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0.5% PLAIN INJECTION BUPIVACAINE VS 0.5% PLAIN INJECTION BUPIVACAINE + INJECTION NALBUPHINE (10MG) FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK – A COMPARATIVE STUDY FOR 60 PATIENT

Medicine

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ABSTRACT

The limited duration of local anesthetics like bupivacaine is a significant challenge in regional anesthesia. This study aimed to evaluate nalbuphine as an adjuvant to bupivacaine for supraclavicular brachial plexus block. We conducted a prospective, double-blind, randomized controlled trial on 60 patients, divided into two groups: Group N received 25 mL of 0.5% plain bupivacaine with 1 mL (10 mg) of nalbuphine, and Group C received the same bupivacaine with 1 mL of normal saline. The addition of nalbuphine resulted in a significantly faster onset of sensory block (5.01 ± 1.46 minutes vs. 8.83 ± 1.76 minutes) and motor block (9.23 ± 2.20 minutes vs. 14.36 ± 1.75 minutes) ($p<0.00001$). Furthermore, the duration of motor block and analgesia was substantially prolonged in Group N. The mean duration of motor block was 447.10 ± 31.25 minutes versus 316.57 ± 28.82 minutes in Group C, and the mean duration of analgesia was 684.53 ± 28.04 minutes compared to 442.30 ± 36.15 minutes ($p<0.00001$). Final results suggest that nalbuphine is a safe, economical, and effective adjuvant in peripheral nerve blocks.

KEYWORDS

Nalbuphine, Bupivacaine, Supraclavicular Brachial Plexus Block, Adjuvant, Analgesia

INTRODUCTION

Regional anesthesia, particularly the supraclavicular brachial plexus block, is a preferred method for pain relief during upper limb surgeries due to its effective analgesia with fewer systemic side effects compared to general anesthesia[1]. However, a key limitation is the short duration of action of local anesthetics like bupivacaine, which often requires additional postoperative analgesics[3]. To address this, various pharmacological adjuvants have been studied, including clonidine, dexmedetomidine, and opioids. Nalbuphine, a synthetic opioid with mixed μ-receptor antagonist and κ-receptor agonist properties, has garnered attention for its potential to prolong regional anesthesia without causing significant respiratory depression[4].

A review of existing literature shows inconsistencies in nalbuphine's reported effects on block onset, with some studies showing a statistically significant effect[5] but others finding no such effect[7],[8]. This variance provides a rationale for my study. My aim was to evaluate the effect of adding nalbuphine as an adjuvant to bupivacaine, comparing the onset and duration of sensory and motor blocks and the time to first rescue analgesia.

MATERIALS AND METHODS

This prospective, double-blind controlled trial included 60 patients, all within American Society of Anesthesiologists (ASA) grades I, II, or III, aged 18-60 years, and weighing 50-90 kg.

After obtaining written informed consent, participants were randomly allocated into two groups of 30 patients each. Group N (Nalbuphine) received 25 mL of 0.5% plain bupivacaine mixed with 1 mL (10 mg) of nalbuphine, while Group C (Control) received the same bupivacaine volume with 1 ml of normal saline. Solutions were identical in appearance to ensure blinding.

Technique

The anesthetic procedure used a landmark-based supraclavicular brachial plexus block. With the patient supine and head turned away, under strict aseptic precaution a 23-gauge, 1.5-inch needle was inserted 1 cm superior to the clavicle midpoint and directed caudal, medial, and posterior until paresthesia or a motor response was noted. Anesthetic drugs were administered incrementally after negative aspiration.

A blinded observer assessed block success using a three-point scale (0=no block, 1=partial, 2=complete) for sensory and motor function. Onset time was from the end of injection to a Grade 1 response. Block duration was from a complete block (Grade 2) to the reappearance of function. Analgesia duration was from sensory blockade onset to the patient's first request for rescue analgesia (Visual Analogue Scale > 3). Hemodynamic parameters were monitored at regular intervals.

RESULTS

Nalbuphine significantly accelerated block onset. Mean onset time for sensory block in Group N was 5.01 ± 1.46 minutes, significantly faster than Group C's 8.83 ± 1.76 minutes ($p<0.00001$). Similarly, motor block onset was faster in Group N (9.23 ± 2.20 minutes) compared to Group C (14.36 ± 1.75 minutes) ($p<0.00001$). These findings are in Table 1.

Table 1: Comparison of Onset Times for Sensory and Motor Block

Variable	Group N (Mean ± SD)	Group C (Mean ± SD)	P-Value
Onset of Sensory Block (min)	5.01 ± 1.46	8.83 ± 1.76	<0.00001
Onset of Motor Block (min)	9.23 ± 2.20	14.36 ± 1.75	<0.00001

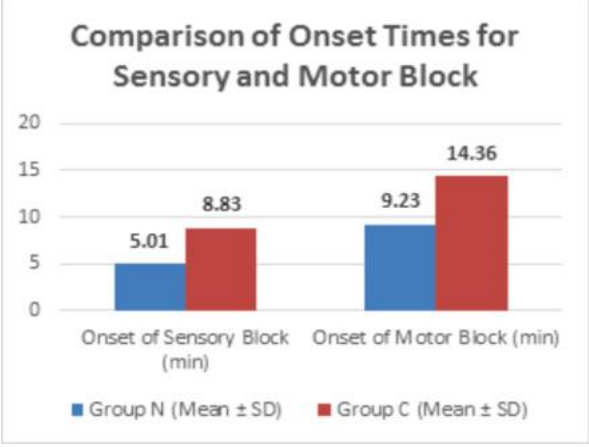

Figure 1: Comparison of Mean Onset Time for Sensory Block in Nalbuphine (Group N) and Control (Group C) Groups.

The duration of both motor block and analgesia was substantially prolonged in Group N. The mean duration of motor block was 447.10 ± 31.25 minutes in Group N versus 316.57 ± 28.82 minutes in Group C ($p<0.00001$). The mean duration of analgesia in Group N was 684.53 ± 28.04 minutes, a significant increase compared to 442.30 ± 36.15 minutes in Group C ($p<0.00001$). This data is in Table 2.

Table 2: Comparison of Duration of Motor Block and Analgesia

Variable	Group N (Mean ± SD)	Group C (Mean ± SD)	P-Value
Duration of Motor Block (min)	447.10 ± 31.25	316.57 ± 28.82	<0.00001
Duration of Analgesia (min)	684.53 ± 28.04	442.30 ± 36.15	<0.00001

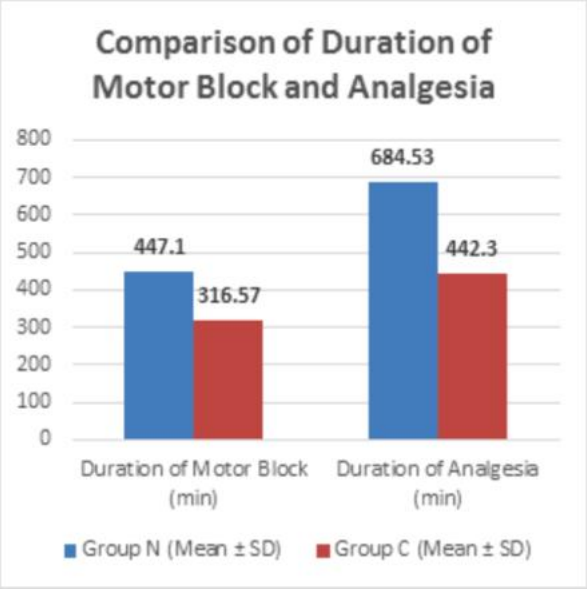

Figure 2: Comparison of Mean Duration of Motor Block in Nalbuphine (Group N) and Control (Group C) Groups.

Regarding hemodynamic stability, there were no statistically significant differences in mean heart rate, systolic, or diastolic blood pressure between groups at any time point ($p>0.05$).

DISCUSSION

The findings from study provide compelling evidence that nalbuphine is a highly effective adjuvant in supraclavicular brachial plexus block. The result align with and strengthen the finding of growing body of literature that supports the use of nalbuphine in regional anaesthesia. It was observed that nalbuphine significantly prolong the duration of both sensory and motor blockage as well as postoperative analgesia, is consistent with prior study by Nazir et al.[5] and Waly et al.[6].Nazia Nazir et al[5] have shown the 10 mg of nalbiphine as an adjuvant to 0.375%bupiva caine gives a significant faster onset (66%) comparing to control group whereas guptaet al[7] have faster onset than the control group with no statistical significance.

A particularly noteworthy finding of this study is the highly statistically significant acceleration of block onset time in the nalbuphine Group, a result that has previously been inconsistent across the literature. While some studies suggest those by Gupta et al.[7] and Abdelhaq et al.[8] has shown the trend toward faster onset but without statistically significance, this finding however provide unequivocal evidence of the reduced onset time which is a key clinical benefit.

The mechanism behind this effect can be explained by pharmacological properties of nalbuphine myelinated nerve fibres from brachial plexus propagate impulses through a process known as saltatory conduction, where the action potential “jumps” between the nodes of Ranvier. For a local anaesthetic like bupivacaine to block voltage-gated sodium channel, it must first penetrate the lipid-rich nerve sheath to reach these nodes. Nalbuphine processing lipophilic properties is able to more readily cross this lipid membrane, thereby facilitating the rapid access of the local anaesthetic to its target receptors and consequently accelerating the onset of the block. This mechanistic explanation not only validates the observed clinical effect but also contributes to a deeper understanding of the drug's action in peripheral nerve block.

The clinical implications of my findings are substantial. The observed mean duration of analgesia of approximately 11.4 hours (684.53 minutes) in nalbuphine group significantly reduces the need for rescue analgesics in the critical postoperative period. This not only improves patient comfort and satisfaction but also has the potential to decrease the total consumption of systemic opioids, thereby minimizing common side effect such as nausea, vomiting and respiratory depression.

When compared to other adjuvants like dexmedetomidine, nalbuphine offers a favourable safety profile, as it causes minimal sedation and maintains stable hemodynamics, as confirmed by my study's finding[9].This is a crucial distinction, as some adjuvant can introduce undesirable side effects like hypotension or bradycardia. This study's finding of stable heart rate and blood pressure throughout the procedure further reinforces nalbuphine's safety and reliability in this clinical setting. The mild systemic effect such as slight decline in blood pressure can be attributed to the calmative effect of the drug on the patient which is a desirable side benefit.

CONCLUSION

Based on the comprehensive findings of this comparative study, it is concluded that the addition of 10 mg of Nalbuphine as an adjuvant to 25 mL of 0.5% Bupivacaine in supraclavicular brachial plexus blocks is highly efficacious. The combination significantly accelerates the onset of both sensory and motor blockades. Furthermore, Nalbuphine remarkably prolongs the total duration of sensory block, motor block, and postoperative analgesia, thereby significantly delaying the patient's need for first rescue analgesics and reducing overall postoperative analgesic consumption. This combination also maintains excellent perioperative hemodynamic stability without increasing the incidence of opioid-related adverse effects such as nausea, vomiting, pruritus, or respiratory depression. Therefore, Nalbuphine proves to be a safe, reliable, and highly effective adjuvant for upper limb surgeries under supraclavicular block.

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