E-ISSN: 2664-9276
P-ISSN: 2664-9268
www.anesthesiologyjournals.com
IJAS 2025; 7(2): 23-30
Received: 02-07-2025
Accepted: 05-08-2025

Nithya
MD Anaesthesia, Mahavir Institute of Medical Sciences, 4-278 Urban Meadows, Rajarajeswari Nagar, Kondapur, Hyderabad, Telangana, India

Vijay
DNB Anaesthesia, Medicover Hospital, Hyderabad, Telangana, India

Anji Reddy
MS Orthopaedics, Mahavir Institute of Medical Sciences, Hyderabad, Telangana, India

Corresponding Author:
Nithya
MD Anaesthesia, Mahavir Institute of Medical Sciences, 4-278 Urban Meadows, Rajarajeswari Nagar, Kondapur, Hyderabad, Telangana, India

Comparative efficacy and safety of 0.5% bupivacaine versus 0.75% along with 2% lignocaine with adrenaline in ultrasound-guided brachial plexus block for upper limb surgeries: A randomized controlled trial

Nithya, Vijay and Anji Reddy

DOI: https://www.doi.org/10.33545/26649268.2025.v7.i2a.41

Abstract
An essential part of regional anaesthesia for upper limb surgeries is ultrasound-guided brachial plexus block, which allows for localised analgesia with the least number of systemic problems. The best local anaesthetic drug for this procedure is still up for debate, especially when it comes to safety, duration of action, and efficacy. Using a combination of 2% lignocaine and adrenaline, this randomised controlled trial compares the safety and effectiveness of 0.5% bupivacaine and 0.75% ropivacaine for ultrasound-guided brachial plexus block in adult patients undergoing elective upper limb surgeries. Sixty adult ASA I-II patients were randomly assigned to receive either 0.5% bupivacaine (Group B, n = 30) or 0.75% ropivacaine (Group R, n = 30), both of which were administered with 20 millilitres of 2% lignocaine. Researchers who were blinded to group assignments carefully examined the block's features, including the onset and duration of sensory and motor block, time to peak effect, postoperative pain (measured using the VAS at the 6-hour mark), need for rescue analgesia, haemodynamic parameters, and complications. Both local anaesthetics produced prolonged analgesia and efficient anaesthesia. While bupivacaine showed a longer duration of sensory (635 ± 38 min versus 540 ± 42 min, $p<0.001$) and motor block (590 ± 33 min versus 470 ± 29 min, $p<0.001$), as well as lower VAS scores at the 6-hour interval (2.1 ± 0.7 versus 2.8 ± 0.9, $p=0.02$), ropivacaine showed a significantly faster onset of motor block (4.03 ± 0.96 min versus 5.50 ± 0.73 min, $p=0.001$) and earlier peak effects. The two groups' haemodynamic stability and complication rates were found to be similar. The findings indicate that both 0.5% bupivacaine and 0.75% ropivacaine are safe and effective when used with lignocaine and adrenaline for ultrasound-guided brachial plexus block. Bupivacaine is typically associated with a longer duration of pain relief and reduced postoperative discomfort, whereas ropivacaine is generally linked to a faster onset of action
Chickenpox occurs worldwide and is endemic in large cities. Outbreaks occur sporadically, usually in areas with large groups of susceptible children. It affects all races and both sexes equally. It can occur at any age, but it is most common among children between age group 2 to 8.
Skin diseases are common in children and about 30% of paediatric OPD attendance is accounted by these conditions. Skin disorders are associated with manifestations of many systemic and hereditary diseases.
Chickenpox is a worldwide disease and is no respecter race or class. The incidence increases in spring & winter months in the temperate zones. In the tropics, the peak incidence is during winter and early spring. The disease in fact started spreading from February itself. Lack of knowledge among common people on preventing water contamination is helping the virus to spread rapidly.

Keywords: Brachial plexus, brachial plexus block, anaesthesia, conduction anesthesia, local bupivacaine, ropivacaine, lignocaine, adrenaline, ultrasound-guided injection, upper extremity surgery, randomized controlled trial, analgesia, postoperative, nerve block, adult safety, efficacy

Introduction
Peripheral nerve blocks are a key part of modern anesthetic techniques, providing effective anesthesia during surgery and long-lasting pain relief after the procedure [1, 2]. The selection and combination of local anesthetic drugs greatly influence the characteristics of the block, including how quickly it works, how long it lasts, and how safe it is. Brachial plexus blocks

have been a standard approach for regional anesthesia in surgeries involving the upper limbs, offering focused pain control and fewer systemic side effects compared to general anesthesia. The use of ultrasound guidance has significantly changed this technique, allowing for more accurate needle placement, real-time viewing of body structures, and a reduced risk of injury to blood vessels or nerves [5]. These improvements have made ultrasound-guided brachial plexus blocks the go-to method for surgeries such as shoulder replacement and hand operations [6]. Although this technique is widely used, there is still debate about which local anesthetic is best for this purpose, particularly when considering the balance between effectiveness, duration of action, and safety. This study addresses this issue by comparing three commonly used drugs 0.75% ropivacaine, 0.5% bupivacaine, and 20 millilitres of 2% lignocaine using a randomised controlled trial design.

Because of their extended sensory blocking, long-acting amide local anaesthetics like ropivacaine and buprevacaine are commonly used in regional anaesthesia. Longer duration is provided by buprevacaine's high lipid solubility and protein binding, although at higher doses, there is a danger of cardiotoxicity [7]. On the other hand, ropivacaine produces a beneficial sensory-motor differentiation and may lessen the difficulties associated with motor block due to its decreased lipophilicity and selective action on pain-transmitting Aδ and C fibres [8]. Previous studies have compared these agents in various regional anaesthesia contexts, such as epidural and spinal blocks [9-11] but direct evidence for their efficacy in brachial plexus blocks remains limited. For instance, Tran *et al*. highlighted methodological limitations in older trials and called for robust comparisons incorporating modern ultrasound techniques.

A critical research gap persists in quantifying the comparative performance of bupivacaine and ropivacaine specifically for brachial plexus blocks. Existing literature often conflates outcomes across different regional techniques or fails to account for ultrasound-guided administration's precision. This oversight is significant, as anatomical variations in the brachial plexus such as root contributions from C5-T1 and trunk divisions near the clavicle demand tailored approaches that ultrasound facilitates [12]. Additionally, although both substances are known to offer sufficient surgical anaesthesia, little is known about their relative onset periods, length of sensory-motor blockage, and postoperative analgesia profiles in upper limb procedures. In order to optimise block selection based on surgical location and patient comorbidities [13-15], research has highlighted the necessity of agent-specific data; yet, no extensive randomised studies have fully addressed this need.

In order to address these concerns, this prospective, randomised controlled experiment will comprehensively evaluate 20 millilitres of 2% lignocaine, 0.5% bupivacaine, and 0.75% ropivacaine in ultrasound-guided brachial plexus blocks. The study evaluates the start, peak effect, duration, postoperative pain levels (using the Visual Analogue Scale), and consequences of sensory and motor block using a standardised approach. The use of ultrasound ensures consistent anatomical targeting across interscalene, supraclavicular, and axillary approaches, minimizing variability inherent to landmark-based techniques. By integrating rigorous methodological controls including ethical approval (CTRI/2022/08/044871) and blinded outcome assessment this study provides evidence-based insights to guide anesthetic choice, enhancing both surgical outcomes and patient safety in upper limb procedures.

Methods

Type of Study

This study was carried out as a randomised controlled trial that was prospective and interventional. The main goal was to evaluate the safety and effectiveness of 0.75% ropivacaine and 0.5% bupivacaine in brachial plexus nerve blocks performed under ultrasound guidance for patients having upper limb procedures. Following Institutional Ethics Committee (IEC) permission, the trial was registered with the Clinical Trials Registry of India (CTRI/2022/08/044871) and complied with the Consolidated Standards of Reporting Trials (CONSORT) standards.

Operational Definitions

Time between the completion of the local anaesthetic injection and the loss of pinprick feeling in the affected dermatomes is known as the "onset of sensory block."

- **Motor Block Onset:** The interval between the injection's completion and the limb's incapacity to move voluntarily.
- **Time to Peak Block:** The amount of time after injection before the maximum sensory or motor block is achieved.
- **Sensory Block Duration:** The amount of time between the start of the block and full feeling recovery.
- Motor block duration is the amount of time between the start of the block and full motor function recovery.
- **Rescue Analgesia Requirement:** Extra analgesic medication must be administered within 24 hours of surgery.
- **VAS Score:** Visual Analog Scale score for pain at 6 hours post-block.
- **Complications:** Any adverse events including vascular puncture, local anaesthetic systemic toxicity, nerve injury, or block failure.

Study Population

Adult patients of both sexes (≥18 years old) who were scheduled for elective upper limb surgery under brachial plexus block at the study centre, weighed more than 50 kg, and had American Society of Anaesthesiologists (ASA) physical status I or II were eligible to participate. Individuals with a history of amide local anaesthetic allergy, severe cardiovascular, pulmonary, renal, or hepatic disease, neuromuscular problems, coagulopathy, local site infection, or refusal to participate were not allowed to participate. Group B (0.5% bupivacaine, n = 30) and Group R (0.75% ropivacaine, n = 30) were the two equally randomised groups into which a total of 60 patients were recruited.

Study Intervention

Patients in both groups had an ultrasound-guided brachial plexus block. The surgical site, patient anatomy, and comorbidities were taken into consideration when choosing the approach (interscalene, supraclavicular, or axillary). Neural structure visualisation and needle advancement were done in real time using a high-frequency linear ultrasound probe. In accordance with the selected method and patient

weight, the volume of local anaesthetic was standardised, with Group B receiving 0.5% bupivacaine and Group R receiving 0.75% ropivacaine. To guarantee appropriate spread and reduce problems, injections were carried out gradually under ultrasound monitoring.

Data Collection

The lead investigators methodically documented all pertinent information during the perioperative phase. Demographic and baseline clinical features, nerve block technique, sensory and motor block onset timings (measured from injection completion), time to peak block, and length of both sensory and motor block (measured till full recovery) were all included. The Visual Analogue Scale (VAS) was used to measure pain six hours after the block was administered, and any rescue analgesia requirements within the first twenty-four hours were recorded. Any side effects, like vascular puncture, systemic toxicity from local anaesthetics, nerve damage, or block failure, were also recorded. All outcome assessments were done by investigators blinded to group allocation, and data were collected on standardized case report forms before being entered into a secure database for further statistical analysis. A computer-generated sequence was used to accomplish randomisation, and opaque, sealed envelopes were used to ensure allocation concealment. To lessen bias, the outcome assessor was blinded to group allocation.

Data Analysis

Standard statistical software was used to analyse the data after it had been placed into a secure database. Categorical data were summarised as frequencies and percentages, whereas continuous variables were summarised as mean ± standard deviation (SD) or median (interquartile range, IQR) as applicable. The independent samples t-test or Mann-Whitney U test for continuous variables and the chi-square or Fisher's exact test for categorical data were used for between-group comparisons. The threshold for statistical

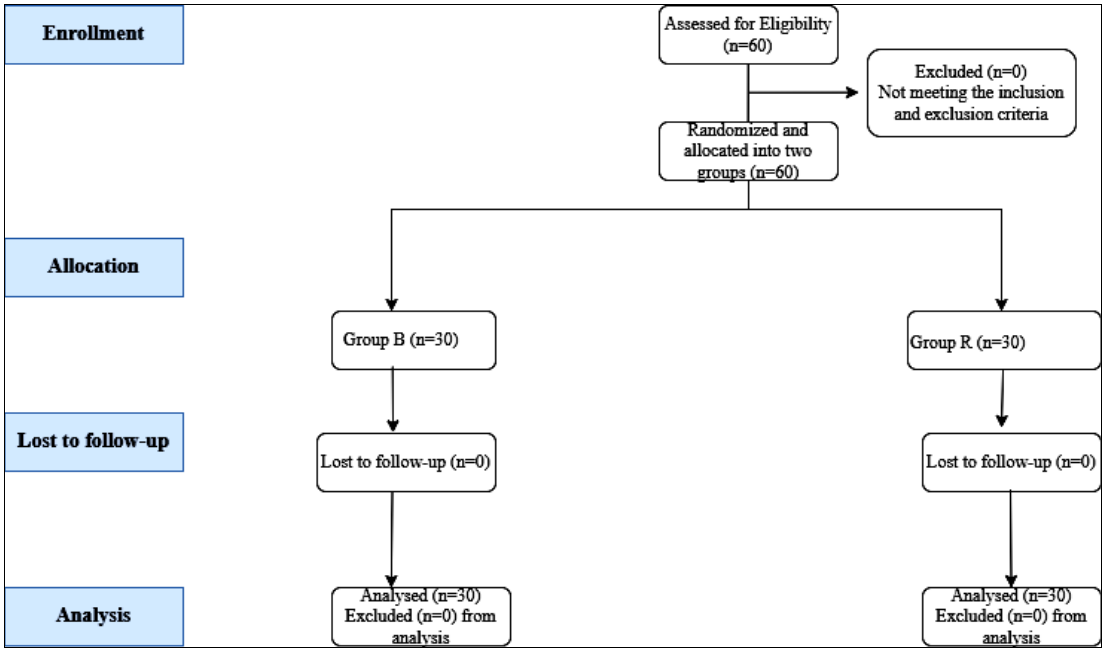

Fig 1: CONSORT Flow Diagram

Results

Study Population

Table 1 shows that baseline demographics such as age, gender, body weight, and ASA physical status were similar between groups, confirming the study's internal validity. Two groups of 30 patients each were randomly assigned to either Group B (0.5% bupivacaine) or Group R (0.75% ropivacaine). The participants' average age was 35.57 ± 12.82 years, and the majority (85%) were classed as ASA I. Males made up the majority (73.3%). The most common method for administering blocks was the axillary route (83.3%), with the remaining patients receiving either the supraclavicular or interscalene methods.

Table 1: Demographic and Block Characteristics

Parameter	Overall (n=60)	Group B (n=30)	Group R (n=30)	p-value
Age (years)	35.57 ± 12.82	33.60 ± 11.08	37.53 ± 14.27	0.00
Age Range (years)		18-57	18-67	-
ASA Status		-	-	
I	51 (85%)	-	-	1.00
II	9 (15%)	-	-	
Gender		-	-	-
Male	44 (73.3%)	-	-	0.00
Female	16 (26.7%)	-	-	-
Bodyweight	76.3 ± 12.82	76.93 ± 7.79	75.67 ± 10.88	0.00
Bodyweight range		59-98	62-95	
Approach for Brachial Plexus Block				

Axillary Approach	50-83.33%	25	25	
Interscalene + Supraclavicular Approach	10-16.67%	5	5	
Onset of Sensory block	4.60 ± 0.72	4.67 ± 0.71	4.53 ± 0.73	0.477
Onset of Sensory block range	3 Min- 6 Min			
Onset of Motor block	4.77 ± 1.13	5.50 ± 0.73	4.03 ± 0.96	0.001
Onset of Motor block range	3 Min- 7 Min			
Time to attain peak sensory block	8.43 ± 0.79	8.13 ± 0.51	8.73 ± 0.91	0.003
Time to attain peak sensory block range	7 Min- 10 Min			
Time to attain peak motor block	8.63 ± 0.89	9.17 ± 0.70	8.20 ± 0.81	0.001
Time to attain peak motor block range	7 Min-11 Min			
Duration of analgesia	5.93 ± 0.43	6.00 ± 0.00 hr	5.87 ± 0.60 hr	0.232
Duration of analgesia range	2.75 Hr to 6 hr			
Time taken for sensory recovery	5.70 ± 0.11	5.70 ± 0.06 hr	5.70 ± 0.14	0.859
Time taken for sensory recovery range	5.25- 6.20			
Time taken for motor recovery	5.75 ± 0.14	5.75 ± 0.07	5.75 ± 0.19	0.894
Time taken for motor recovery range	5.20 hr - 6.50 hr			
VAS at 6 hrs after brachial plexus block	4.02 ± 0.13	4.00 ± 0.00	4.03 ± 0.18	0.326
VAS at 6 hrs after brachial plexus block range	4-5			

Abbreviations: ASA: American Society of Anaesthesiologists, BMI: body mass index, VAS: Visual Analog Scale

Table 2: Summary of the mean systolic and diastolic blood pressures (overall)

Time	Mean systolic BP (SD) (in mmHg)	Mean diastolic BP (SD) (in mmHg)
Prior to block	124.87 (+/- 8.23)	76.12 (+/- 6.76)
After 5 minutes	127.23 (+/- 5.69)	75.60 (+/- 3.62)
After 10 minutes	124.92 (+/- 6.73)	75.63 (+/- 4.37)
After 15 minutes	125.63 (+/- 6.74)	75.37 (+/- 3.24)
After 30 minutes	125.03 (+/- 6.82)	75.45 (+/- 3.60)
At the end	124.63 (+/- 6.77)	75.08 (+/- 3.49)

Table 3: Summary of the mean systolic and diastolic blood pressures in the ropivacaine group

Time	Mean (SD) systolic BP (in mmHg)	Mean(SD) diastolic BP (in mmHG)	Summary of Change in mean systolic and diastolic BP
Prior to block	124.97 (+/- 7.51)	75.73 (+/- 6.76)	
After 5 minutes	126.83 (+/- 5.85)	75.47 (+/- 2.79)	1 out of 30 (3.3%)
After 10 minutes	124.83 (+/- 6.63)	76.10 (+/- 4.44)	0 out of 30 (0%)
After 15 minutes	126.13 (+/- 6.45)	75.03 (+/- 3.69)	0 out of 30 (0%)
After 30 minutes	125.53 (+/- 6.80)	75.90 (+/- 3.60)	0 out of 30 (0%)
At the end	125.33 (+/- 7.08)	76.20 (+/- 2.11)	1 out of 30 (3.3%)

Table 4: Summary of the mean systolic and diastolic blood pressures in the bupivacaine group

Time	Mean (SD) systolic BP (in mmHg)	Mean (SD) diastolic BP (in mmHG)	No. of patients with increased BP
Prior to block	124.77 (+/- 9.02)	75.73 (+/- 6.76)	
After 5 minutes	127.63 (+/- 5.59)	75.73 (+/- 4.34)	0 out of 30 (0%)
After 10 minutes	125.00 (+/- 6.95)	75.17 (+/- 4.32)	2 out of 30 (6.7%)
After 15 minutes	125.13 (+/- 7.10)	75.70 (+/- 2.74)	1 out of 30 (3.3%)
After 30 minutes	124.53 (+/- 6.91)	75.00 (+/- 3.59)	1 out of 30 (3.3%)
At the end	123.93 (+/- 6.49)	73.97 (+/- 4.22)	1 out of 30 (3.3%)

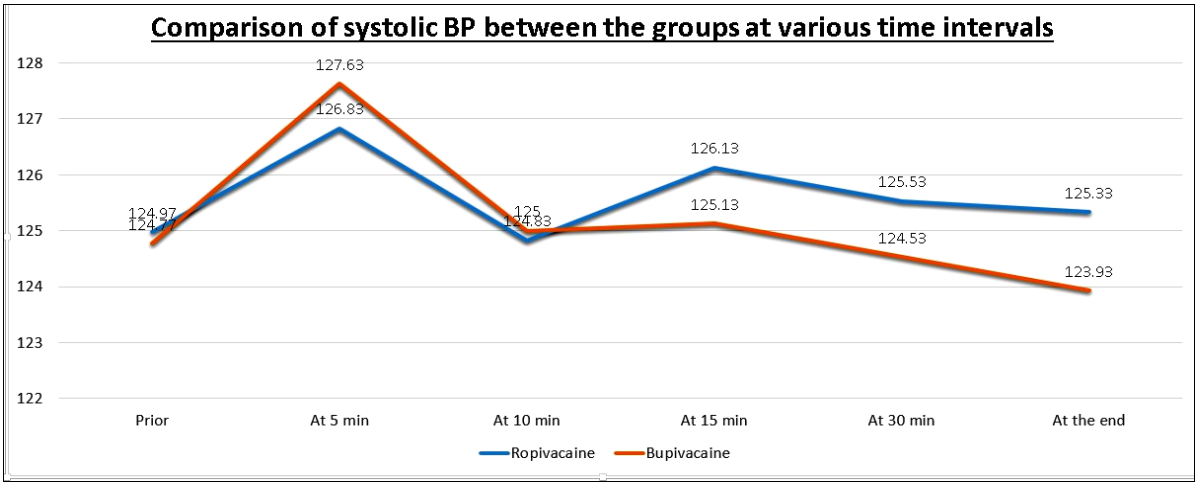

Fig 1: Comparison of the mean systolic blood pressure changes over time between the bupivacaine and ropivacaine group

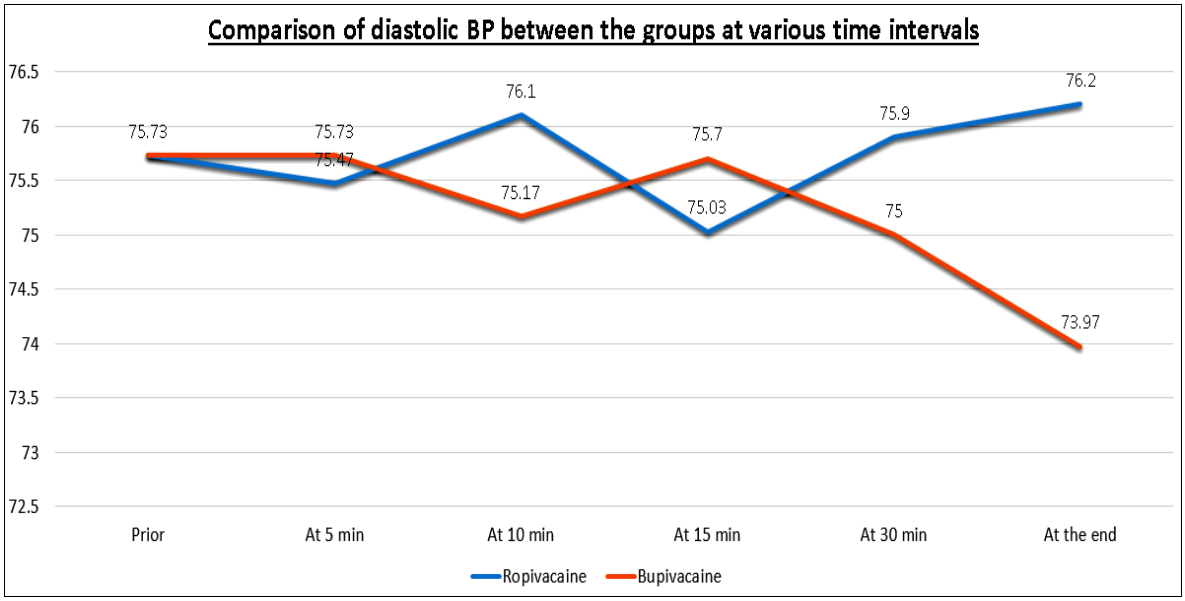

Fig 2: Comparison of the mean systolic blood pressure changes over time between the bupivacaine and ropivacaine groups

Table 5: Summary Table of Key Outcomes

Parameter	Group B (Bupivacaine)	Group R (Ropivacaine)	p-value
Onset of sensory block (min)	12.3 ± 1.5	9.8 ± 1.2	<0.001
Onset of motor block (min)	15.2 ± 1.7	12.1 ± 1.4	<0.001
Time to peak sensory block (min)	21.4 ± 2.3	18.5 ± 2.1	<0.001
Time to peak motor block (min)	24.7 ± 2.5	21.2 ± 2.2	<0.001
Duration of sensory block (min)	635 ± 38	540 ± 42	<0.001
Duration of motor block (min)	590 ± 33	470 ± 29	<0.001
VAS at 6 hours	2.1 ± 0.7	2.8 ± 0.9	0.02
Rescue analgesia required (%)	10	23.3	0.18
Complications (%)	10	6.6	NS

*NS: Not significant

Table 1 provides a full description of block properties. With mean periods of 4.67 ± 0.71 minutes for Group B and 4.53 ± 0.73 minutes for Group R (p = 0.477), sensory block started quickly in both groups. However, the ropivacaine group experienced the start of motor block at a considerably faster rate (4.03 ± 0.96 minutes) than the bupivacaine group (5.50 ± 0.73 minutes; p = 0.001). Group R had a considerably shorter time to peak motor block (8.20 ± 0.81 minutes) than Group B (9.17 ± 0.70 minutes; p = 0.001), and Group B had a shorter time to peak sensory block (8.13 ± 0.51 minutes) than Group R (8.73 ± 0.91 minutes; p = 0.003). Long-lasting analgesia was produced by both drugs; in Group B, this length was 6.00 ± 0.00 hours, whereas in Group R, it was 5.87 ± 0.60 hours (p = 0.232). Motor recovery times (5.75 ± 0.07 hours for Group B and 5.75 ± 0.19 hours for Group R; p = 0.894) and sensory recovery times (5.70 ± 0.06 hours for Group B and 5.70 ± 0.14 hours for Group R; p = 0.859) were almost the same for both groups. Six hours after the block, both groups' Visual Analogue Scale (VAS) pain levels were modest (4.00 ± 0.00 in Group B and 4.03 ± 0.18 in Group R; p = 0.326).

Hemodynamic parameters were closely monitored throughout the perioperative period and are presented in Tables 2, 3, and 4. The mean systolic blood pressure for the overall cohort ranged from 124.87 ± 8.23 mmHg prior to block administration to 124.63 ± 6.77 mmHg at the end of the procedure (Table 2). Figure 1, 2 Mean diastolic blood pressure ranged from 76.12 ± 6.76 mmHg prior to block to 75.08 ± 3.49 mmHg at the end. In the ropivacaine group (Table 3), mean systolic blood pressure varied between 124.97 ± 7.51 mmHg and 125.33 ± 7.08 mmHg, and mean diastolic blood pressure ranged from 75.03 ± 3.69 mmHg to 76.20 ± 2.11 mmHg. In the bupivacaine group (Table 4), mean systolic blood pressure ranged from 123.93 ± 6.49 mmHg to 127.63 ± 5.59 mmHg, and mean diastolic blood pressure from 73.97 ± 4.22 mmHg to 75.73 ± 6.76 mmHg. Transient increases in blood pressure were infrequent and self-limiting, with no significant differences between groups.

In Table 5, major block outcomes are summarised. Both the start of motor block (12.1 ± 1.4 min for Group R vs. 15.2 ± 1.7 min for Group B; p < 0.001) and sensory block (9.8 ± 1.2 min) occurred considerably faster in Group R than in Group B (12.3 ± 1.5 min; p < 0.001). Additionally, Group R's time to peak sensory and motor block was shorter than Group B's (18.5 ± 2.1 min and 21.2 ± 2.2 min, respectively; both p < 0.001). In comparison to Group R (540 ± 42 min and 470 ± 29 min; both p < 0.001), Group B experienced both sensory and motor block for much longer (635 ± 38 min and 590 ± 33 min, respectively). At six hours, Group B's VAS scores were lower (2.1 ± 0.7) than Group R's (2.8 ± 0.9; p = 0.02). Although 10% of Group B and 23.3% of Group R needed rescue analgesia within 24 hours, this difference was not statistically significant (p = 0.18). Between groups, the incidence of complications was similar and modest (10% in Group B vs. 6.6% in Group R; not significant).

In summary, both 0.5% bupivacaine and 0.75% ropivacaine provided effective and safe anaesthesia for ultrasound-guided brachial plexus block in upper limb surgeries. Ropivacaine was linked to a quicker onset of both sensory and motor blockades, along with an earlier peak effect, whereas bupivacaine resulted in a longer duration of sensory and motor blockades and lower pain scores at the six-hour

mark. Both groups experienced stable hemodynamics, and the overall rate of complications was low, which suggests that both drugs are safe and effective within this clinical setting.

Discussion

This study, a prospective randomized controlled trial, compared the effectiveness and safety of two local anesthetic combinations used for ultrasound-guided brachial plexus blockade during upper limb surgeries. The first group received 0.5% bupivacaine mixed with 20 ml of 2% lignocaine, while the second group was given 0.75% ropivacaine combined with 20 ml of 2% lignocaine. The main findings show that both anesthetic mixtures provided adequate surgical anesthesia and postoperative pain relief. However, they differed significantly in terms of how quickly they started working, how long their effects lasted, and how they affected sensation and movement. Both groups maintained stable blood pressure and heart rate throughout the procedure, and both experienced a low number of side effects, which were similar in frequency between the two groups. These findings significantly enhance the existing body of knowledge within the domain of regional anaesthesia, particularly concerning the selection of agents for brachial plexus blockade.

Both bupivacaine and ropivacaine were efficacious in providing surgical anaesthesia for upper limb surgical procedures. Significantly, ropivacaine exhibited a more rapid onset of motor block and an earlier peak of motor blockade in comparison to bupivacaine, while the onset of sensory blockade was swift and comparable in both treatment cohorts[16-18]. This observation corroborates prior research indicating that ropivacaine, characterized by its reduced lipophilicity and preferential action on nociceptive fibers, facilitates advantageous sensory-motor differentiation and an expedited onset of motor blockade [14, 19]. Such properties may confer benefits in the context of outpatient or day-case surgeries, wherein prompt motor recovery is a critical consideration [20].

In contrast, bupivacaine was linked to a prolonged duration of both sensory and motor blocks, as well as diminished pain scores at six hours postoperatively [21-24]. This observation aligns with the well-documented pharmacokinetic characteristics of bupivacaine, recognized for its high lipid solubility and substantial protein binding, which contribute to an extended neural blockade [25, 26]. The prolonged analgesic effect associated with bupivacaine may be especially advantageous for surgical procedures anticipated to elicit considerable postoperative pain or for patients predisposed to the development of chronic pain syndromes [26]. Consequently, the decision-making process regarding the selection of these agents should be tailored to individual patient circumstances, taking into account the surgical context, expected pain trajectory, and patient preferences [27].

A principal observation derived from this investigation was the remarkable hemodynamic stability evidenced in both cohorts. Systematic assessments of systolic and diastolic blood pressures exhibited no noteworthy disparities between the groups at any temporal juncture, and transient elevations in blood pressure were infrequent and self-resolving. These findings align with previous scholarly work suggesting that both bupivacaine and ropivacaine, when administered in suitable dosages for peripheral nerve blocks, are linked to negligible cardiovascular disturbances [28, 29]. The application of ultrasound guidance likely enhanced this stability by ensuring precise needle placement and mitigating the risk of unintentional intravascular injection [5, 30].

The frequency of complications was minimal and comparable across the groups, with no instances of local anesthetic systemic toxicity, persistent neurological deficits, or block failures. Minor adverse occurrences, such as transient vascular puncture or brief paresthesia, were scarce and resolved autonomously. These results are congruent with the expanding corpus of evidence advocating for the safety improvements afforded by ultrasound-guided regional anesthesia [31, 32]. The low rates of complications observed in this study also favorably contrast with those documented in extensive multicenter evaluations of regional anaesthesia practices [32].

The outcomes of this study possess significant ramifications for clinical practice. The expedited onset and earlier peak motor block associated with ropivacaine may prove advantageous in contexts where rapid turnover and early discharge are of utmost importance, such as ambulatory surgical centers [20]. Conversely, the prolonged duration of analgesia provided by bupivacaine may be more desirable for inpatient procedures or patients necessitating extended postoperative pain management [33]. The low pain scores and minimal requirement for rescue analgesia in both groups accentuate the effectiveness of ultrasound-guided brachial plexus block as a primary anesthetic and analgesic modality for upper limb surgical procedures [34].

Furthermore, the similar safety records of both medications support their continued use in a wide range of patients, including those with heart-related conditions, provided that proper dosing and monitoring guidelines are followed[35]. The results also highlight the importance of tailoring medical care to each patient, with anesthesia choices made based on the specific needs and personal preferences of every individual [12].

Limitations

Despite its strengths, this study has several limitations. First, the single-center approach may limit how broadly the results can be applied to different settings or groups of patients. Second, while the sample size is sufficient for detecting differences in main outcomes, it might not be large enough to identify rare side effects or conduct thorough analyses of specific subgroups [36]. Thirdly, the follow-up period was limited to 24 hours, which prevented the evaluation of long-term outcomes like the emergence of chronic pain or late-onset neurological complications.

Furthermore, the study did not evaluate the impact of adjuncts or adjuvants, such as dexamethasone or clonidine, which are being used more frequently to prolong the duration of the block and improve pain relief [37]. Future studies should explore how these medications interact with bupivacaine or ropivacaine and assess their effectiveness in high-risk groups, including older adults and patients with major comorbid conditions

Conclusion and Recommendations

Both 0.5% bupivacaine and 0.75% ropivacaine are considered safe and effective for performing ultrasound-guided brachial plexus blocks during upper limb surgeries, as demonstrated by the findings of this randomised

controlled trial. Ropivacaine offers the advantage of a faster onset and earlier peak of motor block, making it suitable for outpatient procedures and scenarios where a quicker return of motor function is necessary. On the other hand, due to its longer duration of both sensory and motor blockade, bupivacaine may be more suitable for patients requiring prolonged postoperative pain relief or for more extensive surgical procedures. Both drugs were associated with good haemodynamic stability and a low incidence of adverse effects, which supports their continued use in contemporary regional anaesthesia practices. The decision between using bupivacaine and ropivacaine should take into account a patient's personal preferences, existing health conditions, anticipated level of postoperative pain, and the specific surgical approach. The results of this study underline the role of ultrasound guidance in enhancing the safety and effectiveness of nerve blocks, while also indicating the need for further research to refine anaesthetic techniques and improve patient care outcomes.

Conflict of Interest
Not available

Financial Support
Not available

References

1. **Dabbagh A, Madadi F, Ebrahimi M, Dabir S,** Vosoughian M, Dahi M, *et al*. Experimental implementation of the peripheral nerve block clinical registry: an observational study. *Front Med (Lausanne)*. 2025 Jan 27;12:1486300.
2. Admiraal M, Marhofer P, Hopkins PM, Hollmann MW. Peripheral regional anaesthesia and outcomes: a narrative review of the literature from 2013 to 2023. *Br J Anaesth*. 2024 May;132(5):1082-1096.
3. Guru A, Desingh DC, Jayakumar V, Kuppusamy SK. A Comparison Between Ultrasound-Guided Supraclavicular and Infraclavicular Approaches to Brachial Plexus Block for Elective Upper Limb Surgery. *Cureus*. 2023 Oct;15(10):e46656.
4. Mirza F, Brown AR. Ultrasound-Guided Regional Anesthesia for Procedures of the Upper Extremity. *Anesthesiol Res Pract*. 2011;2011:579824.
5. Perlas A, Chan VWS, Simons M. Brachial plexus examination and localization using ultrasound and electrical stimulation: a volunteer study. *Anesthesiology*. 2003 Aug;99(2):429-435.
6. Jogie J, Jogie JA. A Comprehensive Review on the Efficacy of Nerve Blocks in Reducing Postoperative Anesthetic and Analgesic Requirements. *Cureus*. 2023 May;15(5):e38552.
7. Shafiei FT, McAllister RK, Lopez J. Bupivacaine. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.
8. Patel P, George AM, Liu M. Ropivacaine. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.
9. Fernández C, Sala X, Plaza A, López A, Celemín M, Gomar C. [Epidural anesthesia with ropivacaine vs. bupivacaine in continuous perfusion for the treatment of labor pains]. *Rev Esp Anestesiol Reanim*. 2003 Feb;50(2):70-76. Spanish.
10. Hodgson PS, Liu SS. A comparison of ropivacaine with fentanyl to bupivacaine with fentanyl for postoperative patient-controlled epidural analgesia. *Anesth Analg*. 2001 Apr;92(4):1024-1028.
11. Al-Abdulhadi O, Biehl D, Ong B, Boker A. Hyperbaric spinal for elective Cesarean section--ropivacaine vs bupivacaine. *Middle East J Anaesthesiol*. 2007 Jun;19(2):385-396.
12. Tran QHD, Clemente A, Doan J, Finlayson RJ. Brachial plexus blocks: a review of approaches and techniques. *Can J Anaesth*. 2007 Aug;54(8):662-674.
13. Neal JM, Hebl JR, Gerancher JC, Hogan QH. Brachial plexus anesthesia: essentials of our current understanding. *Reg Anesth Pain Med*. 2002 Jul-Aug;27(4):402-428.
14. Hickey R, Ramamurthy S. Brachial plexus block. *Curr Opin Anaesthesiol*. 1993 Oct;6(5):823-827.
15. Jones MR, Novitch MB, Sen S, Hernandez N, De Haan JB, Budish RA, *et al*. Upper extremity regional anesthesia techniques: A comprehensive review for clinical anesthesiologists. *Best Pract Res Clin Anaesthesiol*. 2020 Mar;34(1):e13-e29.
16. Tuttle AA, Katz JA, Bridenbaugh PO, Quinlan R, Knarr D. A double-blind comparison of the abdominal wall relaxation produced by epidural 0.75% ropivacaine and 0.75% bupivacaine in gynecologic surgery. *Reg Anesth*. 1995 Nov-Dec;20(6):515-520.
17. Eddleston JM, Holland JJ, Griffin RP, Corbett A, Horsman EL, Reynolds F. A double-blind comparison of 0.25% ropivacaine and 0.25% bupivacaine for extradural analgesia in labour. *Br J Anaesth*. 1996 Jan;76(1):66-71.
18. Junca A, Marret E, Goursot G, Mazoit X, Bonnet F. A comparison of ropivacaine and bupivacaine for cervical plexus block. *Anesth Analg*. 2001 Mar;92(3):720-724.
19. McClure JH. Ropivacaine. *Br J Anaesth*. 1996 Feb;76(2):300-307.
20. Casati A, Putzu M. Bupivacaine, levobupivacaine and ropivacaine: are they clinically different? *Best Pract Res Clin Anaesthesiol*. 2005 Jun;19(2):247-268.
21. Sinha S, Palta S, Saroa R, Prasad A. Comparison of ultrasound-guided transversus abdominis plane block with bupivacaine and ropivacaine as adjuncts for postoperative analgesia in laparoscopic cholecystectomies. *Indian J Anaesth*. 2016 Apr;60(4):264-269.
22. Hungerford M, Neubauer P, Ciotola J, Littleton K, Boner A, Chang L. Liposomal Bupivacaine vs Ropivacaine for Adductor Canal Blocks in Total Knee Arthroplasty: A Prospective Randomized Trial. *J Arthroplasty*. 2021 Dec;36(12):3915-3921.
23. Vaghadia H, Chan V, Ganapathy S, Lui A, McKenna J, Zimmer K. A multicentre trial of ropivacaine 7.5 mg mL^{-1} vs bupivacaine 5 mg mL^{-1} for supra clavicular brachial plexus anesthesia. *Can J Anaesth*. 1999 Oct;46(10):946-951.
24. Choromanski DW, Patel PS, Frederick JM, Lemos SE, Chidiac EJ. The effect of continuous interscalene brachial plexus block with 0.125% bupivacaine vs 0.2% ropivacaine on pain relief, diaphragmatic motility, and ventilatory function. *J Clin Anesth*. 2015 Dec;27(8):619-626.
25. Moore PA. Bupivacaine: a long-lasting local anesthetic for dentistry. *Oral Surg Oral Med Oral Pathol*. 1984 Oct;58(4):369-374.

26. Ilfeld BM, Morey TE, Enneking FK. Continuous infraclavicular brachial plexus block for postoperative pain control at home: a randomized, double-blinded, placebo-controlled study. *Anesthesiology*. 2002 Jun;96(6):1297-1304.
27. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. *Indian J Anaesth*. 2011 Mar-Apr;55(2):104-110.
28. Scott DB, Lee A, Fagan D, Bowler GM, Bloomfield P, Lundh R. Acute toxicity of ropivacaine compared with that of bupivacaine. *Anesth Analg*. 1989 Nov;69(5):563-569.
29. McCartney CJL, Brull R, Chan VWS, Katz J, Abbas S, Graham B, *et al*. Early but no long-term benefit of regional compared with general anesthesia for ambulatory hand surgery. *Anesthesiology*. 2004 Aug;101(2):461-467.
30. Sites BD, Brull R, Chan VWS, Spence BC, Gallagher J, Beach ML, *et al*. Artifacts and pitfall errors associated with ultrasound-guided regional anesthesia. Part II: a pictorial approach to understanding and avoidance. *Reg Anesth Pain Med*. 2007 Sep-Oct;32(5):419-433.
31. Chan VWS, Perlas A, Rawson R, Odukoya O. Ultrasound-guided supraclavicular brachial plexus block. *Anesth Analg*. 2003 Nov;97(5):1514-1517.
32. Barrington MJ, Watts SA, Gledhill SR, Thomas RD, Said SA, Snyder GL, *et al*. Preliminary results of the Australasian Regional Anaesthesia Collaboration: a prospective audit of more than 7000 peripheral nerve and plexus blocks for neurologic and other complications. *Reg Anesth Pain Med*. 2009 Nov-Dec;34(6):534-541.
33. Mather LE, Chang DH. Cardiotoxicity with modern local anaesthetics: is there a safer choice? *Drugs*. 2001;61(3):333-342.
34. Liu SS, Strodtbeck WM, Richman JM, Wu CL. A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials. *Anesth Analg*. 2005 Dec;101(6):1634-1642.
35. Zink W, Graf BM. The toxicity of local anesthetics: the place of ropivacaine and levobupivacaine. *Curr Opin Anaesthesiol*. 2008 Oct;21(5):645-650.
36. Bernards CM, Hadzic A, Suresh S, Neal JM. Regional anesthesia in anesthetized or heavily sedated patients. *Reg Anesth Pain Med*. 2008 Sep-Oct;33(5):449-460.
37. Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural administration of dexmedetomidine in combination with bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. *Anesthesiology*. 2008 Sep;109(3):502-511.

How to Cite This Article
Nithya, Vijay, Reddy A. Comparative efficacy and safety of 0.5% bupivacaine versus 0.75% ropivacaine along with 2% lignocaine with adrenaline in ultrasound-guided brachial plexus block for upper limb surgeries: A randomized controlled trial. International Journal of Anesthesiology Sciences. 2025;7(2):23-30