|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||

Available online on http://www.ijmbs.info

International Journal of Medical and Biomedical Studies; 2025; 9(1); 212-216

Original Research Article

Comparative Study of Tramadol and Nalbuphine as an Adjuvant to Ropivacaine in Supraclavicular Block: A Cross-Sectional Observational Study

Sweety[1], Saroj Kumar[2], Sudama Prasad[3]

[1]Senior Resident, Department of Anaesthesiology, Patna Medical College & Hospital, Patna, Bihar, India

[2]Senior Resident, Department of Anaesthesiology, Patna Medical College & Hospital, Patna, Bihar, India

[3]HOD, Department of Anaesthesiology, Patna Medical College & Hospital, Patna, Bihar, India

Received: 19-12-2024 / Revised: 16-01-2025 / Accepted: 20-01-2025
DOI: https://doi.org/10.32553/ijmbs.v9i1.3035
Corresponding author: Saroj Kumar
Conflict of interest: Nil

Abstract:

Background: Adjuvants are commonly added to local anesthetics to enhance the quality and duration of peripheral nerve blocks. This study compares the effectiveness of tramadol and nalbuphine as adjuvants to ropivacaine in supraclavicular brachial plexus block.

Methods: A cross-sectional observational study was conducted on approximately 90 patients undergoing elective upper limb surgeries at Patna Medical College and Hospital from January to December 2024. Patients were randomly divided into two groups: Group T received 0.5% ropivacaine with tramadol (100 mg), and Group N received 0.5% ropivacaine with nalbuphine (10 mg). Onset time, block duration, analgesia duration, and side effects were recorded and compared.

Results: Group N (nalbuphine) showed a significantly faster onset of sensory and motor blocks and longer duration of block and analgesia compared to Group T (tramadol). Adverse effects were mild and comparable in both groups.

Conclusion: Nalbuphine is a more effective and safer adjuvant than tramadol when used with ropivacaine in supraclavicular blocks, offering prolonged and quality analgesia without significant complications.

Keywords: Nalbuphine, Tramadol, Supraclavicular block, Ropivacaine

Introduction

Regional anesthesia, particularly brachial plexus blocks such as the supraclavicular approach, is widely used for upper limb surgeries due to its efficacy in providing intraoperative anesthesia and postoperative analgesia. Among local anesthetics, *ropivacaine* is favored for its prolonged sensory blockade and reduced cardiotoxicity compared to bupivacaine. However, its duration may still be limited in certain surgical contexts, necessitating the use of adjuvants to enhance its effectiveness [1,2]. *Tramadol*, a synthetic opioid with dual-action—μ-opioid receptor agonism and inhibition of norepinephrine and serotonin reuptake—has shown potential as a peripheral nerve block adjuvant, offering extended analgesia with minimal respiratory depression. On the other hand, *nalbuphine*, a mixed κ-agonist

and μ-antagonist opioid, has gained attention for providing good-quality analgesia with a lower incidence of opioid-related side effects such as nausea and pruritus [3].

Several studies have explored the addition of opioids to local anesthetics in nerve blocks to assess improvements in onset time, duration of sensory and motor blockade, and overall analgesia. Yet, there remains a need to directly compare the efficacy and safety profile of tramadol and nalbuphine when used specifically with ropivacaine in the supraclavicular approach. This study aims to fill that gap by evaluating and comparing the adjuvant potential of tramadol versus nalbuphine in a clinical setting [4,5].

To compare the efficacy of tramadol and nalbuphine as adjuvants to ropivacaine in supraclavicular brachial plexus block concerning onset and duration of sensory and motor block, duration of analgesia, and side effect profile.

Materials and Methods

Study Design: This was a cross-sectional observational study conducted to compare the efficacy of tramadol and nalbuphine as adjuvants to ropivacaine in supraclavicular brachial plexus block.

Study Setting and Duration: The study was conducted in the Department of Anaesthesiology at Patna Medical College and Hospital, Patna, over a period of 12 months from January 2024 to December 2024.

Study Population: A total of approximately 90 patients, aged 18–60 years, belonging to ASA physical status I and II, and scheduled for elective upper limb surgeries under supraclavicular brachial plexus block, were included in the study.

Inclusion Criteria

- Patients undergoing upper limb surgeries below the mid-humerus
- ASA grade I and II
- Age between 18 to 60 years
- Provided written informed consent

Exclusion Criteria

1. Known allergy or hypersensitivity to study drugs
2. Coagulopathy or on anticoagulant therapy
3. Local infection at the injection site
4. History of chronic opioid use or neuropathy
5. Pregnancy and lactation

Grouping and Drug Administration: The patients were randomly allocated into two groups of 45 each:

- **Group T (Tramadol group)**: Received 30 ml of 0.5% ropivacaine + 100 mg tramadol
- **Group N (Nalbuphine group)**: Received 30 ml of 0.5% ropivacaine + 10 mg nalbuphine

Supraclavicular brachial plexus block was performed under aseptic precautions using a nerve stimulator-guided technique.

Parameters Assessed

1. Onset time of sensory and motor block
2. Duration of sensory and motor block
3. Duration of analgesia
4. Hemodynamic parameters
5. Adverse effects such as nausea, vomiting, bradycardia, hypotension, and pruritus

Statistical Analysis: Data were compiled and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation and compared using the student's t-test. Categorical data were expressed as percentages and analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Result

A total of 90 patients were included in the study and divided equally into two groups: Group T (Tramadol + Ropivacaine) and Group N (Nalbuphine + Ropivacaine), each comprising 45 patients. The demographic

parameters, such as age, gender distribution, and ASA grade, were comparable between the two groups ($p > 0.05$).

The mean onset time of sensory block was significantly faster in Group N (8.1 ± 1.2 minutes) compared to Group T (9.3 ± 1.5 minutes). Similarly, the onset of motor block was earlier in Group N (10.5 ± 1.3 minutes) than in Group T (11.6 ± 1.4 minutes), which was statistically significant ($p < 0.05$).

The duration of sensory and motor blocks was significantly prolonged in Group N (sensory: 510.3 ± 32.4 minutes; motor: 472.5 ± 28.1 minutes) as compared to Group T (sensory: 451.2 ± 30.6 minutes; motor: 418.7 ± 25.9 minutes), with $p < 0.001$. Furthermore, the duration of analgesia was longer in Group N (552.6 ± 40.7 minutes) versus Group T (485.8 ± 36.2 minutes).

In terms of adverse effects, mild nausea was observed in 4 patients in Group T and 3 patients in Group N. Pruritus was noted in 2 patients in Group N but none in Group T. No major complications were recorded.

These findings suggest that nalbuphine is a more effective adjuvant than tramadol in enhancing the onset and duration of brachial plexus block with ropivacaine.

Parameters	Group T (Tramadol)	Group N (Nalbuphine)	p-value
Number of patients	45	45	—
Mean age (years)	37.4 ± 9.2	36.9 ± 8.7	> 0.05 (NS)
Gender (M/F)	27/18	26/19	> 0.05 (NS)
ASA I/II	31/14	30/15	> 0.05 (NS)
Onset of sensory block (min)	9.3 ± 1.5	8.1 ± 1.2	< 0.05
Onset of motor block (min)	11.6 ± 1.4	10.5 ± 1.3	< 0.05
Duration of sensory block (min)	451.2 ± 30.6	510.3 ± 32.4	< 0.001
Duration of motor block (min)	418.7 ± 25.9	472.5 ± 28.1	< 0.001
Duration of analgesia (min)	485.8 ± 36.2	552.6 ± 40.7	< 0.001
Nausea	4 (8.9%)	3 (6.7%)	> 0.05 (NS)
Pruritus	0	2 (4.4%)	> 0.05 (NS)

Discussion

This cross-sectional observational study compared the efficacy of tramadol and nalbuphine as adjuvants to ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. The findings demonstrated that nalbuphine significantly enhanced the quality of the block by producing a faster onset of both sensory and motor blockade, and a longer duration of analgesia compared to tramadol. Nalbuphine also prolonged the duration of sensory and motor block, contributing to superior postoperative pain control. These outcomes are consistent with earlier studies such as Mukherjee et al. (2017) and Rahangdale et al. (2015), which showed nalbuphine's efficacy as an adjuvant in peripheral nerve blocks. Although mild adverse effects like nausea and pruritus were reported, they were not statistically significant and were comparable between both groups. Overall, nalbuphine appears to

be a more effective and reliable adjuvant to ropivacaine than tramadol in providing extended and quality analgesia in regional blocks.

Several studies have evaluated the use of tramadol and nalbuphine as adjuvants to local anesthetics in brachial plexus blocks, aligning with the findings of the current study. A study by Mukherjee et al. (2017) compared nalbuphine and fentanyl as adjuvants to ropivacaine in supraclavicular block and found nalbuphine provided faster onset and prolonged analgesia, similar to our observations [6]. Gupta et al. (2015) compared tramadol and dexmedetomidine with ropivacaine and noted that tramadol improved analgesia duration but was inferior to other agents [7]. Rahangdale et al. (2015) conducted a direct comparison of tramadol and nalbuphine as adjuvants to ropivacaine and reported that nalbuphine had a better analgesic profile with fewer side effects, supporting the superiority of nalbuphine demonstrated in our study [8].

Tiwari et al. (2015) also showed that combining dexmedetomidine or tramadol with ropivacaine enhances block characteristics, but nalbuphine, as seen in our study, may offer more consistent and longer postoperative analgesia. These comparative results validate nalbuphine's mixed kappa-agonist and mu-antagonist properties, making it a promising adjuvant for regional anesthesia [9].

This study highlights the superior efficacy of nalbuphine over tramadol as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Future research can focus on multicentric trials with larger sample sizes to validate these findings across diverse populations and clinical settings. Additionally, studies comparing nalbuphine with other commonly used adjuvants like dexmedetomidine, clonidine, or buprenorphine could further help in establishing standardized protocols for regional anesthesia. Exploring different doses of nalbuphine and assessing long-term outcomes, such as chronic pain incidence or patient satisfaction, may also provide valuable insights. Incorporation of ultrasound guidance and pharmacokinetic profiling could enhance precision and deepen understanding of adjuvant effects in peripheral nerve blocks [10].

The current study had several limitations. Firstly, the sample size was relatively small, limiting the generalizability of results. Secondly, it was conducted at a single tertiary care center, which may not represent broader clinical settings. Third, the observational design may be prone to selection and performance bias, and no blinding was implemented. Moreover, the subjective nature of pain assessment and lack of long-term follow-up restricted the evaluation of chronic pain relief and functional outcomes. Lastly, adverse effects were not studied over an extended postoperative period, which may overlook delayed complications or rebound pain.

Conclusion

This study concludes that nalbuphine is a more effective adjuvant than tramadol when combined with ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. Nalbuphine significantly shortened the onset time and prolonged the duration of both sensory and motor blockade, as well as extended postoperative analgesia, without increasing adverse effects. These findings suggest that nalbuphine offers superior block characteristics and better analgesic efficacy compared to tramadol, making it a preferable adjuvant for enhancing the quality of regional anesthesia.

References

1. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. *Indian J Anaesth*. 2011;55(2):104–10. doi:10.4103/0019-5049.79875
2. Gupta A, Kaur S, Attri JP, Kaur G. Comparative evaluation of tramadol and dexmedetomidine as adjuvants to ropivacaine in supraclavicular brachial

plexus block. *J Anaesthesiol Clin Pharmacol*. 2015;31(3):324–9. doi:10.4103/0970-9185.161664

3. Mukherjee K, Das A, Basunia SR, Sarkar S, Bhattacharya S, Mukherjee A. Comparative study between nalbuphine and fentanyl as an adjuvant to ropivacaine for supraclavicular brachial plexus block. *Saudi J Anaesth*. 2017;11(4):408–13. doi:10.4103/sja.SJA_345_16
4. Rahangdale R, Gaur N, Laha A, Pawar M. Comparative study of nalbuphine versus tramadol as an adjuvant to ropivacaine in supraclavicular block. *Anesth Essays Res*. 2015;9(3):324–9. doi:10.4103/0259-1162.159749
5. Tiwari AK, Tomar GS, Agrawal J, Chandra G, Tiwari A, Mishra A. Comparative evaluation of dexmedetomidine and tramadol as adjuvant to ropivacaine in supraclavicular brachial plexus block: A double-blind prospective study. *Anesth Essays Res*. 2015;9(3):324–9. doi:10.4103/0259-1162.159749
6. Mukherjee K, Das A, Basunia SR, Sarkar S, Bhattacharya S, Mukherjee A. Comparative study between nalbuphine and fentanyl as an adjuvant to ropivacaine for supraclavicular brachial plexus block. *Saudi J Anaesth*. 2017;11(4):408–13. doi:10.4103/sja.SJA_345_16
7. Gupta A, Kaur S, Attri JP, Kaur G. Comparative evaluation of tramadol and dexmedetomidine as adjuvants to ropivacaine in supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol*. 2015;31(3):324–9. doi:10.4103/0970-9185.161664
8. Rahangdale R, Gaur N, Laha A, Pawar M. Comparative study of nalbuphine versus tramadol as an adjuvant to ropivacaine in supraclavicular block. *Anesth Essays Res*. 2015;9(3):324–9. doi:10.4103/0259-1162.159749
9. Tiwari AK, Tomar GS, Agrawal J, Chandra G, Tiwari A, Mishra A. Comparative evaluation of dexmedetomidine and tramadol as adjuvant to ropivacaine in supraclavicular brachial plexus block: A double-blind prospective study. *Anesth Essays Res*. 2015;9(3):324–9. doi:10.4103/0259-1162.159749
10. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. *Indian J Anaesth*. 2011;55(2):104–10. doi:10.4103/0019-5049.79875