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A Randomised Trial Comparing Block Characteristics of a Mixture Versus Sequential Injections of Lignocaine and Ropivacaine for Supraclavicular Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgery

Dr Sweta Mahapatra[1], Dr Sucheta Pattanayak[2]

[1]Post Graduate Resident Department of Anaesthesiology, Hi-Tech Medical College and Hospital, Bhubaneswar, Odisha, India

[2]Assistant Professor, Department of Anaesthesiology, Hi-Tech Medical College and Hospital, Bhubaneswar, Odisha, India

Address for Correspondence

Dr Sweta Mahapatra

Department of Anaesthesiology, Hi-Tech Medical College and Hospital, Bhubaneswar-751025, Odisha, India
Email: swetasathpathy76[at]gmail.com

Abstract: ***Background: The optimal method for combining local anaesthetic (LA) agents for peripheral nerve blocks remains unclear. This study evaluated whether administering lignocaine and ropivacaine as a combined solution differs from giving the two drugs sequentially, with respect to block performance during ultrasound-guided supraclavicular brachial plexus anaesthesia for upper-limb surgeries. Methods: In this double-blind randomised clinical trial, 64 adult patients planned for upper-limb surgery were allocated to receive either a 1: 1 mixture of 2% lignocaine with adrenaline and 0.75% ropivacaine (Mixed group, M) or separate sequential injections of the same solutions (Sequential group, S), with 15 mL of each drug. The primary outcome was the proportion of patients achieving complete sensory block of all four major nerves at 10 minutes. Secondary outcomes included onset profiles of sensory and motor block up to 30 minutes, overall duration of block, analgesia duration, and any complications. Results: Baseline characteristics were comparable in both groups. At 10 minutes, a significantly larger proportion of patients in Group S achieved complete sensory block (69%) compared with Group M (41%). Sensory and motor block characteristics equalised by 30 minutes. Total duration of analgesia, sensory block, and motor block did not differ between groups. No serious complications occurred. Conclusion: Sequential administration of lignocaine followed by ropivacaine provides a faster early onset of sensory and motor block compared with mixing both agents, although the overall duration of block remains similar with both techniques.***

Keywords: Local Anaesthesia, Lignocaine, Brachial Plexus, Ropivacaine, Supraclavicular brachial plexus block

1.Introduction

Local anaesthetics with greater lipid solubility, such as ropivacaine, provide more profound and longer-lasting neural blockade compared with intermediate-acting agents like lignocaine. Clinicians often combine two LA agents to utilise the rapid onset of lignocaine and the prolonged effect of ropivacaine. Despite widespread use, there remains no unified recommendation regarding whether these drugs should be injected as a mixture or administered sequentially.

Previous studies have offered conflicting observations regarding the onset times, density, and duration of sensory and motor blockade with mixed LA solutions. Research on sequential administration is relatively limited, particularly in the context of supraclavicular brachial plexus block. Theoretically, sequential delivery may influence how each drug diffuses around the neural structures, potentially impacting onset speed.

This investigation was carried out to compare the mixture technique with sequential injection of lignocaine and ropivacaine, focusing on onset characteristics and overall block quality. We hypothesised that sequential delivery of undiluted agents would achieve faster sensory block onset.

2.Material and Method

Study Design: Double blinded Randomized Controlled Study.

Study setting:

- Place of Study: Department of Anaesthesiology, HI-TECH Medical College and Hospital, Bhubaneswar.
- Field of Study: In Modular OT of HI-TECH Medical College and Hospital.

Study Periods:

2 Years: February 2024 to January 2026

Study Participants: Patients getting admitted under different departments for undergoing surgeries.

Study tools:

- Group S (sequential)-Patients will be given 15 mL of lignocaine with adrenaline injected first, followed immediately by 15 mL of ropivacaine.
- Group M (mixed)-Patients will be given 15 mL of 2% lignocaine with adrenaline (1: 200, 000) mixed with 15 mL of 0.75% ropivacaine (total 30 mL).

Sample Size: Individuals were randomly divided into 2 groups and study was conducted.

Sampling: Detailed PreAnaesthetic checkup will be done in all patients. A detailed history will be taken and thoroughly physical examination will be done to rule out and also to optimize associated Co-morbidities. The following investigations will be carried out in all patients.

- CBC
- Serum Urea
- Serum Creatinine
- Serum fasting Blood Sugar
- Chest X Ray
- 12 lead Electrocardiography
- Serum Sodium and Potassium
- Bleeding time, Clotting time
- HIV, HBsAg, HCV

Selection Criteria:

Inclusion:

- ASA Grade 1 and 2.
- Age group 18-60 years.
- Both male and female participants.

Exclusion:

- Patients' refusal.
- BMI more than 30.
- Patients with history of Asthma and COPD

Monitoring & Assessment:

All blocks were performed under ultrasound guidance by an experienced anaesthesiologist. Sensory and motor block were assessed in musculocutaneous, median, radial, and ulnar nerve distributions using a standard scoring system**.**

Outcome Measure:

Primary outcomes included sensory and motor block onset. duration, and postoperative analgesia.

3.Results and Observations

Participant Flow and Baseline Characteristics

Of 70 screened candidates, 64 completed the study (32 in each group). Baseline demographic variables, type of surgery, and surgical duration were similar between groups.

Primary Outcome

At 10 minutes post-injection, complete sensory block was observed in:

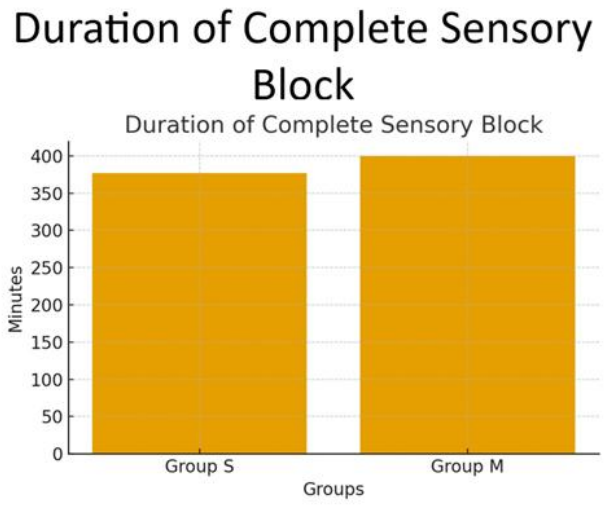
- Group S: 69%
- GroupM: 41% ($P = 0.04$)

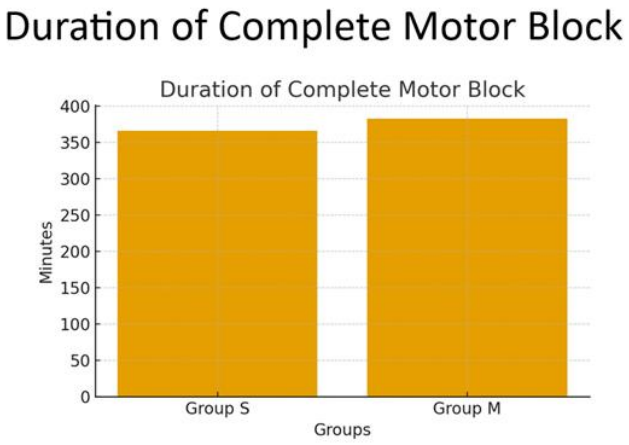
Thus, sequential administration produced significantly faster early sensory block.

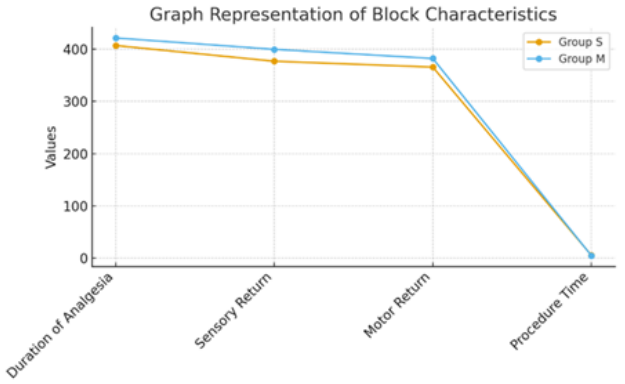
Secondary Outcomes

- Sensory and motor block onset patterns favoured Group S at early intervals, though differences were not always statistically significant.
- By 30 minutes, both groups achieved similar rates of complete sensory and motor block.
- Total duration of sensory block, motor block, and analgesia showed no meaningful differences.
- Block procedure time was comparable between groups.
- One case of transient Horner's syndrome occurred in Group S, resolving spontaneously.

No major complications such as pneumothorax or local anaesthetic systemic toxicity were recorded.







4.Discussion

The findings of this study indicate that sequential administration of lignocaine followed by ropivacaine accelerates early sensory block compared with giving both agents as a premixed solution. The difference likely reflects alteration in drug spread or concentration gradients when administered undiluted.

However, both techniques produced similar overall clinical profiles by 30 minutes and comparable durations of analgesia and motor/sensory block, suggesting that long-term block characteristics are primarily determined by the total LA dose rather than injection sequence.

These results align with existing literature suggesting that mixtures may dilute drug concentration locally, potentially slowing early blockade. Previous studies have reported mixed observations, but the present data reinforce the practical benefit of sequential injection for faster onset without added risk.

5.Limitations of the Study

- The study was conducted at a single center, which may introduce institutional bias.

Only ASA I-II patients were included, so results may not apply to higher-risk populations (e.g., ASA III-IV, elderly with comorbidities).

- Long-term outcomes and late complications were not evaluated; only perioperative effects were considered.
- The study did not use advanced monitoring tools (e.g., cardiac output monitoring) include assessment based on fixed time intervals rather than continuous monitoring and absence of a pure single-agent control group.

6.Conclusion

Sequential injection of lignocaine followed by ropivacaine for supraclavicular brachial plexus block results in a quicker early onset of sensory and motor block compared with premixed administration. Despite these early differences, both methods provide similar overall block duration and safety profiles. Sequential injection may therefore be preferred when rapid onset is clinically advantageous.

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Nil.

Conflict of Interest

There are no conflicts of interest.

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