fortune Journals

Research Article

ANESTHESIA AND CRITICAL CARE

ISSN: 2687-7996

Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries

Mohammad Mahabubuzzaman[1*], Shahidullah Humayun Kabir[2], Mohammad Jahid Iqbal[1], Sharmin Ara Begum[3], Dabasis Kumar[4], Md Ishaq Babu[5], Khaled Kaisar[2], SM Zubaer Hasan[2], Mansura Akter Panna[6], Sadikatul Islam[7], AK M Shahidur Rahman[8]

Abstract

Ropivacaine, a relatively recent amino amide local anaesthetic, is known for its reduced risk of cardiac and neurological toxicity compared to bupivacaine or lidocaine. While there has been thorough research on its application in epidural anaesthesia, there is limited documentation regarding its use in brachial plexus blocks. The current investigation aims to compare ropivacaine with bupivacaine concerning the quality of brachial plexus blocks and any associated adverse effects. In this prospective, randomized, double-blind study, seventy elderly patients aged 60 or older, with American Society of Anaesthesiologists (ASA) physical status classifications I and II, underwent upper limb surgery with brachial plexus block, were split into two groups. Group B received bupivacaine with fentanyl and normal saline, while Group R received ropivacaine with fentanyl and normal saline. There were no significant differences between the groups in age, sex, weight, ASA class, surgery duration, or other factors. Group R had faster onset times for sensory and motor blocks and longer sensory block duration compared to Group B ($p<0.05$). However, there was no significant difference in total motor block duration ($p>0.05$). Group R also had a longer time before needing rescue analgesia, suggesting potentially extended pain relief compared to Group B ($p<0.05$). Though GroupR showed a trend towards fewer adverse events, these differences were not statistically significant ($p>0.05$). The benefits of prolonged sensory block for postoperative pain relief and the undesirability of extended motor block along with its impact on patient mobility, the administration of ropivacaine may be regarded as preferable to bupivacaine.

Keywords: Bupivacaine; Brachial Plexus Block (BPB); Ropivacaine; Supraclavicular Approach.

Introduction

Brachial plexus block (BPB) is advantageous during upper limb orthopaedic surgery, avoiding the adverse effects of general anaesthesia and benefiting patients with cardio-respiratory comorbidities. It is particularly important for elderly patients due to better preservation of pharyngeal and laryngeal reflexes, reducing aspiration risk, decreasing stress responses, and avoiding difficult intubation [1]. Additionally, it provides superior postoperative analgesia without excessive sedation, enabling early mobilization and discharge. Various approaches like- interscalene, supraclavicular, infraclavicular, and axillary are used based on the surgical site [2].

Affiliation:

[1]Junior Consultant of Anaesthesiology and Intensive Care Unit (ICU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

[2]Senior Consultant of Anaesthesiology and Intensive Care Unit (ICU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

[3]Assistant professor, Department of Anaesthesiology and Intensive Care Unit (ICU), Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh

[4]Assistant Registrar, Department of Anaesthesiology and Intensive Care Unit (ICU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

[5]Residential Surgeon, Department of Anaesthesiology and Intensive Care Unit (ICU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

[6]Junior Consultant of Anaesthesiology and Intensive Care Unit (ICU), Sheikh Hasina National Institute of Burn & Plastic Surgery, Dhaka, Bangladesh

[7]Lacturer, Department of Biochemistry, Naogaon Medical College, Naogaon, Bangladesh

[8]Medical Officer, Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

***Corresponding author:**
Dr. Mohammad Mahabubuzzaman, Junior Consultant of Anaesthesiology and Intensive Care Unit (ICU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh.

Email: mahabubkmc@gmail.com

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Received: October 08, 2024
Accepted: October 17, 2024
Published: October 25, 2024

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

Various local anaesthetic agents are used for brachial plexus block (BPB). Lignocaine, an amide local anaesthetic, acts rapidly but lasts only 60-90 minutes [3]. However, its accidental injection into blood vessels can lead to serious adverse effects such as convulsions, coma, and cardiac arrest [4]. To counteract its vasodilatory effect, adrenaline is added, which prolongs lignocaine's action by delaying absorption. Nonetheless, if adrenaline is absorbed systemically or injected into blood vessels, it can cause hypertension, palpitation, arrhythmia, angina, and flushing [5].

Bupivacaine, another widely used amide local anaesthetic, is preferred for its cost-effectiveness and availability. It is four times more potent than lignocaine and provides adequate intraoperative anaesthesia with a longer duration of action (4-8 hours), though it has a slower onset [6]. Bupivacaine is associated with central nervous system and cardiac toxicity, including a risk of cardiac arrest following unintended intravascular injection. To minimize these risks, bupivacaine is used at the lowest effective concentration (0.25%). Therefore, there is a need for a drug that offers the benefits of bupivacaine without its cardiotoxicity and central nervous system (CNS) toxicity [7-8].

Ropivacaine has emerged as a promising alternative to bupivacaine, showing fewer cardiovascular and central nervous system toxic effects [9]. Research indicates that ropivacaine causes minimal cardiac depression and fewer CNS effects when administered intravenously. As a long-acting amide local anesthetic, ropivacaine is a pure S (−) enantiomer of propivacaine, making it safer than the racemic bupivacaine due to reduced cardiotoxicity and neurotoxicity [10]. Its lower lipid solubility results in less penetration into myelinated motor fibers, leading to lesser motor blockade and better sensory differentiation [11]. Although ropivacaine is less potent than bupivacaine at low doses, such as for epidural analgesia, it shows similar potency and efficacy at high doses, like in peripheral nerve blocks [12]. Ropivacaine provides a less intense motor blockade and a longer duration of sensory block at comparable concentrations, facilitating early limb mobilization with effective analgesia [13]. Given its relative novelty among anesthesiologists in this country, we compared the clinical characteristics and quality of brachial plexus blocks using ropivacaine versus bupivacaine in patients underwent upper limb surgery at our institute.

The use of ultrasound for brachial plexus block (BPB) allows real-time visualization of nerves and surrounding structures, guiding the needle to the target nerve roots and showing the spread of the anaesthetic. This technique reduces the required dosage of local anaesthetics and enhances block effectiveness, making it the gold standard for nerve blocks.

Methodology

Study Design

This prospective, randomized, double-blind study was conducted in collaboration between the Department of Anaesthesia and Intensive Care Medicine and the Department of Traumatology and Orthopaedics at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) in Dhaka, Bangladesh.

Study Population

The study included elderly individuals (aged ≥60 years) of both sexes, classified as American Society of Anaesthesiologists (ASA) class I or II [14], and weighing between 50 and 70 kg, who were scheduled for upper limb surgery. A total of 70 patients were selected based on the absence of allergies to amide local anaesthetics or study drugs, no contralateral phrenic nerve palsy or pneumothorax, and no severe active cardiovascular, respiratory, renal, or hepatic abnormalities. Exclusion criteria included- pregnancy, lactation, any type of physical or mental diseases, chronic pain interfering with pain score evaluation and refusal to participate. Informed written consent was obtained from all participants. They were then randomly assigned to either the bupivacaine group (Group B) or the ropivacaine group (Group R), with 35 patients in each group. Randomization was performed using Random Number Generator Software.

Ethical Approval

This study was carried out following ethical approval from the institutional review board (IRB no- NITOR/Academy/2023/469, Date: 08/05/2023).

Study Duration

The study was conducted from July 2023 to June 2024.

Study Procedure

After selection all study patients were informed about the procedure and potential side effects of the study drugs. They were educated on using the Visual Analog Scale (VAS) to measure postoperative pain intensity, and written informed consent was obtained. Patients fasted for 8 hours before surgery and received 7.5 mg of midazolam as an anxiolytic at the night before. Pre-operative written consent was confirmed, and routine investigations were completed.

Upon arrival in the pre-operative room, patients were connected to standard monitoring equipment (non-invasive blood pressure, ECG, pulse oximeter), and baseline parameters were recorded. An experienced anaesthesiologist performed the brachial plexus block (BPB) under ultrasound guidance, while another anaesthesiologist monitored the patients. After confirming complete anaesthesia, patients were moved to the operating room.

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

Seventy patients were randomly divided into two groups, each receiving 30 ml volume of a local anaesthesia mixture. Group B (Bupivacaine group) was administered 20 ml of 0.5% Bupivacaine with 50 µg of fentanyl (1 ml), and 9 ml of normal saline. Group R (Ropivacaine group) received 20 ml of 0.5% Ropivacaine with 50 µg of fentanyl (1 ml), and 9 ml of normal saline.

Sensory and motor blocks onset in the radial, ulnar, and median nerves were assessed every 5 minutes for 20 minutes using a pinprick test. Sensory block was graded from 0 (no pain) to 3 (severe pain), and motor block was evaluated using a modified Bromage's scale from 0 (full movement) to 4 (no movement). A complete block was defined as a sensory block grade of 0 and a motor block grade of 3 or 4. If the block was incomplete after 20 minutes (sensory block grade 2 or 3 and motor block grade 1 or 2), general anaesthesia was administered, and the patient was excluded from the study.

Block quality during surgery was categorized as follows: Grade I (no adjuvants used), Grade II (opioids used), and Grade III (surgery performed under general anaesthesia). For Grade II blocks, intravenous pethidine (0.5 mg/kg) was administered. Grade III blocks, where surgery was performed under general anaesthesia or where sensory block was grade 3 (severe pain) after 20 minutes of BPB, were considered block failures and excluded from the analysis.

Throughout the perioperative period, patients were monitored for complications including nausea, vomiting, itching, Horner's syndrome, chest discomfort, and shivering.

The duration of the motor block was recorded from the time of administration until full motor function returned, and the duration of the sensory block was recorded until the VAS score reached ≥4. Rescue analgesia with intramuscular pethidine (1.5 mg/kg) was provided for a VAS score ≥4. All analgesia-related variables were recorded in minutes.

Outcome Variables

The onset and duration of sensory and motor block, the quality of the block during surgery, the time until the first postoperative rescue analgesic was administered, intraoperative hemodynamic parameters (such as heart rate and mean blood pressure), and any adverse events related to the procedure or drugs were observed and compared in patients receiving either bupivacaine or ropivacaine in brachial plexus block.

Statistical Analysis

All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 26 for Windows. Data were statistically described using mean ± standard deviation (SD), or frequencies and percentages where appropriate. Numerical variables between the study groups were compared using the Student's t-test for independent samples. For categorical data comparisons, the Chi-square (X^2) test was used. A p-value of less than 0.05 was considered statistically significant.

Results

Seventy patients were initially included in this study. However, in group B, three patients experienced block failure; and in group R, two patients had block failure. The demographic characteristics of the seventy participants were recorded. After analysing the demographic characteristics of the seventy participants, no statistically significant differences were found between Group B and Group R in terms of age, sex, weight, ASA class, or duration of surgery (Table- 1). After excluding the patients with block failure, data from left 65 patients; 32 patients in group B and 33 patients in group R were analysed for other outcomes.

There was no significant difference in the distribution of surgery indications between the two groups (Figure 1).

Table 1: Baseline characteristics of participants (N= 70)

Characteristics		Group B (n=35)	Group R (n=35)	p value
Age (years)		68.3±5.1	67.1±5.5	0.485*
Sex	Male	20 (57.1%)	22(62.9%)	0.807**
	Female	15 (42.9%)	13 (37.1%)	0.606**
Weight(kg)		62.5±4.3	63.6±4.6	0.722*
ASA class	Class I	11 (31.4%)	13 (37.1%)	0.615**
	Class II	24 (68.6%)	22 (62.9%)	0.801**
Duration of surgery (minutes)		88.4±17.5	90.7±19.1	0.687*
Block failure		3 (8.5%)	2(5.7%)	0.732**

p value was determined by *Student t-test and **Chi-square test (χ2)

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

In Group B, 69% of patients exhibited Grade I, 22.5% exhibited Grade II, and 8.5% exhibited Grade III block. Similarly, in Group R, 80% of patients exhibited Grade I, 14.3% exhibited Grade II, and 5.7% exhibited Grade III block. However, there were no statistically significant differences in grade of block distribution between the groups (Figure 2).

After monitoring intraoperative hemodynamic parameters such as heart rate, mean blood pressure, and oxygen saturation at different time interval, no significant differences were observed between the groups (p>0.05) (Figures 3 and Figure 4).

The data indicate significant differences between Group B and Group R in the onset of sensory (15.4±2.2 versus 9.2±2.1 minutes, p=0.014) and motor blocks (20.7±3.6 versus 13.7±1.9 minutes, p-0.002), as well as the total duration of sensory block (352.6±31.7 versus 522.9±49.1 minutes, p= 0.001). Group R demonstrates faster onset times for both sensory and motor blocks, and a longer duration of sensory block compared to Group B (p<0.05). However, there is no notable difference between the two groups in terms of the total duration of motor block (p>0.05). Additionally, Group R experiences a significantly longer duration before needing rescue analgesia (329.4±35.3 versus 511.4±54.6 minutes), suggesting potentially prolonged pain relief compared to Group B (p<0.05) (Table 2).

Although there seems to be a tendency toward a lower occurrence of adverse events in Group R compared to Group B; these differences were not statistically significant (p>0.05) (Table 3).

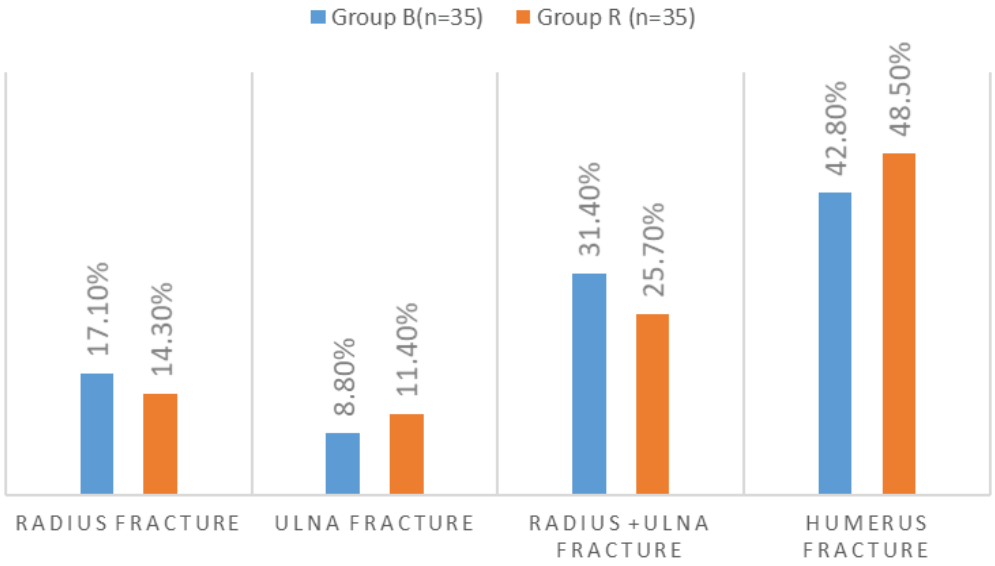

Figure 1: Distribution of surgery indications between the groups (N= 65)

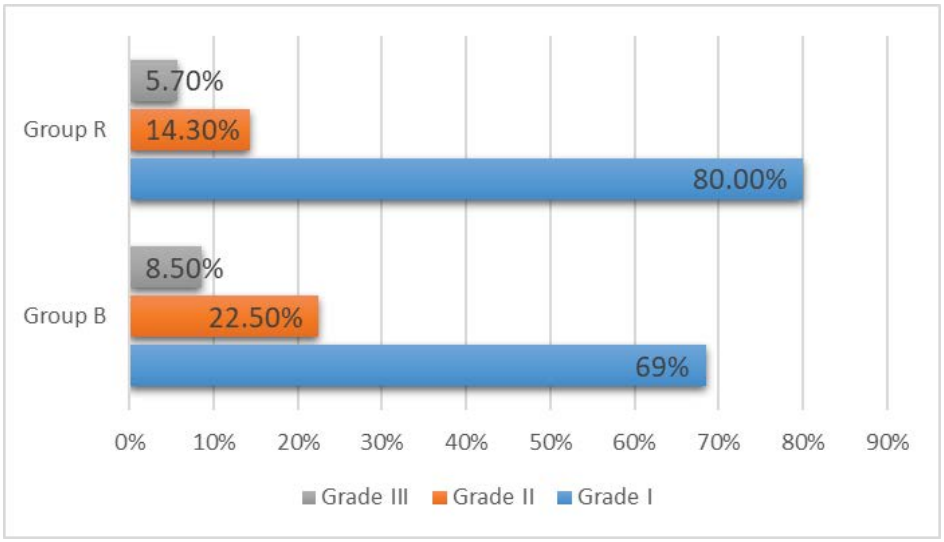

Figure 2: Grade of block distribution between the groups (N=65)

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

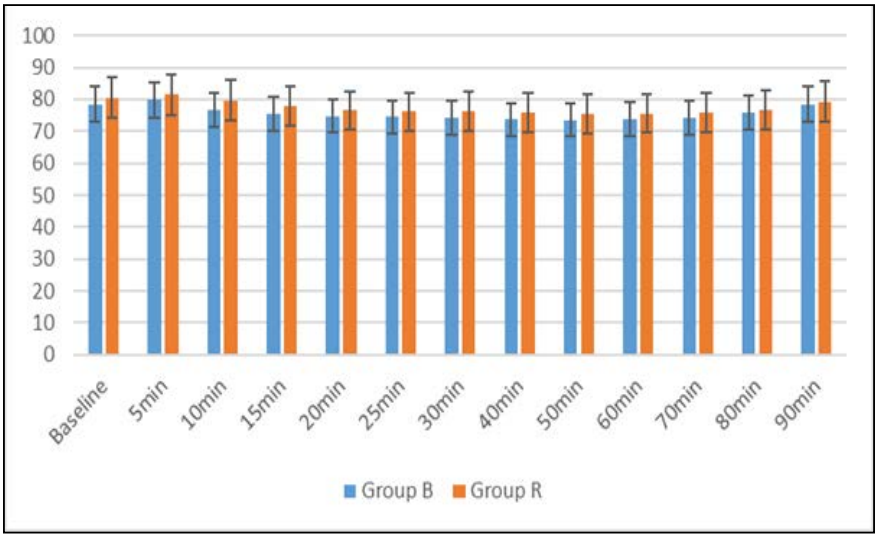

Figure 3: Heart rate of the study patients during intraoperative period (N=65)

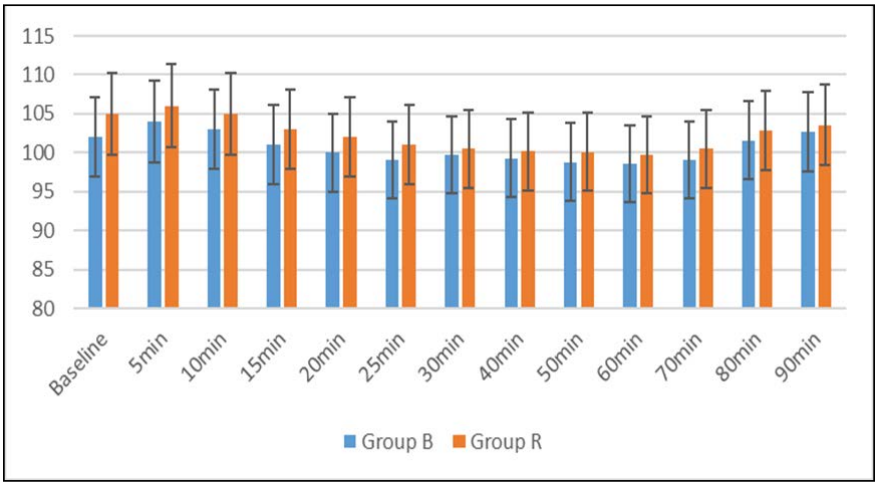

Figure 4: Mean blood pressure of the study patients during intraoperative period (N= 65)

Table 2: Onset of sensory and motor block and duration of sensory and motor block among the study patients (N= 65)

Variable (minutes)	Group B (n=32)	Group R (n=33)	p value
Time onset of sensory block	15.4±2.2	9.2±2.1	0.014[s]
Time onset of motor block	20.7±3.6	13.7±1.9	0.002[s]
Total duration of sensory block	352.6±31.7	522.9±49.1	0.001[s]
Total duration of motor block	317.7±25.4	265.8±21.1	0.170[ns]
Time for first rescue analgesia	329.4±35.3	511.4±54.6	0.001[s]

p value was determined by Student t-test. s= Significant, ns= Not significant

Table 3: Adverse events among the study patients (n= 65)

Adverse events	Group B (n=32)	Group R (n=33)	p value
Horner's syndrome	7 (21.8%)	4 (12.1%)	0.172
Chest discomfort	5 (15.6%)	2 (6.1%)	0.232
Bradycardia	5 (15.5%)	3 (9.1%)	0.452
PONV*	6 (18.7%)	3 (9.1%)	0.284

*Post-operative nausea and vomiting, p value was determined by Chi-square test ($\chi 2$)

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

Discussion

In this present study, the brachial plexus block (BPB) is preferred for patients underwent upper extremity surgeries. This technique is a well-accepted part of comprehensive anaesthesia care and is particularly valuable for high-risk patients and emergency situations [15]. The brachial plexus block provides excellent anaesthesia without causing loss of consciousness or impairing protective airway reflexes [16]. Bupivacaine, a long-acting local anaesthetic, has yet been the most popular choice for supraclavicular block in elective upper limb surgeries. However, its use is limited by potential central nervous system (CNS) and cardiovascular (CVS) side effects. Ropivacaine was developed as a safer alternative to bupivacaine [10]. While it is indeed safer, ropivacaine is slightly less potent, nontoxic and exhibits some motor-sparing effects [10].

Our study observed block failure rates of 8.5% in the bupivacaine group (Group B) and 5.7% in the ropivacaine group (Group R), with an overall block success rate of 92.8%. There was no statistical difference in case of grade of anaesthesia between the two groups ($p>0.05$). A previous study demonstrated that both ropivacaine at 7.5 mg/ml and bupivacaine at 5 mg/ml are effective local anaesthetics for interscalene brachial plexus anaesthesia, achieving an 84% success rate [17]. Our results were also consistent with another similar study, which showed an effective anaesthesia using ropivacaine at 5 mg/ml [18].

In this study, the onset of sensory and motor blocks occurred more quickly with ropivacaine than with bupivacaine. Additionally, the duration of sensory block and the time until the first rescue analgesia were longer with ropivacaine compared to bupivacaine. However, the motor blockade lasted longer with bupivacaine, resulting in a faster recovery of motor functions in the ropivacaine group compared to the bupivacaine group.

In a related study, the test group received 25 ml 0.75% ropivacaine and control group received 25 ml 0.5% bupivacaine without fentanyl for supraclavicular brachial plexus block [19]. They observed that onset of sensory block was attained faster, and the duration was seen in group which received ropivacaine whereas onset and peak of motor block was faster attained and duration was more in group which received bupivacaine [19]. This result was matched with our study finding.

Joshi V and Chande H had compared the efficacy of ropivacaine and bupivacaine for supraclavicular brachial plexus block [20]. They found that the sensory block onset was significantly faster in the ropivacaine group, with an average onset time of 11.90 minutes, compared to 14.39 minutes in the bupivacaine group. Conversely, the motor block onset was quicker in the ropivacaine group, averaging 14.6 minutes, while it was slower in the bupivacaine group, with an average onset time of 19.4 minutes. Additionally, the duration of the motor block was significantly longer in the bupivacaine group, with an average duration of 406.23 minutes [20]. These results were partially consistent with findings of this current study.

In another study, it was showed that ropivacaine had a quicker onset of sensory and motor blockade compared to bupivacaine. The duration of both sensory and motor blockades was longer in the ropivacaine group, although the quality of blocks in both groups showed no statistically significant difference [21]. In accordance Bertini L *et al.,* found that complete sensory and motor block rates were higher in the ropivacaine groups at 10 minutes, 15 minutes, and 20 minutes post-injection ($p<0.001$), and ropivacaine's mean peak time was shorter than bupivacaine ($p<0.05$). The quality of anesthesia, measured by intraoperative opioid requirements and patient satisfaction, was significant higher with ropivacaine ($p<0.05$), however no significant differences in other parameters [22].

Regarding ropivacaine tolerability; it was documented that preoperative, intraoperative, and postoperative heart rate, blood pressure, and oxygen saturation were similar across the study groups, with no notable side effects recorded [23]. In this context Iwata T *et al.,* reported that 90.3% of patients required no supplemental analgesia during surgery, though a few needed fentanyl due to insufficient nerve block effects [24]. Although few adverse effects, such as numbness and delayed motor and sensory recovery, were observed [24].

One related previous study found that the quality of block, in terms of intraoperative anesthesia requirements, showed no significant difference between the groups [12]. However, in another study, ropivacaine provided superior anesthesia quality, aligning with Bertini *et al.,* who found ropivacaine better than bupivacaine at 0.5% concentration. Increasing ropivacaine concentration to 0.75% didn't significantly improve anesthesia quality [22]. Similarly, Tripathi D *et al.,* found ropivacaine (0.75%) offered better block than bupivacaine (0.5%) [25]. Capnogna G. *et al.,* had compared the analgesic potencies of bupivacaine and ropivacaine in labor, finding ropivacaine superior, though the need for rescue top-ups between the two groups was not statistically significant [26]. Another related study also supported our findings [27] In contrast Kooloth RA *et al.,* observed no significant differences in the blockade quality of both drugs for supraclavicular blocks [28]. Vainionpaa VA *et al.,* compared 0.5% ropivacaine and 0.5% bupivacaine in supraclavicular brachial plexus blocks and found no significant differences in their clinical or pharmacokinetic profiles [29]. Similarly, Vaghadia H *et al.,* found no notable difference in anesthesia quality when comparing 0.75% ropivacaine and 0.5% bupivacaine [30].

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

Conclusion

Ropivacaine is a safe alternative to bupivacaine as a long-acting local anaesthetic for supraclavicular brachial plexus block. The study suggests that ropivacaine provides a quicker onset of both sensory and motor block, a longer duration of anaesthesia and analgesia, that offers a comparable quality of block to bupivacaine. Moreover, ropivacaine has the added benefit of extending the time before the first rescue analgesic is needed in the postoperative period, compared to bupivacaine.

Limitation of the study

In this study, the dose of ropivacaine was not adjusted according to the patient's body weight; instead, a fixed dose was given, which may have impacted the outcomes mentioned above.

Conflicts of interest

All authors declared that there is no conflict of interest regarding this publication.

References

1. Khanduri KC. Regional anaesthesia techniques for orthopaedic surgery. Medical journal armed forces India 64 (2008): 108-110.
2. Aliste J, Bravo D, Finlayson RJ, et al., A randomized comparison between interscalene and combined infraclavicular-suprascapular blocks for arthroscopic shoulder surgery. Canadian Journal of Anesthesia 1 (2017): 1-8.
3. Sepehripour S, Dheansa BS. Is there an advantage in onset of action with mixing lignocaine and bupivacaine?. Journal of Plastic, Reconstructive & Aesthetic Surgery 70 (2017):1782.
4. El-Boghdadly K, Pawa A, Chin KJ. Local anesthetic systemic toxicity: current perspectives. Local and regional anesthesia 8 (2018): 35-44.
5. Bae JY, Woo CH, Kim SH, et al., Cardiovascular crisis after small dose local infiltration of epinephrine in patient with asymptomatic subarachnoid hemorrhage-A case report. Korean Journal of Anesthesiology 59 (2010): 53-57.
6. Balakrishnan K, Ebenezer V, Dakir A, et al., Bupivacaine versus lignocaine as the choice of locall anesthetic agent for impacted third molar surgery a review. Journal of Pharmacy and Bioallied Sciences 7 (2015): 230-233.
7. Macfarlane AJ, Gitman M, Bornstein KJ, et al., Updates in our understanding of local anaesthetic systemic toxicity: a narrative review. Anaesthesia 76 (2021): 27-39.
8. Gitman M, Fettiplace MR, Weinberg GL, et al., Local anesthetic systemic toxicity: a narrative literature review and clinical update on prevention, diagnosis, and management. Plastic and reconstructive surgery 144 (2019): 783-795.
9. Stienstra R. The place of ropivacaine in anesthesia. Acta anaesthesiologica Belgica 54 (2003):141-150.
10. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian journal of anaesthesia 55 (2011): 104-110.
11. Muñiz MT, Rodríguez J, Bermúdez M, et al., Low volume and high concentration of local anesthetic is more efficacious than high volume and low concentration in Labat's sciatic nerve block: a prospective, randomized comparison. Anesthesia & Analgesia 107 (2008): 2085-2088.
12. Nekee NS, BD B, Sejpal KN, et al., A Comparative Study on the Quality of Blockade by Bupivacaine and Ropivacaine for Supraclavicular Block. International Journal of Contemporary Medical Research 6 (2019): 6-9.
13. Mohta M. Ropivacaine: Is it a good choice for spinal anesthesia?. Journal of Anaesthesiology Clinical Pharmacology 31 (2015): 457-458.
14. Doyle DJ, Garmon EH. American Society of Anesthesiologists classification (ASA class). StatPearls (2019)
15. Mian A, Chaudhry I, Huang R, et al., Brachial plexus anesthesia: a review of the relevant anatomy, complications, and anatomical variations. Clinical Anatomy 27 (2014): 210-221.
16. Etta OE, Akpan SG, Eyo CS, et al., Brachial plexus block for upper limb procedures: experience at the University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria. Journal of the West African College of Surgeons 5 (2015): 76-87.
17. Hofmann-Kiefer K, Herbrich C, Seebauer A, et al., Ropivacaine 7.5 mg/ml versus bupivacaine 5 mg/ml for interscalene brachial plexus block—A comparative study. Anaesthesia and intensive care 30 (2002):331-337.
18. McNamee DA, McClelland AM, Scott S, et al., Spinal anaesthesia: comparison of plain ropivacaine 5 mg ml–1 with bupivacaine 5 mg ml–1 for major orthopaedic surgery. British journal of anaesthesia 89 (2002):702-706.
19. Mohan R, Abraham S. Supraclavicular Brachial Plexus Block-A Comparative Study between Ropivacaine and Bupivacaine. Journal of Medical science and Research. 2019 October;7(10): 49-54.
20. Joshi V and Chande H. Comparative analysis on efficacy of ropivacaine and bupivacaine for supraclavicular brachial

Mahabubuzzaman M, et al., Anesth Crit Care 2024
DOI:10.26502/acc.072

plexus block: Randomized study. MedPulse International Journal of Anaesthesiology 21 (2022): 141- 144.

21. Modak S, Basantwani S. Comparative study of 0.5% ropivacaine and 0.5% bupivacaine for brachial plexus block by supraclavicular approach for upper limb surgeries. International Journal of Basic & Clinical Pharmacology 5 (2017): 1205-1209.

22. Bertini L, Tagariello V, Mancini S, et al., 0.75% and 0.5% ropivacaine for axillary brachial plexus block: a clinical comparison with 0.5% bupivacaine. Regional anesthesia and pain medicine 24 (1999): 514-518.

23. Venkatesh RR, Kumar P, Trissur RR, et al., A randomized controlled study of 0.5% bupivacaine, 0.5% ropivacaine and 0.75% ropivacaine for supraclavicular brachial plexus block. Journal of clinical and diagnostic research: JCDR 10 (2016): UC09.

24. Iwata T, Nakahashi K, Inoue S, et al., Low-dose ropivacaine for supraclavicular brachial plexus block combined with general anesthesia for successful postoperative analgesia: A case series. Saudi Journal of Anaesthesia 7 (2013): 37-39.

25. Tripathi D, Shah K, Shah C, et al., Supraclavicalar brachial plexus block for upper limb orthopedic surgery: A randomized, double blinded comparison between ropivacaine and bupivacaine. The Internet Journal of Anesthesiology 30 (2012): 1-7.

26. Capogna G, Celleno D, Fusco P, et al., Relative potencies of bupivacaine and ropivacaine for analgesia in labour. British journal of anaesthesia 82 (1999): 371-373.

27. Singh S, Raman R, Singh GP, et al., Randomised control trial of dexmedetomidine and magnesium sulfate as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Int J Contemp Med 7 (2019): 39-44.

28. Kooloth RA, Patel SN, Mehta MK. A comparision of 0.5% Ropivacaine and 0.5% Bupivacaine in supraclavicular brachial plexus block. National Journal of Medical Research 5 (2015): 67-70.

29. Vainionpaa VA, Haavisto ET, Huha TM, et al., A clinical and pharmacokinetic comparison of ropivacaine and bupivacaine in axillary plexus block. Anesthesia & Analgesia 81 (1995): 534-538.

30. Vaghadia H, Chan V, Ganapathy S, et al., A multicentre trial of ropivacaine 7.5 mg· ml− 1 vs bupivacaine 5 mg· ml− 1 for supra clavicular brachial plexus anesthesia. Canadian Journal of anaesthesia 46 (1999): 946-951

Citation: Mahabubuzzaman M, Kabir SH, Iqbal MJ, Begum SA, Kumar D, Babu MI, Kaisar K, Hasan SMZ, Panna MA, Islam S, Rahman AKMS. Comparison between Ropivacaine and Bupivacaine for Brachial Plexus Block by Supraclavicular Approach in Upper Limb Orthopaedic Surgeries. Anesthesia and Critical care 6 (2024): 60-67.