Section: Anesthesiology

Original Research Article

# COMPARATIVE STUDY OF ROPIVACAINE 0.5% AND BOPIVACAINE 0.5% WITH DEXMEDETOMIDINE 50 µg IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB ORTHOPEDIC SURGERIES

***GGN Sudharani[1], Bandaru Venugopalan[2], Shaik Vahida[3], A Sailohitha[4]***

*[1]Associate Professor, Department of Anesthesiology, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India.*
*[2]Associate Professor, Department of Anesthesiology, Government Medical College, Markapuram, Andhra Pradesh, India.*
*[3]Associate Professor, Department of Anesthesiology, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India.*
*[4]Senior Resident, Department of Anesthesiology, Government Medical College, Kadapa, Andhra Pradesh, India.*

***Received*** *: 09/04/2025*
***Received in revised form*** *: 23/05/2025*
***Accepted*** *: 17/06/2025*

**Corresponding Author:**
**Dr. A Sailohitha,**
Senior Resident, Department of Anesthesiology, Government Medical College, Kadapa, Andhra Pradesh, India.
Email: lohithasai2896@gmail.com

**DOI:** 10.70034/ijmedph.2025.3.97

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2025; 15 (3); 527-535

## ABSTRACT

**Background:** The aim is to compare the efficacy of plain ropivacaine and ropivacaine with dexmedetomidine in ultrasound guidance supraclavicular brachial plexus block scheduled for the upper limb orthopedic surgeries.

**Materials and Methods:** It was a Double-blinded randomized controlled study carried out at Tertiary care teaching hospital. During the period from 18 months (DECEMBER 2022 TO JULY 2024). A minimum sample size of 66 was thus required to obtain valid results for the objectives of this study. To improve the validity of the study, we thus rounded off to a sample size of 70, i.e., 35 subjects per group.

**Results:** The patients in group R received 29 ml 0f 0.5% Ropivacaine + 1 ml saline, and those in group RD received 9 ml of 0.5% Ropivacaine + 50 mcg (0.5 ml) of Dexmedetomidine with 0.5 ml saline. The mean age in group R was 35.63 + 6.0 years and the mean age in group RD was 35.57 + 5.94 years. The two groups were thus comparable as there was no statistically significant difference between the two study groups (p=0.986). Majority of the study subjects belonged to ASA category I (41, 58.57%) followed by ASA category II (29, 41.4%). In the present study, similar distribution was seen within the study groups, with no statistically significant difference (Chi2 p-value=0.224). The mean baseline heart rate of the study subjects was 81.21 + 7.51 beats/minute, mean baseline systolic blood pressure was 122.66 + 9.52 mm Hg, and mean baseline diastolic blood pressure was 78.69 + 7.56 mm Hg. The mean duration of motor block was found to be 478.76 + 2.04 minutes in group R, whereas it was 669.84 + 2.45 minutes in group RD. This difference was found to be statistically significant (p<0.001). The mean VAS scores at 6 hours, 10 hours, 14 hours and 24 hours postoperative periods were measured and compared. The subjects in group R were found to have higher mean VAS scores at any point of time, as compared to the subjects in group RD. The differences in mean VAS scores were found to be statistically significant.

**Conclusion:** Dexmedetomidine when given as an adjuvant with ropivacaine as supraclavicular block; significantly shortens the time taken for onset of sensory and motor block. Prolongs the duration of sensory and motor block significantly enhances analgesia. The present study does not cause any significant complications.

**Keywords:** Dexmedetomidine, Ropivacaine, supraclavicular block, Upper limb, Ultra sound guidance, VAS Score.

# INTRODUCTION

In modern surgery, minimizing patient discomfort while achieving safe and effective pain control is paramount. The expanding landscape of minimally invasive surgery (MIS) and the subsequent surge in outpatient procedures necessitate a parallel evolution in analgesic techniques.[1,2] Peripheral nerve blocks (PNBs) have emerged as a frontrunner, surpassing conventional methods like oral medications or general anesthesia in several aspects.[3] PNBs have eventually become a game-changer, offering anesthesiologists a powerful tool for targeted pain relief.

The peripheral nerve block technique provides an alternative to general anesthesia, potentially leading to a smoother surgical experience and faster recovery for patients. The scope and spectrum of peripheral nerve blocks is vast, targeting specific nerves or nerve bundles in various parts of the body, some of the most famous being brachial plexus block, sciatic block, trigeminal block, etc.[3,4]

The main approaches for brachial plexus blocks include the interscalene, supraclavicular, infraclavicular, and axillary blocks.[5,6] The interscalene block is performed in the neck, between the scalene muscles. This approach provides the most complete postoperative analgesia for procedures on the shoulder and upper arm.[5] The supraclavicular block is performed immediately above the clavicle and anesthetizes the entire upper extremity below the shoulder.[6] The infraclavicular block is performed below the clavicle and anesthetizes the lower arm and hand. The axillary block is performed in the axilla and also anesthetizes the lower arm and hand.

The use of ultrasound in PNBs began in the mid-20th century with Doppler technology. This early application focused on detecting blood flow during specific nerve blocks to aid in needle placement.[7] However, it wasn't until advancements in ultrasound technology in the late 20th century that visualization of the nerves themselves became possible. Ultrasound guidance has improved the success and safety of the brachial plexus block techniques by allowing the anesthesiologist to visualize the relevant anatomy and precisely target the nerves. The choice of approach depends on the specific surgical procedure, patient anatomy, and the experience of the anesthesiologist.[7]

This shift towards direct nerve visualization with ultrasound marked a turning point in PNBs. Ultrasound visualization of the anatomical structures facilitate safe methods of regional blocks, improving the accuracy and enabling to secure optimal needle positioning and aiding in monitoring the distribution of local anaesthetic in real time.[8] The amount of local anaesthetic required can be minimized by directly monitoring its distribution. Today, ultrasound guidance has become the gold standard for most PNBs as it offers substantial advantages over traditional methods.[8] Ultrasound guidance allows for higher success rates, reduces the risk of complications, and enables the targeting of specific nerve branches for a more customized pain management approach.[9]

Unlike general anesthesia, PNBs achieve targeted analgesia by reversibly inhibiting nerve conduction through the use of local anesthetic medications which bind to sodium channels on nerve cell membranes, hindering the influx of sodium ions necessary for action potential generation and subsequent pain signal propagation. Amide-derived local anesthetics, such as lidocaine, bupivacaine, ropivacaine and levobupivacaine, are the primary medications employed in PNBs. The selection of a specific agent hinges on the desired duration of action. Lidocaine offers rapid onset but has a shorter duration, making it suitable for brief procedures, whereas bupivacaine provides prolonged anesthesia but has a slower onset time . On the other hand, ropivacaine provides longer duration of anesthesia as compared to lidocaine and has a better safety profile due to lower toxicity as compared to bupivacaine. This selection process is tailored to the specific surgical requirements and the targeted duration of postoperative analgesia.[9,10]

The goal is to achieve optimal pain control while minimizing potential side effects. Anesthesiologists carefully consider various factors, including the patient's medical history, the type of surgery, and the specific PNB technique being employed. This individualized approach ensures a safe and effective pain management strategy for patients undergoing surgical procedures. One of the most common local anesthetics considered in the present day surgical anesthesia is Dexmedetomidine.

DEX can be particularly beneficial for patients experiencing preoperative anxiety or those recovering in intensive care units (ICUs) where a calmer state is desirable. Literature has suggested further investigation to fully understand its long-term effects and optimal use in diverse clinical scenarios as DEX presents itself as a promising candidate for the future of pain management and sedation strategies.[10]

The present study was thus aimed at assessing and comparing the efficacy of using ropivacaine alone and in combination with dexmedetomidine in ultrasound guided supraclavicular blockage.

**Aim and Objectives**

**Aim:**

To compare the efficacy of plain ropivacaine and ropivacaine with dexmedetomidine in ultrasound guidance supraclavicular brachial plexus block scheduled for the upper limb orthopedic surgeries.

**Objectives:**

**To evaluate and compare:**

1. The time of onset of sensory and motor block.
2. The duration of Sensory and Motor block.
3. The duration of analgesia.

## MATERIALS AND METHODS

**Study Subjects:** Patients undergoing mid-humerus, elbow, forearm and hand surgeries under ultrasound guided supraclavicular block regional anaesthesia.
**Study Design:** Double-blinded randomized controlled study
**Study Period:** 18 months (December 2022 to July 2024)
**Study Setting:** Tertiary care teaching hospital.
**Inclusion Criteria**

- Patients under ASA I and II, aged 20-60 years
- Patients undergoing mid-humerus, elbow, forearm and hand surgeries
- Patients who give written informed consent

**Exclusion Criteria**

- Patients with history of bleeding disorders / coagulopathy.
- Patients with local infection at the site of block / sepsis / pneumothorax.
- Patients with documented neurological, psychiatric or neuromuscular disorders.
- Patients with severe cardiovascular, respiratory, renal or liver disease.
- Patients with known allergy to local anaesthetic drugs.
- Patients on medications that interact with / influence blood coagulation

**Sample Size:** Required sample size for this study was estimated using the formula for calculating sample size for comparing means, taking the findings of mean time for onset of block (sensory) from the study conducted by J.Chinnappa and S. Shivakumar et al (2017). OpenEpi sample size calculator was used for this.
A minimum sample size of 66 was thus required to obtain valid results for the objectives of this study. To improve the validity of the study, we thus rounded off to a sample size of 70, i.e., 35 subjects per group.
**Ethical Considerations:** The present study was performed after obtaining prior clearance from the Institutional Ethical Committee (IEC). Written informed consent was obtained from every participant after clearly describing the purpose, procedure, benefits and potential risks of the study in plain comprehensible language.
**Study Procedure:**
**Procedure:** After taking institutional ethical committee approval, written and informed consent was obtained and patients were randomly divided in to two groups each consisting of thirty-five patients.
**Group-R:** 35 patients received 29 ml 0f 0.5% Ropivacaine + 1 ml saline.
**Group-RD:** 35 patients received 9 ml of 0.5% Ropivacaine + 50 mcg (0.5 ml) of dexmedetomidine with 0.5 ml saline.
**Pre-operative Investigations:**

- Hematological indices (Hb%, platelet count, bleeding time, clotting time)
- Blood grouping and Rh typing
- Blood Urea, Serum creatinine
- Urine routine examination
- Blood sugar (FBS and PPBS)
- Electrocardiography
- Chest X-Ray
- 2D-Echocardiography

**Study Variables:**

1. ASA Classification: ASA in anesthesia refers to the American Society of Anesthesiologists (ASA) Physical Status Classification System. It's a scoring system used by anesthesiologists to assess a patient's health before surgery and estimate their risk of complications during surgery. The ASA score is assigned based on a patient's overall health and any underlying medical conditions they may have. The scoring system ranges from 1 to 5, with 1 being the healthiest and 5 being the most critical condition.

**Table 1: ASA Classification of patients based on their physical status**

| ASA Classification |
|---|
| ASA 1: A healthy patient with no systemic diseases. |
| ASA 2: A patient with mild systemic disease. |
| ASA 3: A patient with severe systemic disease. |
| ASA 4: A patient with a severe systemic disease that is a constant threat to life. |
| ASA 5: A moribund patient who is not expected to survive without the operation. |

The ASA classification system is just one of many factors that anesthesiologists consider when developing an anesthesia plan for a patient. Other factors include the type of surgery, the patient's age, and their weight. By considering all of these factors, anesthesiologists can create a safe and effective plan for anesthesia for each individual patient.

2. Onset of analgesia: This was recorded as the interval between the time of injection and the development of loss of sensation to pin prick. The dermatome areas corresponding to the median nerve, radial nerve, ulnar nerve and musculo cutaneous nerves were checked at every minute till there was complete loss of sensation.

**Table 2: Grading of sensory block**

| | |
|---|---|
| Grade 0 | Feeling of Sharp, pin prick sensation. |
| Grade 1 | Analgesia (feeling of dull sensation). |
| Grade 2 | Anesthesia (feeling of no pain at all) |

3. Quality of analgesia: The onset and completion of analgesia was tested by loss of sensation to pin prick. The effect of analgesia after injection was graded as:

**Table 3: Grading of quality of analgesia**

| | |
|---|---|
| Grade I | Good analgesia, sedatives were given only to relieve apprehension. |
| Grade II | Inadequate, incomplete or patchy analgesia, supplementation given with N2O/O2, fentanyl, midazolam or ketamine. |
| Grade III | Very poor analgesia. General anesthesia required t be administered. |

The conclusion of Grade 11 was arrived when any one of the segments supplied by four major nerves (radial, ulnar, median and musculocutaneous nerves) did not have loss of sensation even after 30 minutes of the block.. They were supplemented with mask ventilation with nitrous oxide, IV ketamine 0.5 mg/kg / fentanyl (1µg/ kg) and midazolam (0.02 mg/kg). When there was no loss of sensation in more than one nerve segment then it was considered a failed block. In such case, general anesthesia was provided. Sedation component was recorded by the Ramsay Sedation Score.

4. Degree of motor blockade: The duration of motor block was called as the time interval between the end of giving the drug and the recovery of complete motor function of the elbow, wrist and finger movements.

**Table 4: Modified Bromage scale for motor block of upper extremities (3-point scale)**

| | |
|---|---|
| Grade I | Complete block, no active movement of entire elbow, forearm and hand. |
| Grade II | Almost complete block, slight active movement of the fingers retained. |
| Grade III | No block, nearly full range of movement retained. |

5. Duration of analgesia: Duration of analgesia was recorded with the help of Visual Analog Scale (VAS) which ranges from 0 to 10. This scale was noted per every 60 minutes post-operatively till it comes to 5. Then the rescue analgesia was provided. The drug used was injection diclofenac sodium (1.5 mg/kg) intramuscularly. The time of administration was recorded. The duration of sensory block was called as the time interval between the end of drug injection and the complete resolution of pin prick sensation on all nerve segments.
6. Complications: All patients were monitored for complications (if any) during the intra-operative period and up to 48 hours post-operatively. The observations and particulars of each patient were recorded in the proforma enclosed.

**Study Procedure:**

- 18G intravenous access was secured after obtaining written informed consent
- Patient was connected to multi parameter monitor and baseline vitals were recorded
- Preloading was done with 10ml/kg crystalloid 15 minutes prior to start of procedure.
- The patient was positioned supine with arm placed by the side and the head turned 45° to the contralateral side to be blocked.
- Under sterile aseptic precautions, in the coronal oblique plane the probe was kept in the supraclavicular fossa.
- The pulsating hypo echoic subclavian artery was identified. While maintaining the view of the artery, the probe was angled until both first rib and the pleura could be seen simultaneously to visualize these two structures.
- NIBP, ECG NIBP, ECG, HR and SpO2 were recorded every 2 minutes for first 10 minutes, every 10 minutes for next 50 min and every 15 minutes till end of surgery.

**Statistical Methods**

The data from each enrolled subject was entered, cleaned and coded using Microsoft Excel 2010. Data was checked for normality before performing statistical analysis. Descriptive and inferential statistical analysis was done using IBM SPSS version 27.

## RESULTS

The present study enrolled 70 patients undergoing mid-humerus, elbow, forearm and hand surgeries under ultrasound guided supraclavicular block regional anaesthesia. The patients were randomly allocated to either of two equal groups of 35 patients each. The patients in group R received 29 ml 0f 0.5% Ropivacaine + 1 ml saline, and those in group RD received 9 ml of 0.5% Ropivacaine + 50 mcg (0.5 ml) of Dexmedetomidine with 0.5 ml saline.The mean age in group R was 35.63 + 6.0 years and the mean age in group RD was 35.57 + 5.94 years. The two groups were thus comparable as there was no statistically significant difference between the two study groups (p=0.986).

**Table 5: Comparison of mean age among the study groups**

| Group | n | Mean (years) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 35.63 | 6.00 | 0.986 |
| Group RD | 35 | 35.57 | 5.94 | |
| Total | 70 | 35.60 | 5.92 | |

Majority of the study subjects belonged to ASA category I (41, 58.57%) followed by ASA category II (29, 41.4%). Similar distribution was seen within the study groups, with no statistically significant difference (Chi2 p-value=0.224).

**Table 6: Distribution of subjects based on ASA categories among the study groups**

| Groups | | Group R | Group RD | Total | Chi2 test (p-value) |
|---|---|---|---|---|---|
| ASA-I | n | 23 | 18 | 41 | 0.224 |
| | % | 65.72% | 51.43% | 58.57% | |
| ASA-II | n | 12 | 17 | 29 | |
| | % | 34.28% | 48.57% | 41.43% | |
| Total | n | 35 | 35 | 70 | |

**Baseline vital parameters:** The mean baseline heart rate of the study subjects was 81.21 + 7.51 beats/minute, mean baseline systolic blood pressure was 122.66 + 9.52 mm Hg, and mean baseline diastolic blood pressure was 78.69 + 7.56 mm Hg.

**Table 7: Mean baseline vitals among the study subjects**

| Baseline vitals | Mean ± SD | 95% Confidence interval |
|---|---|---|
| HR-Baseline | 81.21 ± 7.51 | 79.42 - 83.01 |
| SBP-Baseline | 122.66 ± 9.52 | 120.39 - 124.93 |
| DBP-Baseline | 78.69 ± 7.56 | 76.88 - 80.49 |

The mean baseline heart rate was 82.74 ± 8.18 beats / minute in group R and 79.69 ±6.55 beats / minute in group RD. The mean baseline systolic blood pressure was122.31 ± 9.95 mm Hg in group R and 123 ± 9.19 mm Hg in group RD. The mean baseline diastolic blood pressure was 77.83 ± 6.85 mm Hg in group R and 80.46 ± 7.16 mm Hg in group RD. These were no statistically significant differences between any of the baseline vitals of the two study groups.

**Table 8: Comparison of mean baseline vitals among the study groups**

| Baseline vitals | Group | Mean ± SD | 95% Confidence interval | t-test (p-values) |
|---|---|---|---|---|
| HR-Baseline | Group R | 82.74 ± 8.18 | 79.93 - 85.55 | 0.08 |
| | Group RD | 79.69 ± 6.55 | 77.44 - 81.94 | |
| SBP-Baseline | Group R | 122.31 ± 9.95 | 118.89 - 125.74 | 0.766 |
| | Group RD | 123 ± 9.19 | 119.84 - 126.16 | |
| DBP-Baseline | Group R | 77.83 ± 6.85 | 75.47 - 80.18 | 0.121 |
| | Group RD | 80.46 ± 7.16 | 77.99 - 82.92 | |

Duration of surgery was 161.78 + 2.15 minutes in the study subjects. It was similar to this i.e., 161.79 + 2.21 minutes in group R and 161.78 + 2.12 minutes in group RD, andalso comparable between the two study groups (t-test p-value is 0.981).

**Table 9: Comparison of mean duration of surgery among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 161.79 | 2.21 | 0.981 |
| Group RD | 35 | 161.78 | 2.12 | |
| Total | 70 | 161.78 | 2.15 | |

**Anesthetic parameters:**

**Onset of Sensory Block:** The mean time taken for sensory block was found to be 9.21 + 0.11 minutes in group R, whereas it was 6.80 + 0.11 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Table 10: Comparison of mean time taken for onset of sensory block among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 9.21 | 0.11 | <0.001 |
| Group RD | 35 | 6.8 | 0.11 | |

**Onset of Motor Block:** The mean time taken for onset of motor block was found to be 13.11 + 0.11 minutes ingroup R, whereas it was 8.99 + 0.10 minutes in group RD. This difference was found tobe statistically significant (p<0.001).

**Table 11: Comparison of mean time taken for onset of motor block among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 13.11 | 0.11 | <0.001 |
| Group RD | 35 | 8.99 | 0.10 | |

**Duration of Sensory Block:** The mean duration of sensory block was found to be 506.37 + 2.48 minutes in group R, whereas it was 709.44 + 4.32 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Table 12: Comparison of mean duration of sensory block among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 506.37 | 2.48 | <0.001 |
| Group RD | 35 | 709.44 | 4.32 | |

**Duration of Motor Block:** The mean duration of motor block was found to be 478.76 + 2.04 minutes in group R, whereas it was 669.84 + 2.45 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Table 13: Comparison of mean duration of motor block among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 478.76 | 2.04 | <0.001 |
| Group RD | 35 | 669.84 | 2.45 | |

**Duration of Analgesia:** The mean duration of analgesia was found to be 567.85 + 1.68 minutes in group R, whereas it was 831.74 + 4.57 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Table 14: Comparison of mean duration of analgesia among the study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 567.85 | 1.68 | <0.001 |
| Group RD | 35 | 831.74 | 4.57 | |

**Rescue Analgesia:** The mean time taken before giving rescue analgesia was found to be 587.86 + 1.56minutes in group R, whereas it was 849.94 + 4.36 minutes in group RD. This differencewas found to be statistically significant (p<0.001).

**Table 15: Comparison of mean time taken before rescue analgesia among study groups**

| Group | n | Mean (min) | SD | t-test (p-value) |
|---|---|---|---|---|
| Group R | 35 | 587.86 | 1.56 | <0.001 |
| Group RD | 35 | 849.94 | 4.36 | |

**VAS Scores:** The mean VAS scores at 6 hours, 10 hours, 14 hours and 24 hours postoperative periods were measured and compared. The subjects in group R were found to have higher mean VAS scores at any point of time, as compared to the subjects in group RD. The differences in mean VAS scores were found to be statistically significant.

**Table 16: Mean VAS scores at 6, 10, 14 and 24 hours among the study groups**

| Ix group | Group R | | Group RD | | t-test (p-values) |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| VAS 6hrs | 0.25 | 0.06 | 0.00 | 0.00 | < 0.0000001 |
| VAS 10hrs | 4.33 | 0.07 | 0.14 | 0.06 | < 0.001 |
| VAS 14hrs | 6.35 | 0.07 | 4.11 | 0.06 | <0.001 |
| VAS 24hrs | 10.00 | 0.00 | 8.26 | 0.10 | <0.0000001 |

**Postoperative Vital Parameters:** The mean postoperative (at 0 minutes) heart rate, systolic blood pressure as well as diastolic blood pressure were found to be higher among the subjects in group R, as compared to those in group RD, whereas SpO2 was comparable between the two groups.

The mean heart rate (at 0 minutes) was 72.86 ± 2.59 beats / minute in group R, and 70.49 ± 1.96 beats / minute in group RD. The mean systolic blood pressure (at 0 minutes) was 118.29 ± 3.88 mm Hg in group R, and 114.51 ± 2.49 mm Hg in group RD. The mean diastolic blood pressure (at 0 minutes) was 73.11 ± 2.40 mm Hg in group R, and 70.80 ± 1.89 mm Hg in group RD. The differences in postoperative heart rate, systolic blood pressure as well as diastolic blood pressure were found to be statistically significant.

**Table 17: Comparison of mean postoperative vitals among the study groups**

| Vitals | Group | Mean ± SD | 95% Confidence interval | t-test (p-values) |
|---|---|---|---|---|
| Post-HR | Group R | 72.86 ± 2.59 | 71.97 - 73.75 | 0.00005263 |
| | Group RD | 70.49 ± 1.96 | 69.81 - 71.16 | |
| Post-SBP | Group R | 118.29 ± 3.88 | 116.95 - 119.62 | 0.00000749 |
| | Group RD | 114.51 ± 2.49 | 113.66 - 115.37 | |
| Post-DBP | Group R | 73.11 ± 2.40 | 72.29 - 73.94 | 0.00003002 |
| | Group RD | 70.80 ± 1.89 | 70.15 - 71.45 | |
| Post-SpO2 | Group R | 99.32 ± 0.3 | 99.21 - 99.42 | 0.14445 |
| | Group RD | 99.41 ± 0.2 | 99.34 - 99.48 | |

## DISCUSSION

In modern surgical practice, minimizing patient discomfort while ensuring effective pain control is essential. The rise of minimally invasive surgery (MIS) and the increasing prevalence of outpatient procedures have driven the need for advanced analgesic techniques. Among these, peripheral nerve blocks (PNBs) have gained prominence, surpassing traditional methods like oral medications and general anesthesia. PNBs provide targeted pain relief, making them a valuable tool for anesthesiologists.

Ultrasound imaging has proven to be an effective tool for visualizing the brachial plexus within the axilla. The axillary artery and surrounding hyperechoic

fascia are key structures, with the hypoechoic nerves identifiable around them. When the ultrasound probe is positioned longitudinally in the mid-to-distal axilla, a distinct pattern is observed: the median nerve is located lateral and superficial to the axillary artery, the ulnar nerve is typically medial and superficial to the artery, and the radial nerve is situated posterior to the artery, although its exact position may vary. The musculocutaneous nerve often deviates from this pattern and may be found within the fascial layer between the biceps and coracobrachialis muscles or even piercing the belly of the coracobrachialis muscle itself.

In addition to its primary action, ropivacaine can be combined with adjuvants, such as opioids and epinephrine, to enhance its analgesic effects. Opioids, like fentanyl, work by further inhibiting pain perception at the central nervous system level, while epinephrineserves as a vasoconstrictor. The latter reduces local blood flow, prolonging the duration of action of ropivacaine by delaying its systemic absorption.

The clinical application of ropivacaine has evolved alongside advancements in ultrasound technology, which allows for better visualization of nerves during PNBs. This has improved the accuracy and safety of nerve blocks, enabling anesthesiologists to target specific nerve branches more effectively. The use of ultrasound guidance has become the gold standard in many PNB procedures, allowing for real-time monitoring of local anesthetic distribution and minimizing the amount required for effective analgesia. The mechanism of action of Ropivacaine, combined with its pharmacokinetic properties and the ability to enhance its effects with adjuvants, makes it a valuable agent in modern anesthesia practices. Its application in PNBs not only facilitates effective pain management during surgery but also contributes to improved patient outcomes in postoperative recovery.

Adjuvants like opioids and epinephrine can enhance the effectiveness of local anesthetics. Opioids, such as fentanyl, reduce pain perception at the central nervous system level, while epinephrine prolongs the action of local anesthetics by constricting blood vessels. The choice of anesthetics and adjuvants is tailored to individual patient needs, ensuring effective pain management while minimizing side effects.

Recently, dexmedetomidine (DEX), a selective α2-adrenergic receptor agonist, has gained attention for its potential advantages in pain management. DEX offers multimodal analgesic effects, sedation, hemodynamic stability, and reduced opioid dependence. Its unique mechanism of action makes it particularly beneficial for patients with preoperative anxiety or those recovering in intensive care. Ongoing research aims to explore DEX's long-term effects and optimal applications in clinical practice.

Dexmedetomidine's mechanism of action, characterized by its selective binding to alpha-2 adrenergic receptors, provides distinct advantages in anesthesia and pain management. Its ability to offer sedation, analgesia, and hemodynamic stability while minimizing opioid use positions DEX as a promising agent in contemporary anesthesia practices. Ongoing research aims to further elucidate its long-term effects and optimize its use across various clinical scenarios, reinforcing its potential as a cornerstone in modern pain management strategies.

Recent studies have explored the efficacy of combining dexmedetomidine with various local anesthetics, particularly ropivacaine and levobupivacaine, to enhance postoperative analgesia in different surgical contexts.

A systematic review and meta-analysis by F. Li et al. (2023),[2] indicated that the addition of dexmedetomidine to ropivacaine significantly prolonged postoperative analgesia compared to ropivacaine alone. The study reported extended durations of both sensoryand motor blocks, along with a reduction in post-anesthesia side effects such as nausea and vomiting, highlighting the benefits of this combination in pain management.

In a randomized controlled trial by H. F. Ghazaly et al. (2022),[3] the effects of two doses of dexmedetomidine (50 μg and 100 μg) combined with levobupivacaine were evaluated in patients undergoing forearm and hand surgeries. The results showed that the higher dose of dexmedetomidine led to a significantly longer duration of sensory block (15.5 hours) compared to the lower dose (12.8 hours) and control group (10 hours). Additionally, patients receiving the higher dose required less postoperative pain medication, suggesting that dexmedetomidine enhances the effectiveness of levobupivacaine in prolonging analgesia.

M. H. Hamada et al. (2019),[4] compared dexmedetomidine and dexamethasone as adjuvants to bupivacaine for brachial plexus blocks. The results indicated that dexmedetomidine provided longer-lasting pain relief, while dexamethasone resulted in a quicker onset of numbness, suggesting that dexmedetomidine may be better for prolonged analgesia.

E. Koraki et al. (2017),[5] investigated the effects of adding dexmedetomidine to ropivacaine in ultrasound-guided axillary brachial plexus blocks. Their study found that dexmedetomidine significantly extended the duration of sensory and motor blocks and improved total analgesia duration, although it also noted potential side effects like bradycardia and hypotension.

Iyengar et al. (2023),[6] conducted a double-blinded randomized controlled trial involving

60 patients to compare dexmedetomidine and dexamethasone as adjuvants to bupivacaine in ultrasound-guided infraclavicular brachial plexus blocks. The study found that while dexmedetomidine provided a faster onset of numbness, it also caused more sedation. In contrast, dexamethasone resulted in longer-lasting numbness, muscle relaxation, and pain relief with fewer side effects, suggesting that

dexamethasone may be preferable for extended pain management when sedation is not desired.

Reddy et al. (2021),[7] evaluated the effects of perineural versus intravenous dexmedetomidine combined with levobupivacaine in a randomized trial with 120patients. They found that the perineural administration of dexmedetomidine significantly shortened the onset of sensory and motor blocks and prolonged their duration compared to both the intravenous route and levobupivacaine alone. This indicated that perineural dexmedetomidine enhances both the speed and duration of analgesia.

In another study by Balraj Hariharasudhan et al. (2021),[8] the combination of dexmedetomidine and levobupivacaine was shown to provide faster onset times for numbness and longer-lasting pain relief compared to levobupivacaine alone, along with better blood pressure stability. Similarly, Sachdev et al. (2020) reported that while the onset of numbness was slightly slower with dexmedetomidine, it provided significantly longer durations of muscle relaxation and pain relief compared to levobupivacaine alone.

Singh et al. (2020),[9] compared dexmedetomidine and dexamethasone as adjuvants to ropivacaine, finding that both improved pain management without significant differences in duration of analgesia. Nazir et al. (2019),[11] highlighted that dexmedetomidine, when added to ropivacaine, resulted in significantly longer durations of sensory and motor blocks compared to clonidine or ropivacaine alone.

Other studies, such as those by Somsunder et al. (2019),[10] and Hussain et al. (2019),[11] confirmed that perineural dexmedetomidine offered similar effectiveness to intravenous administration but with fewer side effects, particularly regarding sedation and hypotension.

Rekhi et al. (2017),[12] demonstrated that intravenous dexmedetomidine combined with ropivacaine resulted in prolonged sensory block and higher sedation levels compared to midazolam, indicating its effectiveness in enhancing spinal anesthesia.

However, these studies also suggested further research in light of the need to enhance postoperative analgesia and improve patient outcomes. The current study was thus aimed at establishing whether the addition of dexmedetomidine to ropivacaine could provide superior analgesic benefits, faster onset times, and prolonged effects compared to ropivacaine alone, while also assessing the safety and hemodynamic stability of this combination in the context of ultrasound-guided supraclavicular brachial plexus blocks. This study focused on comparing the efficacy of ropivacaine alone versus its combination with dexmedetomidine in ultrasound-guided axillary blocks, highlighting the ongoing evolution and refinement of pain management strategies in modern anesthesia.[13]

The study enrolled 70 patients undergoing mid-humerus, elbow, forearm and hand surgeries under ultrasound guided supraclavicular block regional anaesthesia, allocated randomly to two groups viz., group R and group RD in equal numbers i.e., 35 patients each. The patients in group R received plain Ropivacaine, whereas those in group RD received Ropivacaine along with Dexmedetomidine.

**Sociodemographic data:** The mean age of the study subjects was 35.6 + 5.92 years. The mean age in group Rwas 35.63 + 6.0 years and the mean age in group RD was 35.57 + 5.94 years. The twogroups were thus comparable as there was no statistically significant difference between the two study groups (p=0.986).

**Baseline vital parameters:** The mean baseline heart rate of the study subjects was 81.21 + 7.51 beats/minute,mean baseline systolic blood pressure was 122.66 + 9.52 mm Hg, and mean baselinediastolic blood pressure was 78.69 + 7.56 mm Hg.

The mean baseline heart rate was 82.74 ± 8.18 beats / minute in group R and 79.69 ±6.55 beats / minute in group RD. The mean baseline systolic blood pressure was 122.31 ± 9.95 mm Hg in group R and 123 ± 9.19 mm Hg in group RD. The mean baseline diastolic blood pressure was 77.83 ± 6.85 mm Hg in group R and 80.46 ± 7.16 mm Hg in group RD. These were no statistically significant differences between any of the baseline vitals of the two study groups.

Duration of surgery was 161.78 + 2.15 minutes in the study subjects. It was similar to this i.e., 161.79 + 2.21 minutes in group R and 161.78 + 2.12 minutes in group RD, andalso comparable between the two study groups (t-test p-value is 0.981).

**Anesthetic parameters:**

**Onset of Sensory Block**

The mean time taken for sensory block was found to be 9.21 + 0.11 minutes in group R,whereas it was 6.80 + 0.11 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Onset of Motor Block**

The mean time taken for motor block was found to be 13.11 + 0.11 minutes in group R,whereas it was 8.99 + 0.10 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Duration of Sensory Block**

The mean duration of sensory block was found to be 506.37 + 2.48 minutes in group R,whereas it was 709.44 + 4.32 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Duration of Motor Block**

The mean duration of motor block was found to be 478.76 + 2.04 minutes in group R,whereas it was 669.84 + 2.45 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Duration of Analgesia**

The mean duration of analgesia was found to be 567.85 + 1.68 minutes in group R,whereas it was 831.74 + 4.57 minutes in group RD. This difference was found to bestatistically significant (p<0.001).

**Rescue Analgesia**

The mean time taken before giving rescue analgesia was found to be 587.86 + 1.56minutes in group R, whereas it was 849.94 + 4.36 minutes in group RD. This differencewas found to be statistically significant (p<0.001).

**VAS Scores**

The mean VAS scores at 6 hours, 10 hours, 14 hours and 24 hours postoperative periods were measured and compared. The subjects in group R were found to have higher mean VAS scores at any point of time, as compared to the subjects in group RD. The differences in mean VAS scores were found to be statistically significant.

**Postoperative Vital Parameters:**

The mean postoperative (at 0 minutes) heart rate, systolic blood pressure as well as diastolic blood pressure were found to be higher among the subjects in group R, ascompared to those in group RD, whereas SpO2 was comparable between the two groups. The mean heart rate (at 0 minutes) was 72.86 ± 2.59 beats / minute in group R, and70.49 ± 1.96 beats / minute in group RD. The mean systolic blood pressure (at 0 minutes) was 118.29 ± 3.88 mm Hg in group R, and 114.51 ± 2.49 mm Hg in group RD. The mean diastolic blood pressure (at 0 minutes) was 73.11 ± 2.40 mm Hg in group R, and 70.80 ± 1.89 mm Hg in group RD. The differences in postoperative heart rate, systolic blood pressure as well as diastolic blood pressure were found to be statistically significant. There were no complications recorded in any of the subjects in eithergroups.

## CONCLUSION

The present study concluded that, Dexmedetomidine when given as an adjuvant with ropivacaine as supraclavicular block: Significantly shortens the time taken for onset of sensory and motor block. Significantly prolongs the duration of sensory and motor block. Significantly enhances analgesia. Does not cause any significant complications

**Recommendations**

- Dexmedetomidine may be utilized as a adjuvant with Ropivacaine in surgical settings with need for quick procedures, such as emergency surgeries, and for long duration surgeries.
- Further clinical research is required to support this evidence as well as look for longterm complications in follow-up, etc.

**Limitations**

Small sample size of the study due to restricted study duration limits the external validity of the results. The data was collected from a single study centre, which may lead to low precision of the findings.

## REFERENCES


1. Chinnappa J, Shivanna S, Pujari VS, Anandaswamy TC. Efficacy of dexmedetomidine with ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. Journal of Anaesthesiology Clinical Pharmacology. 2017 Jan 1;33(1):81-5.
2. Li F, Guo L, Huang Z, Lin F, Pan L. Effects of dexmedetomidine as an adjuvant to ropivacaine or ropivacaine alone on duration of postoperative analgesia: A systematic review and meta-analysis of randomized controlled trials. Plos one. 2023 Oct 11;18(10):e0287296.
3. Ghazaly, H. F., Aly, A. A. A., Zaher, Z. Z., Hassan, M. M., & Mahmoud, A. A. (2022).Comparison of the efficacy of two doses of dexmedetomidine as an adjunct to levobupivacaine in infraclavicular brachial plexus block: prospective double-blinded randomized controlled trial. BMC anesthesiology, 22(1), 338.
4. Hamada, M., Ibrahim, W., Ashiry, M. Comparative Study between Dexmedetomidine and Dexamethasone as an Adjuvant to Bupivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgeries. The Egyptian Journal of Hospital Medicine, 2019; 75(6): 3060-3069. doi: 10.21608/ejhm.2019.34218
5. Koraki E, Stachtari C, Kapsokalyvas I, Stergiouda Z, Katsanevaki A, Trikoupi A. Dexmedetomidine as an adjuvant to 0.5% ropivacaine in ultrasound-guided axillary brachial plexus block. Journal of clinical pharmacy and therapeutics. 2018 Jun;43(3):348-52.
6. Iyengar, S. S., Pangotra, A., Abhishek, K., Sinha, N., Rao, N. S., Singh, V. K., & Prakash, J. (2023). The Comparison of Dexmedetomidine to Dexamethasone as Adjuvants to Bupivacaine in Ultrasound-Guided Infraclavicular Brachial Plexus Block in Upper Limb Surgeries. Cureus,15(7),e41668.
7. Reddy, B. S., Gaude, Y. K., Vaidya, S., Kini, G. K., Budania, L. S., & Eeshwar, M. V. (2021). Effect of dexmedetomidine on characteristics of ultrasound-guided supraclavicular brachial plexus block with levobupivacaine-A prospective double- blind randomized controlled trial. Journal of anaesthesiology, clinical pharmacology, 37(3), 371–377.
8. Hariharasudhan B, Savithasree S, R S Mane, S Sivakumar, B T Arish. Comparison of Levobupivacaine and Levobupivacaine with Dexmedetomidine for Supraclavicular Brachial Plexus Block in Patients Undergoing Upper Limb Surgeries-A Randomised Controlled Trial. Journal of Clinical and Diagnostic Research. 2021 Mar, Vol-15(3): UC06-UC09.
9. Singh, N., Gupta, S., & Kathuria, S. (2020). Dexmedetomidine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. Journal of anaesthesiology, clinical pharmacology, 36(2), 238–243. https://doi.org/10.4103/joacp.JOACP_176_19
10. LSomsunder RG, Archana NB, Shivkumar G, Krishna K. Comparing efficacy of perineural dexmedetomidine with intravenous dexmedetomidine as adjuvant to levobupivacaine in supraclavicular brachial plexus block. Anesthesia Essays and Researches. 2019 Jul 1;13(3):441-5.
11. Syed Thahir Hussain, P Mageswari. A Comparative Study of Levobupivacaine and Levobupivacaine with Dexmeditomidine in USG-Guided Axillary Block for Elbow, Forearm and Hand Surgeries. IndianJAnesthAnalg.2019;6(6Part-II):2182-2187.
12. Mangal V, Mistry T, Sharma G, Kazim M, Ahuja N, Kulshrestha A. Effects of dexmedetomidine as an adjuvant to ropivacaine in ultrasound-guided supraclavicular brachial plexus Block: A prospective, randomized, double-blind study. Journal of Anaesthesiology Clinical Pharmacology. 2018 Jul 1;34(3):357-61.
13. Rekhi BK, Kaur T, Arora D, Dugg P. Comparison of intravenous dexmedetomidine with midazolam in prolonging spinal anaesthesia with ropivacaine. Journal of clinical and diagnostic research: JCDR. 2017 Feb;11(2):UC01.