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Levobupivacaine versus ropivacaine in ultrasound-guided bilateral superficial cervical plexus block for analgesia after thyroidectomy: A randomized controlled trial

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Abstract

Background: Thyroidectomy causes moderate to severe pain in the first hours after surgery. Superficial cervical plexus block can reduce this pain. It is not clear which long-acting local anaesthetic gives the longest relief. We compared 0.25% levobupivacaine with 0.25% ropivacaine for this block. **Methods:** This was a prospective, double-blinded, randomized controlled trial at Chamarajanagar Institute of Medical Sciences from June 2024 to December 2025. We enrolled 40 adults of ASA I or II, aged 18 to 60 years, scheduled for elective total thyroidectomy under general anaesthesia. Patients were randomized to two groups of 20. Group L received 10 ml of 0.25% levobupivacaine on each side. Group R received 10 ml of 0.25% ropivacaine on each side. The block was given under ultrasound guidance. The primary outcome was the duration of analgesia, from block injection to the first VAS score of 4 or more. Secondary outcomes were VAS scores, rescue analgesic use and adverse events. The trial was registered with CTRI/2025/03/081905. Ethics approval number was CIMS/IEC-09/02/2025. **Results:** The groups were similar in age, weight, BMI and duration of surgery. All blocks were successful. The mean duration of analgesia was 504.0 ± 75.1 minutes with levobupivacaine and 375.0 ± 52.8 minutes with ropivacaine (mean difference 129 minutes, 95% CI 88 to 171, $p < 0.001$). VAS scores were lower with levobupivacaine from 30 minutes onward. Fewer patients in Group L needed rescue analgesia within 6 hours (3 of 20 versus 12 of 20, $p = 0.003$). No serious adverse events occurred. **Conclusion:** Levobupivacaine 0.25% gave longer analgesia and lower pain scores than ropivacaine 0.25% in superficial cervical plexus block for thyroidectomy. Both drugs were well tolerated.

Keywords: *Superficial cervical plexus block, Levobupivacaine, Ropivacaine, Thyroidectomy, Postoperative analgesia*

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1. Introduction

The thyroid gland controls metabolism, growth and development. Thyroid disease is common in India, and thyroidectomy is one of the most frequent endocrine operations (Assi, 2023; Kochupillai, 2000). The surgery is done under general anaesthesia. Pain after surgery comes from the skin, platysma, strap muscles and thyroid capsule. Poorly treated acute pain can affect the heart, lungs and metabolism, and it can delay recovery (Suh *et al.*, 2009; Mayhew *et al.*, 2018).

Superficial cervical plexus block is a simple regional technique for this operation. The plexus is formed by the ventral rami of C1 to C4. It becomes superficial at the posterior border of the sternocleidomastoid muscle. It supplies the skin of the anterolateral neck, the area around the ear and the skin over the clavicle (Jarvis *et al.*, 2023). Studies and meta-analyses show that the block lowers pain scores and analgesic use

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after thyroid surgery (Andrieu *et al.*, 2007; Woldegerima *et al.*, 2020). Ultrasound guidance lets the operator see the spread of the drug in the correct fascial plane. It improves success and reduces the risk of deep needle placement (Senapathi *et al.*, 2017; Singh, 2015).

Levobupivacaine is the S(−) enantiomer of bupivacaine. It has less cardiotoxicity than the racemic drug and similar potency (Bajwa and Kaur, 2013; Burlacu and Buggy, 2008). Ropivacaine is less lipophilic and tends to block sensory fibres more than motor fibres (Kuthiala and Chaudhary, 2011). Both drugs are widely used for peripheral nerve blocks. Few trials have compared them in superficial cervical plexus block for thyroidectomy. We therefore compared the duration of analgesia of 0.25% levobupivacaine and 0.25% ropivacaine in ultrasound-guided bilateral block.

Our primary objective was to compare the duration of postoperative analgesia. Secondary objectives were to compare pain scores, rescue analgesic needs and adverse effects. Hemodynamic outcomes are reported in a companion paper.

2. Methods

2.1. Design and setting

This was a prospective, double-blinded, randomized controlled trial with two parallel groups and a 1:1 allocation. It was done at Chamarajanagar Institute of Medical Sciences Hospital from June 2024 to December 2025. The study followed the Declaration of Helsinki and CONSORT guidance. The Institutional Ethics Committee approved the protocol (approval number CIMS/IEC-09/02/2025). The trial was registered with the Clinical Trials Registry of India (CTRI/2025/03/081905). All patients gave written informed consent.

2.2. Participants

We included adults aged 18 to 60 years, of either sex, with ASA physical status I or II, scheduled for elective total thyroidectomy under general anaesthesia. We excluded patients with allergy to the study drugs, BMI above 30 kg/m², local infection, cardiac, pulmonary, renal or endocrine disease, peripheral neuropathy, previous cervical surgery, coagulation disorders or anticoagulant use.

2.3. Sample size

We calculated the sample size for the primary outcome. We assumed a difference of 90 minutes in analgesia duration with a standard deviation of 75 minutes, a two-sided alpha of 0.05 and 80% power. This gave 11 patients per group. We enrolled 20 per group to allow for dropouts and to give more data on secondary outcomes.

2.4. Randomization and blinding

A computer-generated sequence allocated patients to Group L or Group R. Allocation was concealed in sealed opaque envelopes. An anaesthesiologist who was not part of the study prepared the drug syringes. Patients, surgeons, the anaesthesiologist who gave the block and the outcome assessors did not know the group.

2.5. Preparation and anaesthesia

All patients had a pre-anaesthetic check and received oral alprazolam 0.5 mg the night before surgery. They fasted for 6 hours. An 18G intravenous cannula was placed, baseline vitals were recorded and intravenous pantoprazole 40 mg was given. In the operating room, standard monitors were applied (ECG, non-invasive blood pressure, SpO_2, $EtCO_2$). Patients received glycopyrrolate 0.2 mg, midazolam 1 mg, ondansetron 4 mg and dexamethasone 8 mg intravenously.

2.6. Block technique

With the patient supine and the head turned to the opposite side, the neck was cleaned and draped. We used a portable Sonosite ultrasound machine with a 6 to 13 MHz linear probe. The probe was placed over the midpoint of the sternocleidomastoid muscle, near the level of the cricoid cartilage. It was moved back until the tapering posterior edge of the muscle was in the centre of the screen. The cervical plexus appears as

small hypoechoic nodes above the prevertebral fascia. A 25G needle was passed from lateral to medial under the posterior edge of the muscle, into the fascial plane above the levator scapulae. After negative aspiration, 10 ml of the study drug was injected. We saw the drug spread between the muscle and the prevertebral fascia. The block was done on both sides. A separate assistant checked sensory loss by pinprick at the incision site after 10 to 15 minutes.

2.7. General anaesthesia

Patients were preoxygenated with 100% oxygen for 3 minutes. Induction used propofol 2 mg/kg and fentanyl 2 mcg/kg. Preservative-free lignocaine 1.5 mg/kg was given 90 seconds before intubation. Succinylcholine 2 mg/kg was used for intubation, and tube position was confirmed with capnography. Anaesthesia was maintained with atracurium 0.1 mg/kg, nitrous oxide and oxygen (66:34) and isoflurane 0.5 to 1%. Neuromuscular block was reversed with neostigmine and glycopyrrolate before extubation.

2.8. Outcomes

The primary outcome was the duration of analgesia. This was the time from the local anaesthetic injection to the first VAS score of 4 or more. We measured pain on a 0 to 10 visual analogue scale (0 is no pain, 10 is worst pain). VAS was recorded every 10 minutes for the first 2 hours after surgery and then every 30 minutes until the score reached 4. At that point, rescue analgesia was given as 1 g of intravenous paracetamol. Secondary outcomes were VAS scores over time, number of patients needing rescue analgesia within 6 hours, time to first rescue dose, total paracetamol in 24 hours, and adverse events. Adverse events included nausea, vomiting, shivering, pruritus, local anaesthetic toxicity, phrenic nerve palsy, hematoma and hoarseness.

2.9. Statistical analysis

Data were analysed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous data are shown as mean $\pm$ SD. We compared them with the independent samples *t* test, or the Mann–Whitney U test if data were not normal. Categorical data are shown as number and percentage. We compared them with the chi-square test or Fisher's exact test. VAS scores at each time point were compared between groups. A *p* value below 0.05 was considered significant.

3. Results

Forty patients were enrolled and randomized, 20 in each group. All completed the study and were analysed (Figure 1). Baseline characteristics were similar (Table 1). All blocks were successful.

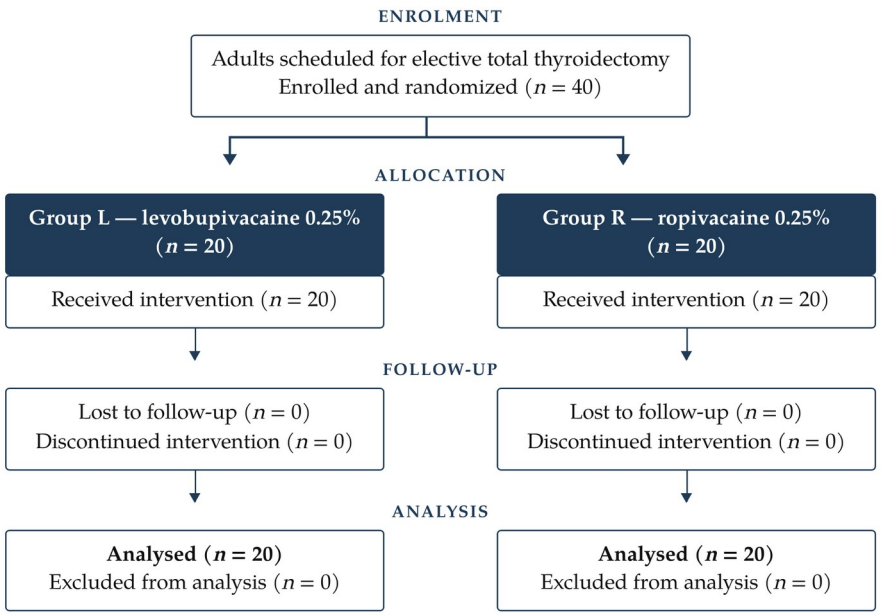


Figure 1: CONSORT flow diagram of participant progress through the trial

Table 1: Baseline characteristics

Variable	Group R (ropivacaine, n = 20)	Group L (levobupivacaine, n = 20)	*p* value
Age (years)	39.2 ± 11.65	40.75 ± 11.34	0.67
Weight (kg)	57.3 ± 7.4	59.7 ± 6.2	0.27
BMI (kg/m²)	22.6 ± 2.0	23.9 ± 2.8	0.115
Duration of surgery (min)	90.2 ± 18.0	86.0 ± 21.0	0.49
Sex, male/female	6/14	5/15	0.72
ASA I/II	12/8	13/7	0.74

3.1. Primary outcome

The mean duration of analgesia was 504.0 ± 75.1 minutes in Group L and 375.0 ± 52.8 minutes in Group R. The difference was 129 minutes (95% CI 88 to 171, $p < 0.001$) (Table 2).

Table 2: Duration of analgesia and rescue analgesia

Outcome	Group R	Group L	*p* value
Duration of analgesia (min)	375.0 ± 52.8	504.0 ± 75.1	< 0.001
Rescue needed within 6 hours, n (%)	12 (60%)	3 (15%)	0.003
Total paracetamol in 24 hours (g)	1.7 ± 0.4	1.3 ± 0.5	0.01

3.2. Pain scores

VAS scores were low and similar in the first 20 minutes. From 30 minutes, scores were lower in Group L at every time point up to 180 minutes ($p < 0.001$) (Table 3).

Table 3: VAS scores over time, mean ± SD			
Time (min)	**Group R**	**Group L**	***p* value**
10	1.00 ± 0.00	1.00 ± 0.00	–
20	1.17 ± 0.38	1.00 ± 0.00	0.089
30	1.61 ± 0.50	1.06 ± 0.24	0.00021
40	1.94 ± 0.25	1.06 ± 0.24	0.00001
50	2.06 ± 0.24	1.39 ± 0.50	0.00012
60	2.39 ± 0.50	1.56 ± 0.51	0.00019
70	2.61 ± 0.50	1.78 ± 0.43	0.00014
80	2.83 ± 0.38	1.94 ± 0.24	0.00007
90	2.94 ± 0.25	2.11 ± 0.43	0.00008
100	2.94 ± 0.25	2.22 ± 0.42	0.00006
120	3.11 ± 0.32	2.39 ± 0.50	0.00009
150	3.39 ± 0.50	2.39 ± 0.50	0.00004
180	3.56 ± 0.51	2.67 ± 0.49	0.00005
210	3.72 ± 0.46	2.78 ± 0.49	0.00003
240	3.89 ± 0.32	2.89 ± 0.32	0.00002

3.3. Adverse events

No patient had local anaesthetic toxicity, phrenic nerve palsy, hematoma, hoarseness or pneumothorax. Minor events were treated easily and were similar in both groups (Table 4).

Table 4: Adverse events, n (%)			
Event	**Group R**	**Group L**	***p* value**
Nausea	3 (15%)	2 (10%)	1.00
Vomiting	1 (5%)	0	1.00
Shivering	2 (10%)	2 (10%)	1.00
Pruritus	0	0	–
Serious events	0	0	–

4. Discussion

In this trial, 0.25% levobupivacaine gave a longer period of analgesia than 0.25% ropivacaine after ultrasound-guided bilateral superficial cervical plexus block. The difference was about 129 minutes, or a little over 2 hours. Pain scores were lower with levobupivacaine from 30 minutes onward, and fewer patients needed early rescue analgesia. Both drugs were safe.

Our result fits with earlier work. Levobupivacaine is more lipophilic and more protein bound than ropivacaine. These traits can prolong sensory block (Bajwa and Kaur, 2013; Kuthiala and Chaudhary, 2011; Leone *et al.*, 2008). Reviews of the two drugs in other blocks have reported similar findings (Burlacu and Buggy, 2008; Leone *et al.*, 2008). We did not find trials that compared them in superficial cervical plexus block for thyroid surgery, so our data add to this area. Earlier trials of this block used bupivacaine, ropivacaine alone, or additives such as dexmedetomidine, clonidine and dexamethasone. They showed longer analgesia and less opioid use than no block (Andrieu *et al.*, 2007; Woldegerima *et al.*, 2020;

Elmaddawy and Mazy, 2018; El-Deeb and Elbahrawy, 2018; Ozgun *et al.*, 2022). Our results show that the choice of drug also matters.

A difference of 2 hours is meaningful. Pain after thyroidectomy is highest in the first 6 to 8 hours. A block that covers most of this period may lower the need for rescue drugs. Ropivacaine still gave about 6 hours of relief, which is useful in practice. Its lower motor effect may help in other blocks. In a sensory block at the neck, this advantage is of less value.

Ultrasound guidance was used in all patients. All blocks were successful and no patient had serious complications. This supports earlier reports on the safety of the technique (Senapathi *et al.*, 2017; Singh, 2015; Balakrishnan *et al.*, 2023).

5. Limitations

This was a single-centre study with 40 patients. The block was done with one drug concentration and volume. We did not measure opioid use, patient satisfaction or chronic pain. Pain was recorded only until the first rescue dose. Larger multicentre trials with these outcomes are needed.

6. Conclusion

Ultrasound-guided bilateral superficial cervical plexus block with 0.25% levobupivacaine gave longer analgesia and lower early pain scores than 0.25% ropivacaine in patients having thyroidectomy. Both drugs were well tolerated. Levobupivacaine is a reasonable first choice when longer pain relief is wanted.

Declarations

Funding: None.

Conflicts of interest: None.

Ethics approval: Institutional Ethics Committee, Chamarajanagar Institute of Medical Sciences (approval number CIMS/IEC-09/02/2025).

Trial registration: Clinical Trials Registry of India, CTRI/2025/03/081905.

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