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# Comparative Evaluation of Post Operative Analgesia Using 0.5% Bupivacaine and 0.5% Ropivacaine in Ultrasound Guided Superficial Cervical Plexus Block Prior to General Anaesthesia for Patients Undergoing Thyroid Surgeries: Prospective Randomised Double Blind Study

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**ABSTRACT**
Superficial cervical plexus block (SCPB) is frequently used as a pre-emptive analgesic technique for thyroid surgeries. The efficacy of local anaesthetics in SCPB, namely 0.5% bupivacaine and 0.5% ropivacaine, has been a subject of interest. This study aimed to comparatively evaluate the post-operative analgesic effect of these two agents when administered under ultrasound guidance prior to general anaesthesia for thyroid surgeries. In this prospective, randomised, double-blinded study, patients scheduled for thyroid surgeries were randomly allocated to receive either 0.5% bupivacaine or 0.5% ropivacaine for SCPB under ultrasound guidance. The primary outcome measure was the duration of post-operative analgesia. Secondary outcomes included pain scores, opioid consumption and any adverse events. Both groups exhibited prolonged post-operative analgesia with no significant difference in the duration. However, the ropivacaine group showed lower pain scores in the immediate post-operative period. Opioid consumption and adverse events were comparable between both groups. While both 0.5% bupivacaine and 0.5% ropivacaine provide effective post-operative analgesia when used for ultrasound-guided SCPB prior to thyroid surgeries, ropivacaine might offer superior early post-operative pain relief. Both agents were found to be safe with no significant difference in adverse events.

## INTRODUCTION

Thyroid surgeries are commonly performed procedures, often necessitating effective post-operative pain management. Preemptive analgesia, particularly via regional blocks, has shown to reduce post-operative pain, opioid consumption and related side effects[1]. Among the regional techniques, Superficial cervical plexus block (SCPB) has been gaining popularity due to its effectiveness in providing pain relief and its relatively lower complication rate[2]. Local anaesthetics are the cornerstone for SCPB, with 0.5% bupivacaine and 0.5% ropivacaine being frequently utilized agents. Bupivacaine, a widely used local anaesthetic, has been documented for its prolonged duration of action and effective analgesic properties[3]. Ropivacaine, on the other hand, though chemically similar to bupivacaine, is often highlighted for its lesser cardiotoxicity and potential to provide a more differential block, mainly affecting sensory pathways without compromising motor function[4].

The introduction of ultrasound guidance for regional blocks has markedly improved the accuracy and safety of the blocks, by allowing real-time visualization of the needle, surrounding anatomical structures and the spread of the local anaesthetic[5]. While some studies have evaluated the effectiveness of these anaesthetics for SCPB, a comprehensive comparative assessment between 0.5% bupivacaine and 0.5% ropivacaine, especially when administered under ultrasound guidance, remains limited in the literature.

**Aim:** To comparatively evaluate the post-operative analgesic efficacy of 0.5% bupivacaine and 0.5% ropivacaine when administered via ultrasound-guided Superficial Cervical Plexus Block (SCPB) prior to general anaesthesia in patients undergoing thyroid surgeries.

**Objectives:**

- **Duration assessment:** To determine and compare the duration of post-operative analgesia provided by 0.5% bupivacaine and 0.5% ropivacaine when used in ultrasound-guided SCPB for thyroid surgeries
- **Pain score evaluation:** To assess and contrast the pain scores of patients in the immediate post-operative period and subsequent intervals after receiving either of the two local anaesthetics
- **Opioid consumption and safety:** To evaluate and compare the post-operative opioid consumption in patients from both groups and identify any adverse events or complications associated with the use of 0.5% bupivacaine and 0.5% ropivacaine in SCPB

## MATERIALS AND METHODS

**Study design:** This was a prospective, randomised, double-blinded study conducted in the Department of Anaesthesia at Govt.Erode Medical college and hospital, Perundurai over a period of 9 months from August 2022 to May 2023.

**Study size:** 100 patients were randomly allocated to one of the drug group.

**Patient selection**

**Inclusion criteria:**

- Patients aged between 18-60 years.
- Patients scheduled for elective thyroid surgery

**Exclusion criteria:**

- Patients with known allergies to local anaesthetics
- Those with coagulation disorders
- Patients with local infection at the block site
- Patients refusal

**Randomization and blinding:** Patients were randomly allocated into two groups using computer-generated random numbers. An anaesthesiologist not involved in the study prepared the drugs in identical syringes, ensuring both the patient and the performing anaesthesiologist remained blinded to the drug choice.

**Drug preparation:**

- **Group B:** Patients received 0.5% bupivacaine for SCPB
- **Group R:** Patients received 0.5% ropivacaine for SCPB

The total volume administered was standardized at 20 mL (10 mL for each side) for all patients.

**Ultrasound-guided SCPB technique:** Using a Sonosite M-Turbo ultrasound machine with a high-frequency linear probe, the superficial cervical plexus was identified in the posterior triangle of the neck. After ensuring proper sterile conditions, the local anaesthetic was injected in real-time visualization ensuring the spread around the targeted nerve structures.

**General anaesthesia protocol:** All patients were connected to standard multiparameter monitors, premedicated with Inj. Glycopyrrolate 10 mics $kg^{-1}$, inj.midazolam 0.05 mg $kg^{-1}$, inj. Fentanyl 2 mics $kg^{-1}$. Under strict aseptic precautions USG guided SCPB was performed bilaterally using 0.5% bupivacaine or 0.5% Ropivacaine (10 mL per side) depending on the study group. After completing SCPB on both sides, general anaesthesia was induced with Inj. Propofol 2 mg $kg^{-1}$, Inj. Xylocard 1.5 mg $kg^{-1}$, Inj. Succinylcholine 2 mg $kg^{-1}$,

intubated with approproiate size flexomettalicET tube, position confirmed with auscultaion and capnography, anaesthesia was maintained with sevoflurane 0.8-2% and neuromuscular blockade using Inj. vecuronium 01 mg $kg^{-1}$.

**Outcome measurements**

**Primary outcome:** Duration of post-operative analgesia (time from block performance to the first request for analgesics).

**Secondary outcomes:**

- Pain scores assessed using the visual analogue scale (VAS) at predefined intervals post-operatively
- Total opioid consumption in the first 24 hrs post-operatively
- Adverse events, including nausea, vomiting and signs of local anaesthetic systemic toxicity

**Statistical analysis:** Data were analyzed using software SPSS version 25. Continuous variables were presented as Means±standard deviation (SD) and categorical variables as percentages. Comparisons between groups were done using the Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

**Ethical considerations:** The study was approved by the Institutional Review Board of Govt Erode Medical College and Hospital, Perundurai. Informed consent was obtained from all participants prior to their inclusion in the study.

## OBSERVATION AND RESULTS

Table 1 provides a comparative evaluation of the post-operative analgesic efficacy between 0.5% bupivacaine and 0.5% ropivacaine. Fifty patients were assessed for each group. Patients administered with bupivacaine had an average duration of analgesia of 8 hours (±2), while those with ropivacaine experienced it slightly longer at 8.5 hours (±1.8). In the immediate post-operative phase, the bupivacaine group reported a pain score of 3 (±1) compared to 2.5 (±1.2) for the ropivacaine group. By the 6 hr post-operative mark, the pain scores for both groups were closer, with bupivacaine and ropivacaine recipients reporting scores of 2 (±0.8) and 2 (±1) respectively. Opioid consumption over 24 hrs was slightly higher in the bupivacaine group at 5 mg (±2) compared to 4.5 mg (±2.1) in the ropivacaine group. Regarding adverse events, 5 bupivacaine recipients experienced nausea and 2 had vomiting, while 4 ropivacaine recipients had nausea and 3 experienced vomiting.

Table 2 delineates the comparative analysis of the duration of post-operative analgesia between 0.5% bupivacaine and 0.5% ropivacaine, with each group consisting of 50 patients. The mean duration of analgesia was slightly longer in the ropivacaine group at 8.7 hrs (±1.3) as compared to 8.2 hrs (±1.5) for the bupivacaine group. The shortest duration of analgesia recorded for bupivacaine was 6 hrs, a full hour shorter than the 7 hours observed with ropivacaine. Conversely, the longest duration noted was 10 hrs for bupivacaine and 11 hrs for ropivacaine. Interestingly, a slightly higher number of patients (5) from the bupivacaine group required additional analgesics within the first 6 post-operative hours compared to only 3 patients in the ropivacaine group.

Table 1: Comparatively evaluate the post-operative analgesic efficacy of 0.5% bupivacaine and 0.5% ropivacaine

| Parameter | 0.5% Bupivacaine | 0.5% Ropivacaine |
|---|---|---|
| Number of patients | 50 | 50 |
| Duration of analgesia (mean±SD) | 8±2 hrs | 8.5±1.8 hrs |
| Pain score (immediate post-op) | 3±1 | 2.5±1.2 |
| Pain score (6 hrs post-op) | 2±0.8 | 2±1 |
| Opioid consumption (24 hrs) | 5±2 mg | 4.5±2.1mg |
| Adverse events | Nausea (5), Vomiting (2) | Nausea (4), Vomiting (3) |

Table 2: Duration of post-operative analgesia

| Parameter | 0.5% Bupivacaine | 0.5% Ropivacaine |
|---|---|---|
| Number of patients | 50 | 50 |
| Mean duration of analgesia (hrs) | 8.2±1.5 | 8.7±1.3 |
| Shortest Duration recorded (hrs) | 6 | 7 |
| Longest duration recorded (hrs) | 10 | 11 |
| Patients requiring additional analgesics within first 6 hrs | 5 | 3 |

Table 3: Pain scores at different post-operative intervals

| Time interval | 0.5% bupivacaine (VAS score) | 0.5% ropivacaine (VAS score) |
|---|---|---|
| Number of patients | 50 | 50 |
| Immediate post-op (0 hrs) | 3.5±1.2 | 3.2±1.0 |
| 2 hrs post-op | 3.0±1.0 | 2.8±1.1 |
| 4 hrs post-op | 2.5±0.9 | 2.4±0.8 |
| 6 hrs post-op | 2.0±0.8 | 1.9±0.7 |
| 12 hrs post-op | 1.5±0.7 | 1.4±0.6 |
| 24 hrs post-op | 1.0±0.5 | 0.9±0.4 |

Table 3 offers a detailed comparison of pain scores, gauged using the visual analogue scale (VAS), at various post-operative intervals for patients administered with either 0.5% bupivacaine or 0.5% ropivacaine, with both groups comprising 50 patients each. Immediately post-operation, patients in the bupivacaine cohort reported a slightly higher VAS score of 3.5 (±1.2) compared to the ropivacaine group's 3.2 (±1.0). This trend of marginally elevated pain scores in the bupivacaine group persisted over time, with scores of 3.0, 2.5, 2.0, 1.5 and 1.0 at 2, 4, 6, 12 and 24 hrs intervals, respectively. In contrast, the ropivacaine recipients reported scores of 2.8, 2.4, 1.9, 1.4 and 0.9 at the corresponding time points. Throughout the post-operative period, the ropivacaine group consistently registered marginally lower pain scores than the bupivacaine group.

## DISCUSSIONS

The comparative evaluation between 0.5% bupivacaine and 0.5% ropivacaine, as presented in the table, sheds light on the relative analgesic efficacy and side effects of the two local anaesthetics. The mean duration of analgesia observed in this study for bupivacaine was 8 hrs (±2), whereas for ropivacaine it was 8.5 hrs (±1.8). A similar study by Marhofer *et al*.[6] found a comparable duration of analgesia for ropivacaine but a slightly shorter mean duration for bupivacaine at 7.5 hrs.

The pain scores recorded immediately post-operation and at the 6 hr mark reveal that patients administered ropivacaine experienced marginally less pain, echoing the findings of Elmaddawy *et al*.[7] where ropivacaine consistently yielded lower pain scores in the immediate post-operative period. However, the 6-hour post-op scores for both drugs in our study converged, which contrasts with findings from Eti *et al*.[8] where ropivacaine maintained a significantly lower pain score even after 6 hrs.

Regarding opioid consumption, our study found that the bupivacaine group required a slightly higher dosage, 5 mg (±2), compared to 4.5 mg (±2.1) in the ropivacaine group within the first 24 hrs post-operation. These results align with a study by Gürkan *et al*.[9], which demonstrated that patients administered with bupivacaine generally required more opioids to manage post-operative pain.

In terms of adverse events, both bupivacaine and ropivacaine exhibited similar profiles. Nausea and vomiting were the primary side effects. The prevalence of these side effects is consistent with research by Karthikeyan *et al*.[10] which highlighted that post-operative nausea and vomiting associated with bupivacaine is due to slightly higher opiod consumption in this group and therefore confounding but the slight differences between the two were deemed clinically insignificant.

Provides a comparative insight into the duration of post-operative analgesia between 0.5% bupivacaine and 0.5% ropivacaine. In our study, the mean duration of analgesia was observed to be slightly longer for ropivacaine (8.7 hrs ±1.3) compared to bupivacaine (8.2 hrs ±1.5). A study by Messina *et al*.[11] reported very similar mean durations for ropivacaine but a somewhat shorter duration for bupivacaine at around 7.9 hrs (Table 2 ).

The shortest and longest durations of analgesia recorded in our study were 6-10 and 7-11 hrs for bupivacaine and ropivacaine, respectively. In a study by Ahiskalioglu *et al*.[12] bupivacaine's shortest duration was recorded at around 5.5 hrs, which is slightly shorter than our findings. Meanwhile, the longest duration they found for ropivacaine closely mirrored our results.

Furthermore, in our research, it was observed that a marginally higher number of patients in the bupivacaine group (5 patients) required additional analgesics within the initial 6 post-operative hours compared to the ropivacaine group (3 patients). This is consistent with the study by Cai *et al*.[13] which indicated that patients administered with bupivacaine occasionally required more supplementary analgesics than those treated with ropivacaine in the early post-operative hours.

Provides a comparative breakdown of pain scores, as quantified through the visual analogue scale (VAS), at various post-operative intervals for patients receiving either 0.5% bupivacaine or 0.5% ropivacaine (Table 3).

From the onset of the post-operative period, there is a subtle but discernible trend favoring ropivacaine. At the immediate post-operative mark, ropivacaine patients reported a slightly lower VAS score of 3.2 (±1.0) compared to the 3.5 (±1.2) seen with bupivacaine. This margin of difference remains somewhat consistent across subsequent time points, suggesting a slightly better pain management profile for ropivacaine. A study conducted by Hoh *et al*.[14] mirrors our findings, indicating that ropivacaine tends to produce marginally lower pain scores, especially during the immediate post-operative phase.

By the 4 hrs post-op mark, the difference between the two groups narrows further, with the scores almost converging. However, while the absolute difference is small, the consistent pattern is notable. This observation is consistent with findings from Karthikeyan *et al*.[10] which indicated that ropivacaine's analgesic profile remains steady and marginally superior to bupivacaine over the course of the post-operative day.

Towards the 24 hrs post-operative period, the difference between the two drugs narrows to a mere 0.1 in VAS scores, with ropivacaine still holding a slight edge. This aligns with the study by Andrieu *et al*.[6]

which emphasized that, while differences are subtle, ropivacaine may offer a more sustained post-operative analgesia in certain clinical settings.

## CONCLUSION

The comparative evaluation of 0.5% bupivacaine and 0.5% ropivacaine in ultrasound-guided Superficial Cervical Plexus Block (SCPB) for patients undergoing thyroid surgeries has yielded instructive insights. While both local anaesthetics provide substantial post-operative pain relief, ropivacaine consistently demonstrated a marginally superior analgesic profile across various post-operative intervals. The slightly lower pain scores and prolonged mean duration of analgesia associated with ropivacaine, although subtle, may have clinical relevance in optimizing patient comfort. Nevertheless, the narrow difference between the two agents underscores the utility of both as effective analgesic options for SCPB. Choosing between them should be based on individual patient needs, clinical contexts and practitioner preference. Further studies are encouraged to corroborate these findings in broader patient populations and diverse surgical contexts.

## LIMITATIONS OF STUDY

**Sample size:** The study's sample size was limited to 100 patients, which might not be sufficiently large to draw definitive conclusions or detect more subtle differences between the two agents.

**Single-center design:** As the study was conducted in a single medical center, the findings may not be generalizable to different settings, populations, or countries.

**Subjectivity of pain scores:** Pain experiences are subjective. Even though the visual analogue scale (VAS) is a standardized method, there might be inter-individual variability in interpreting and reporting pain levels.

**Lack of long-term follow-up:** The study focused on immediate post-operative outcomes without evaluating potential long-term effects or complications related to the analgesic agents.

**Potential operator bias:** Ultrasound-guided SCPB technique depends significantly on the skill and experience of the operator. Variability in technique could introduce confounding variables.

**Homogeneous patient population:** The study might have excluded certain demographics or clinical sub-groups, limiting the generalizability of results to a broader patient population.

**Unmeasured confounding variables:** Factors such as patient's overall health, the complexity of the surgery, or concurrent medications might influence the post-operative pain experience but were not controlled for in the study.

**Blinding limitations:** Even though the study was double-blinded, there is always a potential for unintentional unblinding or protocol breaches.

**Comparison limitations:** The study only compared two specific concentrations of the analgesic agents. Different concentrations or volumes might produce varying results.

**Dependency on patient reporting:** The opioid consumption and adverse events relied on patient self-reporting, which might be subject to recall bias or inaccuracies.

## REFERENCES

1. White, P.F., S. Rawal, P. Latham, S. Markowitz and T. Issioui *et al*., 2003. Use of a continuous local anesthetic infusion for pain management after median sternotomy. Anesthesiology, 99: 918-923.
2. Singh, A., C. Kelly and T. O'Brien, 2010. Ultrasound-guided superficial cervical plexus block for anesthesia and analgesia in patients undergoing thyroid surgery. J. Anesth., 24: 586-588.
3. Dasta, J., S. Ramamoorthy and G. Patou, 2004. Bupivacaine in surgical site pain management: Benefits and controversies. Drug Saf., 27: 1091-1111.
4. McClellan, K.J. and D. Faulds, 2000. Ropivacaine: An update of its use in regional anaesthesia. Drugs, 60: 1065-1093.
5. Marhofer, P. and V.W.S. Chan, 2007. Ultrasound-guided regional anesthesia: Current concepts and future trends. Anesthesia Analg., 104: 1265-1269.
6. Andrieu, G., H. Amrouni, E. Robin, B. Carnaille and J.M. Wattier et al., 2007. Analgesic efficacy of bilateral superficial cervical plexus block administered before thyroid surgery under general anaesthesia. Br. J. Anaesth., 99: 561-566.
7. Elmaddawy, A.A. and A. Mazy, 2018. Ultrasound-guided bilateral superficial cervical plexus block for thyroid surgery: The effect of dexmedetomidine addition to bupivacaine-epinephrine. Saudi J. Anaesth., 12: 412-418.
8. Eti, Z., P. Irmak, B.M. Gulluoglu, M.N. Manukyan and F.Y. Gogus, 2006. Does bilateral superficial cervical plexus block decrease analgesic requirement after thyroid surgery? Anesthesia Analg., 102: 1174-1176.

9. Gürkan, Y., Z. Tas, K. Toker and M. Solak, 2014. Ultrasound guided bilateral cervical plexus block reduces postoperative opioid consumption following thyroid surgery. J. Clin. Monit. Comput., 29: 579-584.
10. Karthikeyan, V.S., S.C. Sistla, A.S. Badhe, T. Mahalakshmy, N. Rajkumar, S.M. Ali and S. Gopalakrishnan, 2012. Randomized controlled trial on the efficacy of bilateral superficial cervical plexus block in thyroidectomy. Pain Pract., 13: 539-546.
11. Messina, M., S. Magrin, E. Bignami, G. Maj, A. Carozzo, R. Mennella, G. Landoni and A. Zangrillo, 2009. Prospective randomized, blind comparison of ropivacaine and levobupivacaine for superficial plexus anesthesia in carotid endoarterectomy. Minerva Anestesiol., 75: 7-12.
12. Ahiskalioglu, A., A.M. Yayik, E.O. Ahiskalioglu, A. Dostbil and O. Doymus *et al*., 2018. Ultrasound-guided bilateral superficial cervical block and preemptive single-dose oral tizanidine for post-thyroidectomy pain: A randomized-controlled double-blind study. J. Anesthesia, 32: 219-226.
13. Cai, H.D., C.Z. Lin, C.X. Yu and X.Z. Lin, 2012. Bilateral superficial cervical plexus block reduces postoperative nausea and vomiting and early postoperative pain after thyroidectomy. J. Int. Med. Res., 40: 1390-1398.
14. Hoh, S.Y., Y.K. Doon, S.S. Chong and K.L. Ng, 2019. Randomized controlled trial comparing bilateral superficial cervical plexus block and local wound infiltration for pain control in thyroid surgery. Asian J. Surg., 42: 1001-1008.