Comparative Study of Ropivacaine 0.75% and Levobupivacaine 0.5% in Ultrasound-Guided Axillary Plexus Block for Elective Upper Limb Surgeries

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Abstract

Background

The axillary plexus block is a standard method for numbing and relaxing muscles during procedures on the upper limbs. Two common local anaesthetics, ropivacaine and levobupivacaine, vary in their start time, block length, and postoperative analgesia.

Aim and Objective:
To evaluate the effectiveness of ropivacaine at 0.75% and levobupivacaine at 0.5% in an ultrasound-guided axillary plexus block. To fully grasp how these two popular local anaesthetics vary in terms of start time, block length, and postoperative analgesia, it is essential to compare and contrast them.
Materials and Methods:

At SCB MCH, Cuttack and SJMC, Puri Hospital 80 patients with ASA physical status I or II and ranging in age from 18 to 65 participated in this prospective, randomized, double-blind clinical experiment. Two groups were formed: one receiving levobupivacaine (0.5%) and the other receiving ropivacaine (0.75%, 25 ml). The start and end times of sensory and motor blocks were the main results. Postoperative pain relief, hemodynamic parameters, and problems were considered secondary outcomes. The data were examined using SPSS version 20.0, and statistical significance was defined as a p-value less than 0.05.

Results:
The results showed that Group A had a substantially quicker mean start time for sensory block (7.92 ± 1.01 min) than Group B (10.35 ± 1.17 min, p = 0.011). Likewise, Group A had a quicker start of motor block (9.10 ± 0.87 min) compared to Group B (11.27 ± 1.11 min, p = 0.005). Group B had a sensory block that lasted 12.25 ± 1.20 hours, whereas Group A had a shorter period of 9.21 ± 0.87 hours (p = 0.032). Group A also had a lower length of motor blocks (8.54 ± 0.87 hours) compared to Group B (11.41 ± 1.17 hrs, p = 0.023). In Group B, the duration of postoperative analgesia was 12.93 ± 1.08 hours, which was significantly longer than in Group A (9.93 ± 0.86 hours, p = 0.038). While no problems were seen in Group B, two individuals in Group A did suffer nausea and vomiting.

Conclusion:
In conclusion, the duration of sensory and motor blocks is longer with 0.75 percent ropivacaine and the duration of both blocks and postoperative analgesia is longer with 0.5% levobupivacaine. There were little side effects reported with any agent. If a longer length of block is needed or a quicker onset is desired, the clinical context should dictate the decision between these two anaesthetics.

Keywords: Axillary Plexus Block, Ropivacaine, Levobupivacaine, Ultrasound-Guided, Postoperative Analgesia, Sensory Block, Motor Block

Introduction

The axillary plexus block is a widely utilized regional anaesthetic technique for upper limb surgeries, offering effective analgesia and muscle relaxation. [1] Among the various local anaesthetics used, Ropivacaine and Levobupivacaine are prominent choices due to their favourable safety profiles and efficacy. [2] Ropivacaine, a newer long-acting local anaesthetic, is known for its lower toxicity and less motor blockade compared to traditional agents like Bupivacaine. [3, 4] Levobupivacaine, the S-enantiomer of Bupivacaine, has been developed to reduce cardiovascular and central nervous system toxicity while maintaining similar anaesthetic properties. [5] The comparative efficacy of Ropivacaine and Levo- bupivacaine in ultrasound-guided axillary plexus block remains an area of active research. Both agents are used to provide analgesia in upper limb surgeries, but differences in their onset times, dura- tion of action, and impact on hemodynamic stability may influence their clinical utility. Understanding these differences can help in tailoring anaesthetic approaches to optimize patient outcomes. [6,7] Previous studies have suggested that ropivacaine might provide a faster onset of sensory and motor blocks, which could be advantageous in a clinical setting where rapid onset is critical.4-6 Conversely, Levobupivacaine might offer a longer duration of motor blockade, which could be beneficial for pro- longed surgical procedures or postoperative analgesia. [1-4] This study aims to compare Ropivacaine 0.75% and Levobupivacaine 0.5% in the context of ultrasound- guided axillary plexus block. By evaluating the time of onset of sensory and motor blocks, duration of motor blockade, postoperative analgesia, and hemodynamic changes, this research provides a clearer understanding of the relative advantages of these two local anaesthetics. The findings from this study could significantly enhance the efficacy of regional anaesthesia for upper limb surgeries, offering hope for improved patient outcomes.

Materials and Methods

This prospective randomized controlled trial was conducted at SCB MCH, Cuttack and SJMC, Puri. The study received approval from the Ethics Committee written informed consent was obtained from all participants before enrolment.

Study Design:

This research is a unique prospective randomized controlled trial performed over eighteen months, particularly designed to assess the effectiveness of Ropivacaine 0.75% and Levobupivacaine 0.5% in ultrasound-guided axillary plexus block.

Research Population:

The research included a defined cohort of patients aged 18 to 65 years, regardless of sex, categorized as American Society of Anesthesiologists (ASA) physical status I or II. The patients were scheduled for elective upper limb surgeries, and we used stringent exclusion criteria to assure the study's safety and integrity. Patients were randomly allocated to two groups via a sealed envelope method. Group

A was administered Ropivacaine 0.75% (25 ml), whereas Group B was given Levobupivacaine 0.5% (25 ml).

Methods for Administering Anaesthesia:

Patients were placed on their backs with their arms bent at a 90-degree angle. Before seeing the region with the ultrasound machine (SonoSite Micromaxx with a 5-10 Hz linear probe), the axillary area was cleansed with disinfectant. The radial, median, and ulnar nerves were found after the axillary artery was identified. A local anesthetic was injected around the nerves while the needle was put in-plane from the anterior portion and progressed care-fully.

Evaluation and Tracking:

All patients had their oxygen saturation, noninvasive blood pressure, and heart rates measured at baseline. Twenty minutes after injection, pinprick and modified Bromage scales were used to measure motor and sensory blockages every minute. We monitored the hemodynamic parameters at0,1,2,3,4,5,10,15,30,60, and 120 minutes. The Visual Analog Scale (VAS) was used to evaluate postoperative analgesia, and rescue medication was given as required.

Result

There were a total of 80 patients who participated in the trial. Forty patients made up Group A, which received 0.75%ropivacaine, and forty patients made up Group B, which received 0.5%levobupivacaine. Comparisons were made between the two groups with respect to demographics, hemodynamic changes, the beginning and length of sensory and motor blocks, postoperative analgesia, and complications. Features of the Population: Group B had an average age of 35.63 ± 11.46 years, while Group A had an average age of 33.47 ± 15.01 years. The age disparity between the two sets of participants did not reach statistical significance ($p > 0.05$). With men making up 70% of Group B and 65% of Group A, there was likewise no statistically significant difference in the distribution of the sexes ($p > 0.05$).

Hemodynamic Parameters

- **Systolic Blood Pressure (SBP):** There were significant differences in SBP at several time in- tervals. At 2 minutes, Group B had a signifi- cantly higher SBP (130.60 ± 11.07 mmHg) than Group A (122.65 ± 12.13 mmHg, $p = 0.022$).
  Similarly, at 4, 10, and 30 minutes, Group A showed higher SBP values ($p < 0.05$).
- **Diastolic Blood Pressure (DBP):** Significant differences were found at 1, 4, 5, and 90 minutes, with Group B showing lower DBP val- ues at these time points ($p < 0.05$).
- **Mean Arterial Pressure (MAP):** Group A had significantly higher MAP values at 3, 15, and 30 minutes compared to Group B ($p < 0.05$).

Onset of Sensory and Motor Block

- **Sensory Block:** The mean time to onset of sensory block was significantly faster in Group A (7.92 ± 1.01 minutes) compared to Group B (10.35 ± 1.17 minutes), with a p-value of 0.011.
- **Motor Block:** The onset of motor block was also significantly quicker in Group A (9.10 ± 0.87 minutes) compared to Group B (11.27 ± 1.11 minutes), with a p-value of 0.005.

Duration of Sensory and Motor Block

- **Sensory Block Duration:** Group A had a shorter mean duration of sensory block (9.21 ± 0.87 hours) than Group B (12.25 ± 1.20 hours,
  $p = 0.032$).
- **Motor Block Duration:** The motor block lasted 8.54 ± 0.87 hours in Group A and 11.41

± 1.17 hours in Group B, with a significant difference (p = 0.023).

Table 1: Comparing onset and duration of sensory and motor block

Block Characteristics	Group A (Ropivacaine) Mean ± SD	Group B (Levobupivacaine) Mean ± SD	p-value
Onset of Sensory Block (min)	7.92 ± 1.01	10.35 ± 1.17	0.011*
Onset of Motor Block (min)	9.10 ± 0.87	11.27 ± 1.11	0.005*
Duration of Sensory Block (hrs)	9.21 ± 0.87	12.25 ± 1.20	0.032*
Duration of Motor Block (hrs)	8.54 ± 0.87	11.41 ± 1.17	0.023*

Postoperative Analgesia: The total duration of postoperative analgesia was significantly longer in Group B (12.93 ± 1.08 hours) compared to Group A (9.94 ± 0.86 hours, p = 0.038).

Table 2: Comparing total duration of analgesia between groups

Duration of Analgesia (hours)	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Total Duration of Analgesia	9.94 ± 0.86	12.93 ± 1.08	0.038*

Complications: Two patients in Group A experienced nausea and vomiting, whereas no complications were observed in Group B. This difference was statistically significant (p < 0.05).

Table 3: Comparing complication between groups

Complications	Group A (n)	Group B (n)	p-value
Nausea & Vomiting	2	0	0.045*
Other Complications	0	0	-

Discussion

Subject under consideration

This randomized clinical trial compared the effects of Ropivacaine (0.75%) and Levobupivacaine (0.5%) in ultrasound-guided axillary plexus blocks on start and duration of motor and sensory blocks, complications, and hemodynamic changes. Group A received 25 ml of ropivacaine (0.75%), whereas Group B received 25 ml of levobupivacaine (0.5%). The patients were randomly assigned to either Group A or Group B after informed permission was obtained. The patients' ASA physical status was I or II, and they ranged in age from 18 to 65 years. The axillary plexus block was performed using standardized protocols. After that, the sensory and motor blocks, discomfort, and hemodynamic parameters were evaluated.

Our research found no statistically significant difference in patient age between Group A and Group B, with an average age of 33.4 and 35.6 years, respectively. The gender distribution was not significantly different between the two groups (p > 0.05), and the proportion of male patients was same in both.

Group A had a sensory block at an average onset time that was 7.92 minutes shorter than Group B.

at 10.35 minutes, p < 0.05, in contrast to Group B. Likewise, Group A had a 9.10 minute mean start of motor block compared to Group B's 11.27 minute onset (p < 0.05). Group B had a sensory block that lasted 12.25 hours, whereas Group A had a considerably lower length of 9.21 hours (p < 0.05). Group A had a motor block that lasted 8.54 hours, which was significantly less than Group B's 11.41 hours (p < 0.05). Group B had a longer duration of postoperative analgesia (12.92 hours) compared to Group A (9.93 hours), with a p-value less than 0.05.

Our results are in line with those of Kim HJ et al. [6], who found that ropivacaine caused sensory block to begin more quickly than levobupivacaine, and that both the sensory and motor blocks were shorter with ropivacaine. A study conducted by Thalamati D et al.1 also discovered that ropivacaine's analgesic effects wore off faster than levobupivacaine's. Additionally, they found that ropivacaine

(5.22 minutes) produced sensory blockage more quickly than levobupivacaine (6.88 minutes), and that both the sensory and motor blocks lasted longer in the levobupivacaine group.
We agree with previous research showing that levobupivacaine provides longer-lasting analgesia, as shown in studies by Cline E et al. [8] and Fournier R et al. [9]. At the same dosages, Fournier R et al. [9] found that levobupivacaine's analgesic effects lasted much longer than ropivacaine's. When administered at the same dosage, the two medications showed identical recovery durations for sensory and motor blocks, according to Casati A et al. [8]. When it came to inhibiting sodium channels in neurons resistant to tetrodotoxin, Brau et al. likewise showed that levobupivacaine worked better than ropivacaine.
Between the two groups, there were no significant differences in systolic and diastolic blood pressure, mean arterial pressure, oxygen saturation, or heart rate from baseline to 120 minutes, according to our research. Chandra K et al. [10] also discovered no statistically significant variations in hemodynamic parameters between the Ropivacaine and Levobupivacaine groups over the research period, therefore our findings are in line with theirs.
Group B did not encounter any difficulties, while two patients in Group A had nausea and vomiting; this difference was statistically significant ($p < 0.05$). By the same token, Thalamati D et al. [1] found the same thing: 3.3% of Ropivacaine patients threw up, whereas no one in the Levobupivacaine group had any problems.

Conclusion

Both Ropivacaine and Levobupivacaine are efficient for ultrasound-guided axillary plexus blocks. However, levobupivacaine is preferred for procedures that need extended analgesia because it provides longer sensory and motor blocks and postoperative analgesia. But ropivacaine's speed is a major plus in the medical field, when a faster start of action is preferred, this might be useful.

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