Section: Anaesthesiology

Original Research Article

# A STUDY ON THE EFFECT OF NALBUPHINE AS AN ADJUVANT TO BUPIVACAINE IN ULTRASOUND-GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS NERVE BLOCK

**A.L. Dharmalingam[1], Shalini Lal[2]**

[1]Associate Professor, Department of Anaesthesiology, Government Medical College Hospital, Omandurar Government Estate, Chennai, Tamilnadu, India
[2]IDCCM Fellow, Department of Critical Care Medicine, Aster Mims Hospital, Calicut, Kerala, India

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Corresponding Author:
**Dr. Shalini Lal,**
Email: shalzanp@gmail.com

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## Abstract

**Background:** Brachial plexus nerve blocks are a growing regional anaesthesia technique used in upper extremity surgeries, providing a safer alternative to general anaesthesia. Adjuvant drugs, such as nalbuphine and buprenorphine, enhance the quality and duration of the blockade, reducing patient financial burden and hospital stay. This study aimed to demonstrate the efficacy of nalbuphine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks. **Materials and Methods:** This prospective, randomised, double-arm, double-blind controlled study was conducted on 60 patients who underwent upper limb surgeries performed under supraclavicular brachial plexus block at Government Kilpauk Medical College Hospital and Government Royapettah Hospital between November 2017 and April 2018. In Group B (control group), 30 patients were administered 25 ml of 0.5% bupivacaine and 1 ml of normal saline. In Group N (nalbuphine group), 30 patients were administered 25 ml of 0.5% bupivacaine + 1 ml (10 mg) of nalbuphine. **Result:** There were no significant differences in age, sex, ASA grade, weight, height, BMI, duration of surgery or pain scores between the groups ($p > 0.05$). The onset time was significantly higher in Group B (14.00 min) than in Group N (21.20 min), whereas the duration time was significantly higher in Group B (285.33 min). The opioid requirement for 24 h was significantly higher in group B (53.33%) than in group N (80%). The study also found no significant association between pulse rate and the intervention groups. **Conclusion:** The anaesthetic agent 0.5% Bupivacaine with Nalbuphine produced better medium-term pain control at 12 h postoperatively compared to 0.5% bupivacaine alone as an adjuvant for ultrasound-guided supraclavicular brachial plexus block.

## INTRODUCTION

Brachial plexus nerve block is a regional anaesthesia technique developed for day-to-day anaesthesia practice. It is sometimes used as an alternative to or along with general anaesthesia for upper extremity surgeries. It is a safer alternative to general anaesthesia for upper limb surgery, works excellently in relieving postoperative pain, and provides excellent haemodynamic stability. It is becoming increasingly popular because the field of regional anaesthesia has improved over time. Several new adjuvant drugs and advanced techniques such as ultrasound-peripheral nerve stimulators have been developed for successful and safe blocking. The main advantage of this method is that it avoids the adverse effects of general anaesthesia. This creates a lower financial burden for the patient, and the hospital stay is reduced.

Many adjuvants to local anaesthetics, such as clonidine, dexmedetomidine, nalbuphine, buprenorphine, and dexamethasone, have been developed to increase the quality of the nerve block, hasten its onset, and increase its duration. Nalbuphine is a novel opioid agonist-antagonist drug and is now being increasingly used as an adjuvant in brachial plexus nerve blocks. It acts as an antagonist of mu-receptors and agonists of kappa receptors to provide reasonably potent and adequate analgesia. In addition, there is no supportive documentary evidence of neurotoxicity following the use of nalbuphine for peripheral nerve blocks. In humans, nalbuphine is usually added to local anaesthetics while performing peripheral nerve block. This has been proven to increase the duration of postoperative


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analgesia. Bupivacaine is a local anaesthetic being used commonly in practice for giving peripheral nerve blocks.

**AIM**

This study aimed to demonstrate the efficacy of nalbuphine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks.

## MATERIALS AND METHODS

This prospective, randomised, double-arm, double-blind controlled study was conducted on 60 patients who underwent surgeries on the upper limb performed under the supraclavicular brachial plexus block at the Government Kilpauk Medical College Hospital and Government Royapettah Hospital, Chennai, between November 2017 and April 2018. The study was approved by the institutional ethics committee before initiation, and informed consent was obtained from all patients.

**Inclusion Criteria**

Patients who underwent elective orthopaedic forearm fracture surgeries under the supraclavicular block were aged between 30 and 60 years, weighed more than 50 kg, were male and female, had ASA physical status classes 1 and 2, and provided valid informed consent were included in the study.

**Exclusion Criteria**

Patients who did not fulfil the inclusion criteria with a history of allergy or hypersensitivity to either the local anaesthetic or opioid group of drugs, any contraindication to a peripheral nerve block, impaired ability to communicate (e.g. confusion, poor hearing, or language barrier) who are unconscious, who are severely ill, pregnant patients with coagulation disorders, local infection at the place of injection, and those taking sedatives or antipsychotics were excluded.

Sixty patients were divided into Group B (control group), 30 patients were administered 25 ml of 0.5% bupivacaine + 1 ml of normal saline, and Group N (nalbuphine group), 30 patients were given 25 ml of 0.5% bupivacaine + 1 ml (10 mg) of nalbuphine.

After administering the block, the motor and sensory blocks were evaluated every 5 min until a complete sensory and motor block was achieved, or 30 min, whichever occurred earlier. To assess sensory block, a pinprick sensation using a 23 G hypodermic needle was used in the distribution of the ulnar, median, musculocutaneous, and radial nerves. A 3-point scale was used, where a 3-point scale of zero denotes normal sensation, one denotes loss of prick sensation, and two denotes loss of touch sensation. To evaluate motor block, thumb adduction (radial nerve), thumb opposition (median nerve), adduction of the thumb (ulnar nerve), and elbow flexion (musculocutaneous nerve) were used.

Similar to the sensory evaluation, a 3-in-1 scale was used. Zero indicates normal motor function, one indicates decreased motor strength and two indicates a complete motor block. The time interval between the end of infiltration of the local anaesthetic and the complete motor and sensory block was defined as the onset time for motor and sensory blocks, respectively. An anaesthetic block in all four nerve territories indicates a complete sensory block. The absence of voluntary movements of the hand and forearm indicated a complete motor block.

If the patient had no complaints or few vague complaints from the patient, there was no need for any drug supplementation. Complaints from the patient necessitate the need for supplemental analgesics and general anaesthesia. Postoperatively, patients were asked to rate their pain on an 11-point visual analogue scale. After discharge from the recovery room, pain was regularly assessed every 30 min for the first two hours, and thereafter 1 h for 24 h. Sensory and motor regression were tested every 15 min until complete resolution was achieved. The duration of the motor block was defined as the time from the end of infiltration of the local anaesthetic until full motor power recovery of the hand and forearm. The duration of analgesia was recorded as the time between the end of administration of the local anaesthetic solution and the time of the first request for rescue analgesia.

**Statistical Analysis**

Statistical Analysis was performed using Statistical Package for Social Sciences (SPSS Version 16.0) statistical analysis software. Acceptable statistical tests of comparisons were performed. Continuous variables were analysed using the unpaired t-test and ANOVA. Categorical variables were analysed using the chi-square test and Fisher Exact Test, Statistical significance was set at $p < 0.05$.

## RESULTS

Regarding age distribution, most of the group B subjects were in the 31-40 years age category (40%), with a mean age of 34.53 years. In group N, the majority were in the 31-40 years age category (40%), with a mean age of 33.33 years ($p = 0.610$). The data subjected to an unpaired t-test revealed a statistically insignificant association between the age distribution and intervention groups.

Regarding gender distribution, it was evident that most of the group B subjects were male (80%), and in group N, the majority were male (76.67%) ($p > 0.999$). The results revealed a statistically insignificant association between gender status and intervention groups. In ASA, most of the group B subjects were in the ASA 1 category (86.67%), and in group N, the majority were in the ASA 1 category (86.67%) ($p > 0.999$). The results revealed a statistically insignificant association between ASA status and intervention groups.

In weight distribution, the group B subjects had a mean weight of 61.37 kg and group N subjects had a mean weight of 62.53 kg ($p = 0.439$). Regarding height distribution, group B subjects had a mean height of 164.73 cm and group N subjects had a mean


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height of 166.10 cm (p = 0.323). Similarly in BMI distribution group B subjects had a mean BMI of 22.78 and group N subjects had a mean BMI of 22.73 (p = 0.916). The results revealed a statistically insignificant association between weight/height/BMI distribution and intervention groups.

On analysis of the duration of surgery distribution, group B subjects had a mean DOS of 125.67 min and group N subjects had a mean DOS of 125.57 min (p = 0.983). The results revealed a statistically insignificant association between the duration of surgery and intervention groups.

Motor blockade onset time distribution, group B subjects had a mean onset time (sensory blockade) of 14.00 min and group N subjects had a mean onset time (sensory blockade) of 14.47 min (p = 0.220), and onset time (motor blockade) of 20.90 min and group N subjects had a mean onset time of 21.20 min (p = 0.566). The differences between the groups were statistically insignificant.

Motor blockade duration time distribution, group B subjects had a mean duration time (sensory blockade) of 345.67 min and group N subjects had a mean duration time (sensory blockade) of 646.47 min, from the motor blockade duration time distribution table, it was evident that group B subjects had a mean duration time (motor blockade) of 285.33 min and group N subjects had a mean duration time of 459 min. Both associations were statistically significant between the groups.

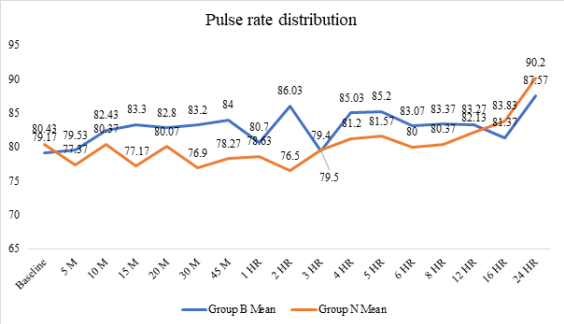


**Figure 1: Pulse rate distribution of the groups**

Analysis of the pain score (VAS) distribution in group B subjects had a mean pain score of 0.00, 5.07 and 5.47 at 6, 12, and 24 h, respectively. Similarly, group N subjects had mean pain scores of 0.00, 3.73 and 5.12 at 6, 12, and 24 hours, respectively. There was a statistically insignificant association between pain scores at 6- and 24-hours PO and intervention groups, revealing the existence of a statistically significant association between pain scores at 12 h postoperatively and intervention groups.

Analysis of the quality of anaesthesia score distribution revealed that most group B subjects had a QAS score of 3 (50%) and most group N subjects had a QAS score of 4 (70%) (p = 0.071). The results revealed a statistically insignificant association between the quality of anaesthesia scores and the intervention groups.

On analysis of the opioid requirement for the 24-hour distribution, most group B subjects were administered three doses of opioids (53,33%), and most group N subjects were administered one dose of opioids (80%). There was a statistically significant association between the opioid requirement for 24 h and the intervention group [Table 1].

It was evident that group B subjects had a mean overall PR of 82.91 bpm and group N subjects had a mean overall PR of 80.94 bpm (p = 0.216). The results revealed a statistically insignificant association between the pulse rate and intervention groups [Figure 1].

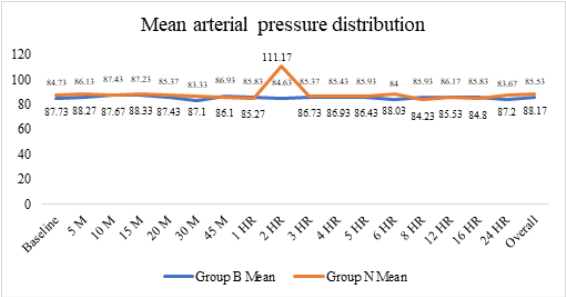


**Figure 2: Mean arterial pressure distribution of the groups**

In mean arterial pressure, the group B subjects had a mean overall MAP of 85.53 mm Hg and group N subjects had a mean overall MAP of 88.17 mm Hg (p = 0.192). The results revealed a statistically insignificant association between the MAP and the intervention groups [Figure 2].

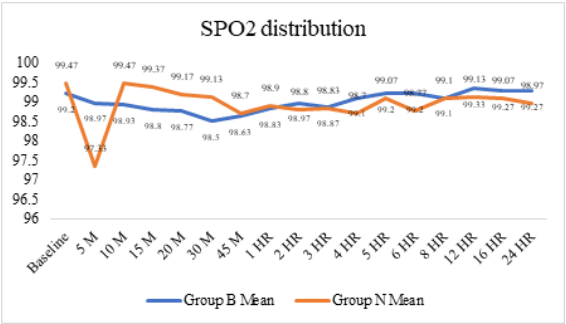


**Figure 3: SPO2 distribution of the groups**

In the SPO2 distribution, group B subjects had a mean overall SPO2 of 99%, and group N subjects had a mean overall SPO2 of 98.94% (p = 0.808). The results revealed a statistically insignificant association between intervention groups [Figure 3].

**Table 1: Demographic data of the study**

| | | | | |
|---|---|---|---|---|
| **Age** | | **34.53±33.33** | **10.04±7.95** | **0.61** |
| Sex | Male | 24 (80) | 23 (76.67) | >0.999 |
| | Female | 6 (20) | 7 (23.333) | |


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| | | | | |
|---|---|---|---|---|
| ASA grading | ASA 1 | 26 (86.67) | 26 (86.67) | >0.999 |
| | ASA 2 | 4 (13.33) | 4 (13.33) | |
| Weight | | 61.37±5.37 | 62.53±6.206.20 | 0.439 |
| Height | | 164.73±5.45 | 166.10±5.17 | 0.323 |
| BMI | | 22.78±2.00 | 22.73±1.97 | 0.916 |
| Duration of Surgery | | 125.67±17.01 | 125.57±18.82 | 0.983 |
| Onset Time | Sensory Blockade | 14±1.46 | 14.47±1.46 | 0.22 |
| | Motor Blockade | 20.90±2.17 | 21.20±1.85 | 0.566 |
| Duration Time | Sensory Blockade | 345.67±14.55 | 646.67±23.24 | <0.001 |
| | Motor Blockade | 285.33±14.79 | 459.00±19.36 | <0.001 |
| Visual Analog Scale | 6 hours | 0 | 0 | >0.999 |
| | 12 hours | 5.07±0.91 | 3.73±0.98 | < 0.001 |
| | 24 hours | 5.47±0.97 | 5.27±1.39 | 0.521 |
| Quality of Anesthesia Score | Score 2 | 12 (40) | 1 (3.33) | 0.071 |
| | Score 3 | 15 (50) | 8 (26.67) | |
| | Score 4 | 3 (10) | 21 (70) | |
| Opioid Requirement in 24 hours (Doses) | One | 2 (6.67) | 24 (80) | <0.001 |
| | Two | 7 (23.33) | 6 (20 | |
| | Three | 16 (53.33) | 0 | |
| | Four | 5 (16.67) | 0 | |

## DISCUSSION

In our study, the mean duration (sensory blockade) was lower in group B than in group N (mean reduction difference of 301 min, 47% shorter). This is similar to a study conducted by Abdelhaq et al., on the effectiveness of adding Nalbuphine to Bupivacaine while performing supraclavicular brachial plexus blocks.

In our study, the mean duration (motor blockade) was lower in Group B than in Group N (mean reduction difference of 173.67 min, 38% shorter). The same view was echoed by a study conducted by Abdelhaq et al., on the effectiveness of adding Nalbuphine to Bupivacaine while performing supraclavicular brachial plexus blocks.

In our study, the pain score distribution between Groups B and N was significant. This is evident by the increased mean pain score in group B compared to that in group N (mean elevation difference of 1.33 points, 26% higher). The same view was echoed by A study conducted by Abdelhaq et al. on the effectiveness when Nalbuphine is added as an adjunct to Bupivacaine while performing supraclavicular brachial plexus blocks.

In our study, the opioid requirement for a 24-hour distribution between groups B and N was meaningfully significant. This is evident by the increased opioid requirement for 24 h in group B compared to group N (mean increased difference of 73.33 points at one dose level, 92% higher). The same view was echoed by the study conducted by Abdelhaq et al., on the effectiveness of Nalbuphine when added to Bupivacaine as an adjunct while performing supraclavicular brachial plexus blocks.

## CONCLUSION

There were no differences in the pain scores between the intervention groups during the immediate and late postoperative periods. The anaesthetic agent 0.5% Bupivacaine with Nalbuphine produced better medium-term pain control at 12 h postoperatively than 0.5% bupivacaine alone as an adjuvant for ultrasound-guided supraclavicular brachial plexus block.

## REFERENCES

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