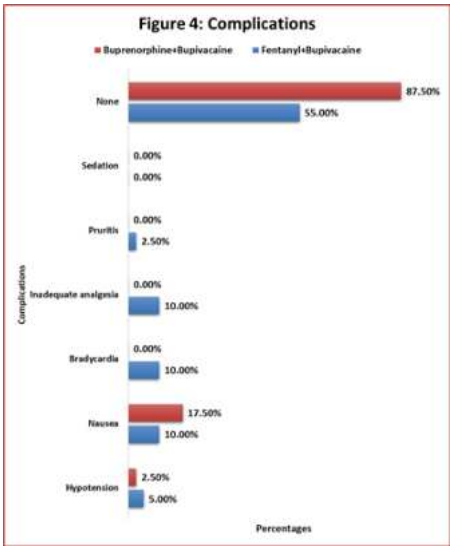

Figure 4: Comparison of complications in both groups

Figure 4 presents a comparison of complication rates between two groups who received different adjuvants for spinal anaesthesia: Fentanyl with Bupivacaine and Buprenorphine with Bupivacaine. The group administered with buprenorphine had reduced rates of hypotension (2.50%), and bradycardia (0.00%) compared to the group administered with fentanyl (5.00% and 10.00% respectively). However, buprenorphine showed a greater incidence of nausea compared to the fentanyl group, with 17.5% of cases experiencing nausea in the buprenorphine group and 10% in the fentanyl group. In addition, the Buprenorphine group did not report any incidents of insufficient pain relief, itching, or sedation. A larger percentage (87.50%) of the Buprenorphine group experienced no problems, compared to the Fentanyl group (55.00%).

DISCUSSION

In our study, the mean time for the onset of sensory block was 3.1 minutes in group A (fentanyl) and 3.6 minutes in group B (buprenorphine). This demonstrates that the addition of fentanyl significantly hastened the onset of sensory block compared to buprenorphine, in line with findings from Technovate et al. 8 The mean onset of motor block was 10.6 minutes in group A and 7.8 minutes in group B, indicating a statistically faster onset of motor blockade with buprenorphine. This observation aligns with previous reports by Lipp et al.9 Additionally, the time taken to achieve the highest level of block was significantly less with fentanyl, consistent with findings reported by Fauzia et al. 10

The mean duration of analgesia was significantly longer in group B (buprenorphine) compared to group A (fentanyl), with values of 6.8 hours and 4.7 hours, respectively. This suggests that buprenorphine may offer prolonged postoperative pain relief compared to fentanyl, as noted by Sen et al.11 and Copogna et al.12 However, buprenorphine showed a greater incidence of nausea compared to the fentanyl group, with 17.5% of cases experiencing nausea in the buprenorphine group and 10% in the fentanyl group, consistent with findings from Sen et al.11

Importantly, our study did not find significant differences in hemodynamics or respiratory rate between the two groups, in line with previous research by Varrasi et al.13 and Fauzia et al.10 This suggests that both fentanyl and buprenorphine may have similar effects on cardiovascular and respiratory parameters, highlighting their safety profiles in this context.

CONCLUSION:

1. The onset of sensory block was shortened by addition of Fentanyl intrathecally
2. The onset of motor block was faster with addition of Buprenorphine.
3. Time taken to achieve highest sensory level was lesser in Fentanyl group.
4. Total duration of analgesia was considerably prolonged with addition of intrathecal Buprenorphine.
5. No major complications or respiratory depression was observed in the two groups.

REFERENCES

1. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain 2020;161(9):1976–1982.
2. Das N, Lahkar B, Brahma H, Borah B. Analgesic efficacy in caesarean section: a comparison between fentanyl and buprenorphine as an adjuvant to bupivacaine under subarachnoid block. New Indian J OBGYN 2023;10(1):77–83.
3. Muruganantham V, Azar N. A comparative study between the efficacy of fentanyl with bupivacaine 0.5% and buprenorphine with bupivacaine 0.5% for lower abdominal and lower limb surgeries in a Government Tertiary Care Teaching Hospital. Int Arch Integr Med 2019;6(5):80–82.
4. Gali YM, Vasudha KL, Rao A, Acharya A. A Comparative Study of Efficacy of Fentanyl Versus Buprenorphine as an Adjuvant to Bupivacaine in Lower Abdominal Surgery. INDIAN J Anesth Analg 2019;6(3):815–820.
5. Singh Y, Yadav AK, Bajpai V, Diwedi P, Verma S, Verma RK. Comparison of intrathecal fentanyl and buprenorphine as adjuvants to bupivacaine in gynecological surgery. Anaesth Pain Intensive Care 2022;26(1):39–43.
6. Furia P, Sasturkar V, Kulkarni S, Joshi P, Bhale P. Efficacy of intrathecal fentanyl versus buprenorphine as an adjuvant to isobaric levobupivacaine in lower limb surgeries: a comparative study. MGM J Med Sci 2021;8(4):336.
7. Lanz E, Simko G, Theiss D, Glocke MH. Epidural buprenorphine—a double-blind study of postoperative analgesia and side effects. Anesth Analg 1984;63(6):593–598.
8. Techanivate A, Urusopone P, Kiatgungwanglia P, Kosawiboonpol R. Intrathecal fentanyl in spinal anesthesia for appendectomy. J-Med Assoc Thail 2004;87 (5):525–530.
9. Lipp M, Daubländer M, Lanz E. 15 mg Intrathecal buprenorphine applied for postoperative analgesia. A clinical double-blind study. Anaesthesist 1987;36(5) :233–238.
10. Khan FA, Hamdani GA. Comparison of intrathecal fentanyl and buprenorphine in urological surgery. J Pak Med Assoc 2006;56(6):277–81.
11. Sen M. Intrathecal buprenorphine for postoperative analgesia in orthopaedic surgery. J Indian Med Assoc 1992;90(1):5–6.
12. Capogna G, Celleno D, Tagariello V, Loffreda.Mancinelli C. Intrathecal buprenorphine for postoperative analgesia in the elderly patient. Anaesthesia 1988;43(2):128–130.
13. Varrassi G, Celleno D, Capogna G, Costantino P, Emanuelli M, Sebastiani M, et al. Ventilatory effects of subarachnoid fentanyl in the elderly. Anaesthesia 1992;47(7):558–562.