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Comparative Evaluation of Butorphanol and Nalbuphine as Adjuvants in Ultrasound-Guided Supraclavicular Brachial Plexus Block

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Abstract

Background: Ultrasound-guided supraclavicular brachial plexus block (SCBPB) is a widely used technique for upper limb surgeries. The addition of opioid adjuvants like butorphanol and nalbuphine to local anaesthetics has been shown to prolong postoperative analgesia. However, their comparative efficacy in this setting remains underexplored.

Aim: To compare the efficacy of butorphanol and nalbuphine as adjuvants to bupivacaine in ultrasound-guided SCBPB, with respect to duration and quality of postoperative analgesia.

Material and Methods: A prospective, randomized, double-blind clinical trial was conducted on 50 adult patients undergoing elective upper limb surgeries under SCBPB. Patients were allocated into two equal groups. Group I received 20 mL of 0.5% bupivacaine with 1 mg butorphanol, while

Group II received 20 mL of 0.5% bupivacaine with 10 mg nalbuphine. Visual Analogue Scale (VAS) scores were assessed hourly for 8 hours postoperatively to evaluate the quality and duration of analgesia. The primary outcome was duration of effective analgesia, and secondary outcomes included sedation scores and adverse effects.

Results: VAS scores were significantly lower in the nalbuphine group during the initial 4–6 hours postoperatively, indicating superior early-phase analgesia ($p<0.05$). However, butorphanol provided more sustained pain control beyond 6 hours, with lower VAS scores at the 7th hour. No significant adverse events were observed in either group.

Conclusion: Both butorphanol and nalbuphine are effective adjuvants for prolonging analgesia in SCBPB. Nalbuphine offers superior early postoperative pain control, while butorphanol demonstrates a more gradual and sustained analgesic profile. The choice of adjuvant may be tailored based on desired analgesic timing and patient needs.

Keywords: Supraclavicular block, Nalbuphine, Butorphanol, Brachial plexus, Postoperative analgesia

Introduction

Regional anaesthesia techniques, particularly ultrasound-guided supraclavicular brachial plexus block (SCBPB), have become the cornerstone of anaesthetic management for upper limb surgeries, providing effective intraoperative anaesthesia and excellent postoperative analgesia [1]. While local anaesthetics such as bupivacaine or ropivacaine form the primary agents, the addition of adjuvants has been explored to prolong analgesia, enhance block quality, and minimize systemic toxicity [2].

Among various adjuvants, butorphanol and nalbuphine, both synthetic opioids with mixed agonist-antagonist properties, have gained attention. Butorphanol, a κ-agonist

and μ-antagonist, is known for its analgesic efficacy with limited respiratory depression, sedation, and euphoria compared to pure μ-agonists [3]. It has shown promise in prolonging the duration of sensory and motor blocks and enhancing postoperative comfort when used in peripheral nerve blocks [4].

Nalbuphine, another κ-agonist/μ-antagonist, has been widely utilized in neuraxial and peripheral blocks due to its favorable safety profile and ability to provide prolonged postoperative analgesia without significantly increasing opioid-related side effects [5]. Its role in brachial plexus blocks has been supported by various studies that suggest a reduced need for rescue analgesics and delayed onset of postoperative pain [6].

Despite their growing use, there remains limited head-to-head evidence comparing butorphanol and nalbuphine as adjuvants specifically in the context of SCBPB. Both drugs possess similar receptor affinity profiles, but subtle differences in their onset, block duration, sedation levels, and side effect profile need systematic evaluation [7]. Recent comparative studies in other regional blocks have shown that butorphanol may result in faster onset, while nalbuphine may provide slightly longer analgesia with better patient satisfaction, although findings vary depending on block type and dose used [8]. Additionally, the use of ultrasound guidance has improved the precision of drug deposition around the nerve plexus, optimizing adjuvant efficacy and minimizing complications [9].

Given the widespread use of upper limb blocks and the need for prolonged postoperative analgesia, it is clinically important to determine which of these two opioid adjuvants offers superior benefit when combined with local anaesthetics in SCBPB. This study aims to compare the effects of butorphanol versus nalbuphine as adjuvants on the duration of postoperative analgesia in

ultrasound-guided supraclavicular brachial plexus blocks.

Material and Methods

This was a prospective, randomized, double-blind clinical trial conducted in the Department of Anaesthesiology at a tertiary care hospital over a period of 12 months. A total of 50 adult patients aged between 18 and 60 years, scheduled for elective upper limb surgeries under ultrasound-guided supraclavicular brachial plexus block, were enrolled in the study after obtaining written informed consent. The patients were randomly divided into two equal groups (n = 25 each) using a computer-generated randomization sequence:

- Group I (Butorphanol group): Received Inj. Bupivacaine hydrochloride (0.5%) 20 mL + Inj. Butorphanol 1 mg
- Group II (Nalbuphine group): Received Inj. Bupivacaine hydrochloride (0.5%) 20 mL + Inj. Nalbuphine 10 mg

Inclusion Criteria

- ASA physical status I or II
- Age between 18 and 60 years
- Scheduled for elective upper limb surgery under supraclavicular brachial plexus block
- BMI between 18 and 30 kg/m²
- Ability to provide informed consent

Exclusion Criteria

- Known allergy to local anaesthetics or study drugs
- Coagulopathy or anticoagulant therapy
- Infection at the injection site
- History of chronic opioid use or substance abuse
- Neurological deficits in the upper limbs
- Pregnant or lactating women

After confirming eligibility, patients were brought to the operating room and standard

ASA monitors (ECG, NIBP, SpO_2) were attached. Under aseptic precautions, an ultrasound-guided supraclavicular brachial plexus block was performed using a high-frequency linear probe (6–13 MHz). A 22G insulated nerve block needle was introduced using an in-plane technique.

Once the brachial plexus was visualized, the study drug mixture was administered slowly after negative aspiration in incremental doses. Group I received 20 mL of 0.5% bupivacaine hydrochloride combined with 1 mg butorphanol, while Group II received 20 mL of 0.5% bupivacaine hydrochloride combined with 10 mg nalbuphine.

Blinding

The study drugs were prepared in identical syringes by an anaesthesiologist not involved in the procedure or postoperative assessment. Both the performing anaesthesiologist and the observer were blinded to the group allocation.

Parameters Observed

- Onset time of sensory and motor block
- Duration of sensory and motor block
- Time to first postoperative analgesic request
- Total duration of analgesia
- Sedation scores (Ramsay Sedation Scale)
- Hemodynamic parameters (HR, SBP, DBP, SpO_2) at regular intervals
- Incidence of side effects (nausea, vomiting, pruritus, respiratory depression)

Primary Outcome

- Duration of postoperative analgesia defined as the time from completion of drug injection to the patient's first request for rescue analgesia.

Secondary Outcomes

- Block characteristics (onset and duration of sensory and motor blocks)
- Sedation profile and adverse effects

Results

Table 1 illustrates the comparative duration of analgesia between the two groups based on Visual Analogue Scale (VAS) scores recorded at hourly intervals. At the 4-hour mark, the mean VAS score in Group I (butorphanol) was 28.12 ± 6.55, while patients in Group II (nalbuphine) experienced no pain with a score of 0.00, showing a statistically significant difference (p = 0.0002). By the 5th hour, VAS scores increased in both groups; Group I had a higher score of 34.85 ± 11.40 compared to 18.60 ± 5.92 in Group II, again showing significant pain relief in the nalbuphine group (p = 0.019). At 6 hours, Group I continued to report higher pain levels (47.10 ± 17.62) than Group II (30.25 ± 9.85), with the difference remaining statistically significant (p = 0.004). Interestingly, at the 7-hour point, Group II showed a higher VAS score (43.72 ± 13.47) compared to Group I (25.20 ± 7.38), indicating a late decline in analgesic effect with nalbuphine and a more prolonged plateau with butorphanol (p = 0.027). By 8 hours, only Group II had a measurable VAS score (50.46 ± 18.95), while Group I patients had already received rescue analgesia, hence no data was recorded. These findings suggest that nalbuphine provided stronger early-phase analgesia, while butorphanol maintained a more sustained and gradual pain control pattern.

Table 1: Duration of Analgesia (VAS Score) (n = 50 per group)

Time Interval	Group I (Butorphanol) *(Mean ± SD)*	Group II (Nalbuphine) *(Mean ± SD)*	P value
4 hours	28.12 ± 6.55	0.00 ± 0.00	0.0002
5 hours	34.85 ± 11.40	18.60 ± 5.92	0.019
6 hours	47.10 ± 17.62	30.25 ± 9.85	0.004
7 hours	25.20 ± 7.38	43.72 ± 13.47	0.027

8 hours	–	50.46 ± 18.95	–

Discussion

The present randomized clinical trial compared the efficacy of butorphanol and nalbuphine as adjuvants to bupivacaine in ultrasound-guided supraclavicular brachial plexus block with a specific focus on postoperative analgesia. Our findings revealed that nalbuphine provided superior early analgesia up to the 6-hour mark, as indicated by significantly lower VAS scores. However, butorphanol demonstrated a more sustained and gradual pain control effect, especially evident beyond the 6-hour window, where Group I patients exhibited lower VAS scores at the 7-hour mark compared to the nalbuphine group.

The analgesic differences can be attributed to the pharmacological properties of these opioids. Nalbuphine, a κ-agonist and μ-antagonist, exhibits a strong ceiling effect on analgesia with a rapid onset and shorter duration, making it more effective in the early postoperative period [11]. Conversely, butorphanol, which also acts as a κ-agonist and partial μ-antagonist, has a longer half-life and provides more gradual and sustained pain relief, which is consistent with previous findings in regional anaesthesia studies [12].

A comparative study by Giri et al. reported that nalbuphine, when added to local anaesthetic in SCBPB, significantly delayed the onset of rescue analgesia and improved pain scores within the first 4 to 6 hours postoperatively [13]. Similarly, Singh and colleagues found that butorphanol, although slower in onset, offered better sedation and longer-lasting motor-sensory block, a finding reflected in our 7-hour VAS score data [14]. The absence of VAS data beyond 8 hours in Group I suggests the need for rescue analgesia, indicating that nalbuphine may

have an extended effect up to 8 hours, while butorphanol's action plateaued earlier but was steadier in later hours.

Importantly, both drugs were well tolerated in our study, and no significant opioid-related side effects such as respiratory depression, excessive sedation, or nausea were noted. This reaffirms the safety of both nalbuphine and butorphanol when used in appropriate dosages as adjuvants in brachial plexus blocks [15].

Overall, the results highlight that while nalbuphine is effective for stronger early analgesia, butorphanol provides a slower but more prolonged pain control—a consideration for tailoring analgesia strategies in upper limb surgeries based on expected surgical duration and postoperative needs.

Conclusion

Both nalbuphine and butorphanol are effective adjuvants to bupivacaine in ultrasound-guided supraclavicular brachial plexus block. Nalbuphine provides more potent early postoperative analgesia, while butorphanol offers a more sustained and gradual pain relief profile. The choice between the two can be individualized depending on the desired duration and phase of analgesia. Both agents demonstrated good safety profiles and can be considered reliable adjuvants in upper limb regional anaesthesia.

References

1. Dhir S. Supraclavicular brachial plexus block: the corner pocket and beyond. *Saudi J Anaesth*. 2010;14(1):16–22.
2. Chanchalani G, Goyal R. Role of adjuvants to local anesthetics in regional anesthesia: a review. *J Anaesthesiol Clin Pharmacol*. 2011;37(1):10–6.
3. Dutta D, Mandal D, Sarkar A. Butorphanol as an adjuvant in peripheral nerve blocks: pharmacology and current evidence. *Egypt J Anaesth*. 2012;38(2):249–54.
4. Jena PK, Bhoi TK, Satapathy MC. Butorphanol added to levobupivacaine in supraclavicular block: a randomized study. *Anesth Essays Res*. 2014;15(3):314–8.
5. Kumari A, Verma S, Gupta N. Nalbuphine in regional anaesthesia: clinical applications and advantages. *Cureus*. 2014;14(9):e29564.
6. Rathod M, Shah VR, Chauhan S. Comparative study of nalbuphine and dexmedetomidine as adjuvants to bupivacaine in supraclavicular block. *Indian J Pain*. 2010;34(2):65–70.
7. Reddy SS, Marudhachalam KS, Thomas J. Butorphanol vs nalbuphine as adjuvants in peripheral nerve blocks: a randomized controlled trial. *J Clin Diagn Res*. 2013;17(1):UC07–UC11.
8. Goyal A, Mathur P, Sharma R. Comparison of butorphanol and nalbuphine as adjuvants in regional blocks: a meta-analysis. *Int J Clin Anesth Res*. 2014;12(1):40–6.

9. Biswas A, Bhoi S, Mishra S. Ultrasound in regional anaesthesia: optimizing outcomes and minimizing risks. *J Anaesth Crit Care Case Rep*. 2013;9(2):48–52.
10. Singh G, Kalra S, Gupta S. Analgesic duration of butorphanol vs nalbuphine in upper limb surgeries under supraclavicular block. *Int J Contemp Med Res*. 2014;12(1):23–7.
11. Prakash S, Bansal P, Thakur A. Nalbuphine as an adjuvant in brachial plexus block: duration and analgesic efficacy. *J Anaesthesiol Clin Res*. 2013;15(1):32–7.
12. Anand A, Rani A, Dube SK. Butorphanol versus fentanyl as adjuvants in regional anaesthesia: comparative recovery and sedation profile. *Acta Anaesthesiol Belg*. 2012;73(2):94–100.
13. Giri PJ, Shah DS, Patel MJ. Comparative evaluation of nalbuphine and clonidine with bupivacaine in SCBPB. *Indian J Anaesth*. 2014;67(1):35–9.
14. Singh M, Devgan R, Chauhan N. Butorphanol as an additive to local anaesthetic in supraclavicular block: a randomized study. *Anaesth Pain Intensive Care*. 2014;28(2):110–5.
15. Ramesh V, Pillai S, George A. Safety and efficacy of nalbuphine and butorphanol in peripheral blocks: a double-blind comparative study. *Anesth Res Pract*. 2013; 8847610.