



A Comparative Study of Effects of Buprenorphine and Dexmedetomidine as an Adjuvant to 0.5 %Ropivacaine in Ultrasound Guided Supraclavicular Block in Elective Upper Limb Surgeries

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ABSTRACT

BACKGROUND AND AIMS

Effective postoperative analgesia is essential in upper limb surgeries. Ultrasound-guided supraclavicular brachial plexus block with ropivacaine provides reliable anesthesia and analgesia. Adjuvants such as buprenorphine and dexmedetomidine may prolong block duration and improve analgesic quality. This study aimed to compare the effects of buprenorphine and dexmedetomidine as adjuvants to 0.5% ropivacaine in supraclavicular brachial plexus block.

METHODS

A prospective, randomized comparative study was conducted on patients undergoing elective upper limb surgeries. Participants were allocated into two groups: Group RB received 0.5% ropivacaine with buprenorphine, and Group RD received 0.5% ropivacaine with dexmedetomidine. The primary outcomes were duration of analgesia, motor block, and sensory block. Secondary outcomes included onset times of sensory and motor block and incidence of adverse effects. Statistical analysis was performed using Student's t-test and chi-square test, with $p < 0.05$ considered significant.

RESULTS

Group RD (dexmedetomidine) demonstrated faster onset of sensory and motor block and significantly prolonged block duration compared to Group RB. Group RB (buprenorphine) provided longer postoperative analgesia but with delayed onset. Side effects were minimal in both groups; Group RD showed occasional bradycardia and hypotension, while Group RB reported mild nausea and sedation.

CONCLUSION

Both buprenorphine and dexmedetomidine are effective adjuvants to ropivacaine in supraclavicular brachial plexus block. Dexmedetomidine offers superior block quality, whereas buprenorphine ensures extended postoperative analgesia. The choice of adjuvant may be individualized based on clinical priorities.



KEYWORDS

Buprenorphine, Dexmedetomidine, Ropivacaine, Supraclavicular Block, Regional Anesthesia.

INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Effective perioperative pain management remains a central goal of modern anaesthesia. Regional anaesthesia techniques, particularly peripheral nerve blocks, have evolved into an essential component of multimodal analgesia. Among these, the supraclavicular brachial plexus block offers reliable anaesthesia for upper limb surgeries with dense sensory and motor blockade, haemodynamic stability, reduced systemic drug exposure, and improved postoperative recovery.

Ropivacaine, a long-acting amide local anaesthetic available as a pure S(-) enantiomer, provides prolonged analgesia with lower cardiotoxicity than bupivacaine. To further extend its duration, several adjuvants have been investigated, including α_2 -agonists and opioids. Dexmedetomidine, a highly selective α_2 -agonist, enhances block quality and prolongs analgesia, while Buprenorphine, a partial μ -opioid agonist, improves analgesic duration due to its lipophilicity and strong receptor affinity.

However, limited evidence exists comparing Buprenorphine and Dexmedetomidine as adjuvants to Ropivacaine specifically in ultrasound-guided supraclavicular brachial plexus blocks. This study aims to fill this gap by evaluating and comparing block characteristics, analgesic duration, and safety profiles of these two adjuvants.

Aims and Objectives

Aim

To compare the effects of Buprenorphine and Dexmedetomidine when added to 0.5% Ropivacaine in ultrasound-guided supraclavicular brachial plexus block for elective upper limb surgeries.

Primary Objectives

1. To compare the duration of analgesia
2. To compare the duration of sensory blockade
3. To compare the duration of motor blockade

Secondary Objectives

1. To compare the onset of sensory blockade
2. To compare the onset of motor blockade
3. To assess adverse effects, if any

MATERIALS AND METHODS

Study Design

Prospective, randomized, double-blinded comparative study.

Study Period

One year after institutional ethical committee approval.

Sample Size

Sixty patients.



Study Population

Patients posted for elective upper limb surgeries at SVRRGH, Tirupati.

Inclusion Criteria

1. ASA I and II
2. Age 18–60 years
3. Patients willing to give informed consent

Exclusion Criteria

1. Allergy to the local anesthetics and opioids
2. Local infection at the site of block
3. Pregnant women
4. Severe cardiopulmonary disease
5. Patients with neurological deficit in operating arm
6. Bleeding disorders/ Patients on anticoagulants
7. ASA III-IV
8. Patients who needed or converted to general anesthesia after unsuccessful block or block failure.

Methodology

Sixty patients were randomized into two equal groups of 30:

- Group RD: 25 mL of 0.5% Ropivacaine + 50 µg Dexmedetomidine
- Group RB: 25 mL of 0.5% Ropivacaine + 0.3 mg Buprenorphine

All patients underwent ultrasound-guided supraclavicular brachial plexus block under aseptic precautions. Sensory and motor block characteristics were assessed using standardized scoring systems. Vital parameters were monitored intraoperatively and postoperatively for 24 hours.

Outcome Measures

1. Onset times
2. Duration of sensory and motor blockade
3. Duration of postoperative analgesia
4. Adverse effects

Statistical Analysis

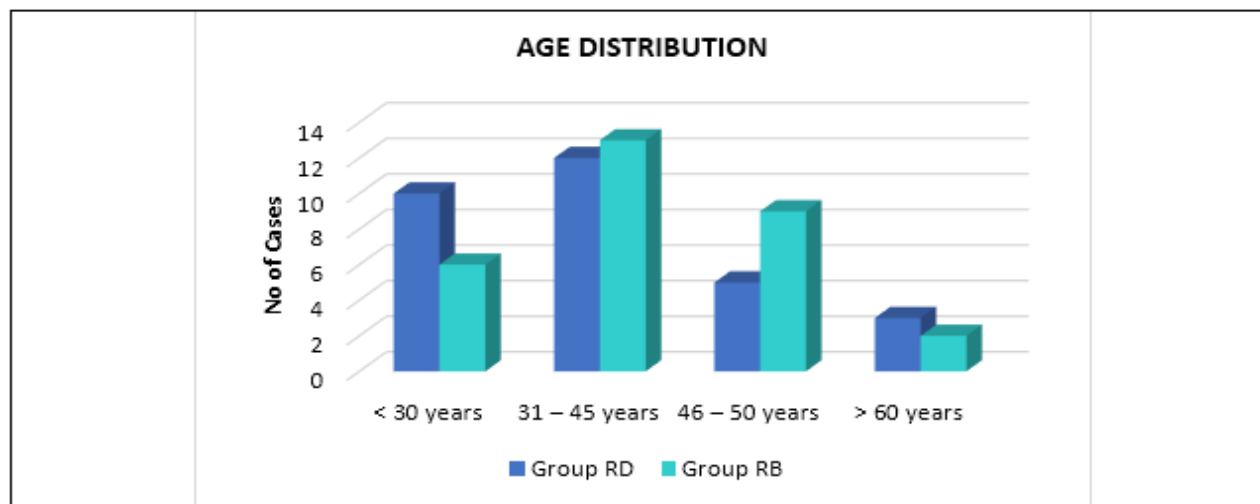
Data were analysed using SPSS v26. Numerical variables were expressed as mean \pm SD and compared using Student's t-test. Categorical variables were compared using chi-square test. $P < 0.05$ was considered statistically significant.

RESULTS

1. Demographic variables (age, sex, weight) were comparable between groups ($p > 0.05$).
2. Onset of sensory block was significantly faster in Group RB ($p = 0.040$).
3. Onset of motor block was significantly faster in Group RB ($p = 0.023$).
4. Duration of sensory block was significantly longer in Group RD ($p = 0.003$).
5. Duration of motor block was significantly longer in Group RD ($p = 0.010$).
6. Duration of analgesia was significantly prolonged in Group RD ($p = 0.024$).
7. Adverse effects: Vomiting occurred in 4 patients (13.3%) in Group RB; none in Group RD ($p = 0.034$). No bradycardia or serious complications noted.

Age	Group RD		Group RB		P Value
	No of Cases	Percentage	No of Cases	Percentage	
< 30 years	10	33.3	6	20.0	0.340
31 – 45 years	12	40.0	13	43.3	
46 – 50 years	5	16.7	9	30.0	
> 60 years	3	10.0	2	6.7	
Total	30	100.0	30	100.0	

Table 1: Age Distribution

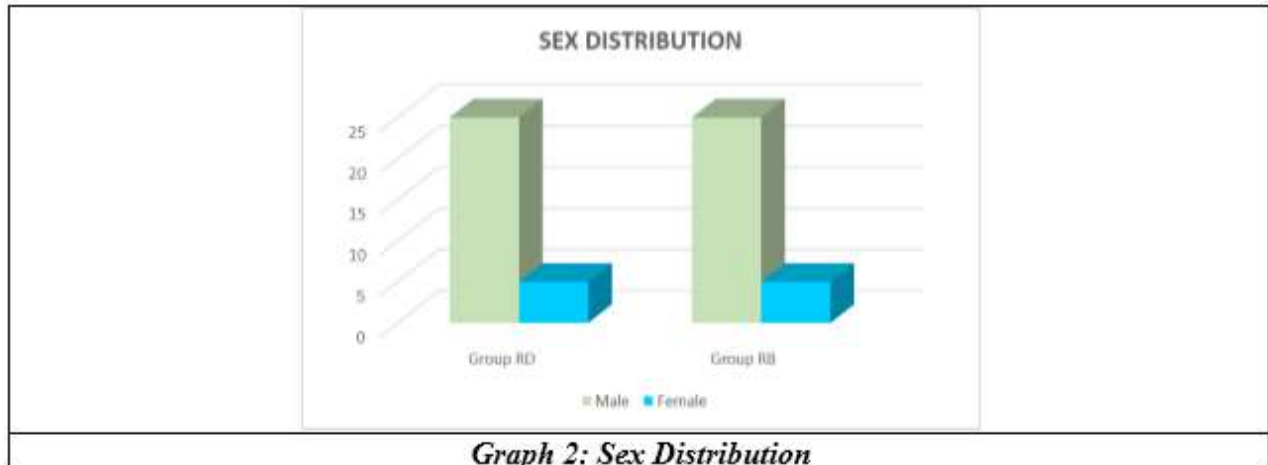


Graph 1: Age Distribution

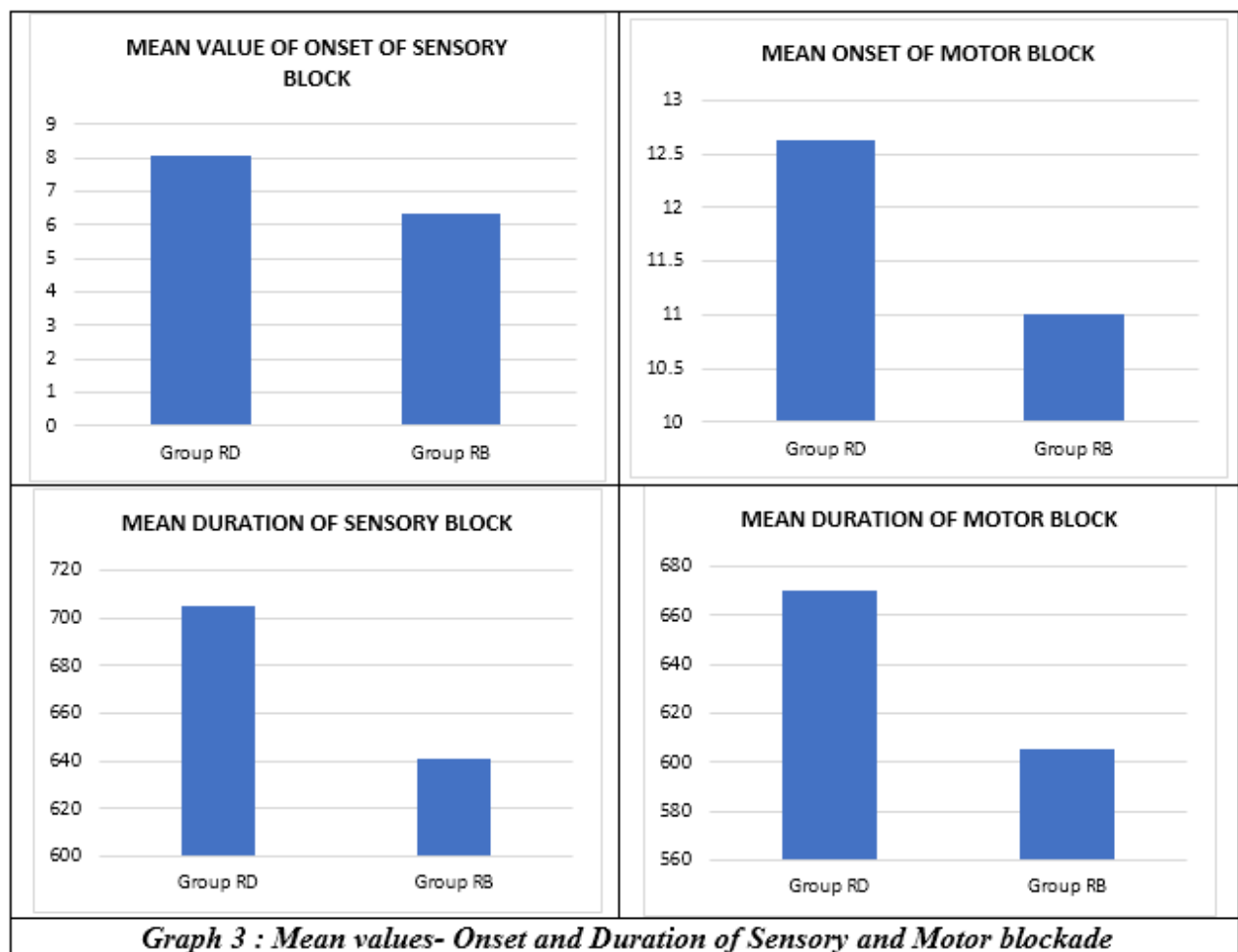
Sex	Group RD		Group RB		P Value
	No of Cases	Percentage	No of Cases	Percentage	
Male	25	83.3	25	83.3	0.067
Female	5	16.7	5	16.7	
Total	30	100.0	30	100.0	

Table 2: Sex Distribution





Graph 2: Sex Distribution

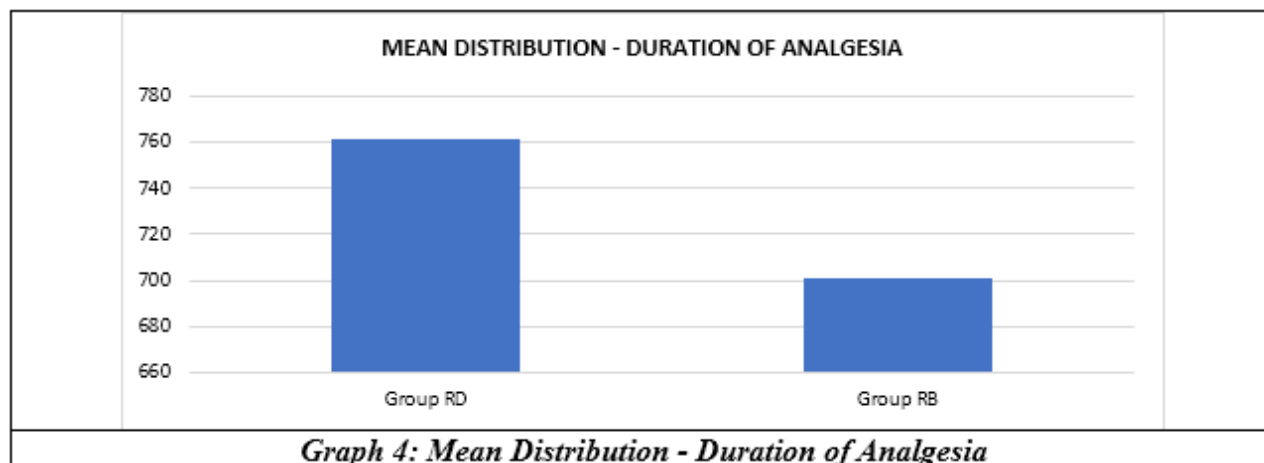


Graph 3 : Mean values- Onset and Duration of Sensory and Motor blockade

Onset of Sensory Block	Group RD	Group RB
	Mean ± SD	8.10 ± 2.040
P Value	0.040	
Onset of Motor Block	Group RD	Group RB

	Mean ± SD	Mean ± SD
	12.63 ± 2.965	11.00 ± 2.779
P Value	0.023	
Duration of Motor Block	Group RD	Group RB
	Mean ± SD	Mean ± SD
	670.17 ± 102.111	605.23 ± 101.692
P Value	0.010	
Duration of Analgesia	Group RD	Group RB
	Mean ± SD	Mean ± SD
	761.31 ± 129.16	701.13 ± 121.14
P Value	0.024	
<i>Table 3</i>		

Side Effects	Group RD		Group RB		P Value
	No of Cases	Percentage	No of Cases	Percentage	
Bradycardia	-	--	-	--	0.034
Vomiting	-	--	4	13.3	
Total	30	100.0	30	100.0	
<i>Table 4</i>					



DISCUSSION

Peripheral nerve blocks are commonly employed during upper limb procedures as a substitute for general anaesthesia. They offer ideal circumstances for operation by inducing muscular relaxation, maintaining stable hemodynamics during surgery, providing good pain management, ensuring postoperative pain relief, reducing financial costs, promoting quicker recovery, and minimizing adverse effects.

In this study, we opted use of ultrasound guidance for supraclavicular brachial plexus block. Nevertheless, the advantages are frequently restricted because of the brief duration of accessible local anesthetics, which results in the resolution of the block before the peak period of postoperative pain. Adjuvants such as opioids and α2 adrenergic agonists have been used as adjuvants to enhance the duration of anesthesia during surgery and provide pain relief after the operation. Our objective



was to compare the effects of these two adjuvants when added to local anaesthetics in supraclavicular block during upper limb procedures.

Ropivacaine is an amino amide local anaesthetic. This is long-acting drug and consists of only the S(-) enantiomer, which greatly minimizes the risk of damage to the central nervous system and cardiac toxicity. Research has demonstrated its comparable efficacy to bupivacaine while exhibiting a reduced incidence of adverse effects.

Rohit et al. (2015)^[1] conducted a study to compare and assess the clinical characteristics of 0.5% Ropivacaine versus 0.5% Bupivacaine for supraclavicular brachial plexus block in upper limb surgeries, a commonly used block in clinical practice. The study randomly divided cases into two groups: Group R received Ropivacaine, and Group B received Bupivacaine. Parameters such as pulse, blood pressure, duration of sensory and motor block, and any complications or side effects from the above drugs were monitored. Statistical analysis showed that the difference between the two groups was not significant in terms of onset sensory and motor blocks onset and duration time, overall pain relief, and incidence of side effects and complications ($p>0.05$). The study found that 0.5% Ropivacaine in supraclavicular brachial plexus blocks are as effective and safe as 0.5% Bupivacaine.

Srihari (2016)^[2] explored the effectiveness of 0.5% Bupivacaine and 0.75% Ropivacaine for brachial plexus blocks via a supraclavicular approach in upper limb surgeries and was compared. This study included 60 patients of ASA Grades 1 and 2, aged 20 to 60 years, from both genders. The sensory and motor block onset was monitored every minute up to 35 minutes post-injection, with all patients observed for 24 hours. The study found that there were no significant clinical differences in the onset, duration, and quality of analgesia between 0.5% Bupivacaine and 0.75% Ropivacaine, Ropivacaine might offer a better safety profile, suggesting its preferable use for brachial plexus blocks in various surgical procedures involving the upper limb.

Balwinderjit et al. (2019)^[3] studied the clinical characteristics of 0.5% Ropivacaine and 0.5% Bupivacaine for brachial plexus blocks via supraclavicular approach in forearm and hand surgeries were compared, motivated by the quest for more cardiostable local anesthetics. This prospective randomized trial involved sixty ASA-I and II, participants split into two groups to receive either Ropivacaine or Bupivacaine combined with normal saline. The research aimed to assess mean pulse, blood pressure, sensory and motor blockade onset and duration, analgesia duration, and adverse effects. The study demonstrated that the differences in sensory and motor blockade onset or analgesia duration between groups was not significant. Ropivacaine, with its lower cardiac toxicity, presented a potentially safer profile and preferred for this sort of regional anesthetic in modern clinical practice. Thus with all these advantages of Ropivacaine over Bupivacaine we decided to use 25 ml 0.5% Ropivacaine (125mg) for patients above 40 kg considering maximum dose of 3mg/kg. Buprenorphine, a lipophilic opioid and has a strong affinity to μ receptors, provides long-lasting benefits and is cost-effective, while causing less adverse effects such as respiratory depression and sedation. Research has shown its substantial impact as adjuvant to local anaesthetic in supraclavicular blocks. Dexmedetomidine is a potent α_2 adrenergic receptor agonist that has a high affinity for α_2 receptors. It has been shown to have beneficial effects on the peripheral nervous system and as an adjuvant. Following an extensive examination of existing literature, few studies were found that directly compared Buprenorphine and Dexmedetomidine effects as an adjuvant to Ropivacaine for brachial plexus blocks. Hence, this study explores the effects of using these adjuncts when used in conjunction with 0.5% Ropivacaine in ultrasound guided supraclavicular brachialplexus block.

We chose a constant dosage of Buprenorphine 300 µg and Dexmedetomidine 50µg. The patients were categorized into two groups RD (Ropivacaine with Dexmedetomidine) and RB (Ropivacaine with Buprenorphine). Both groups will receive equal volume of drug (consisting of 0.5% Ropivacaine of 25 ml and adjuvant in each group).

Onset of Sensory Block

Liu et al. (2018)^[4] studied the analgesic properties of Ropivacaine combined with Dexmedetomidine and Ropivacaine alone for brachial plexus block in upper limb trauma surgery. The study investigated among 114 patients. The mean sensory block onset time in combination group (Ropivacaine with Dexmedetomidine) was around 8.9 minutes and it was 12.4 minutes in Ropivacaine alone group. The study found that onset was significantly faster in Dexmedetomidine group compared to control group, which might be due to study design variations, patient demographics, or the concentration of the adjuvant used.

Mahima et al. (2022)^[5] conducted a randomized single-blinded prospective clinical study to evaluate the effects of adding Dexmedetomidine to Ropivacaine in ultrasound-guided supraclavicular brachial plexus blocks, involving forty patients aged 20-50 years, ASA Grade I and II patients, posted for elective upper limb orthopedic operations. Participants were split into two groups: Group RN received 25 ml volume of 0.75% Ropivacaine with 1 ml normal saline, and Group RD received the same Ropivacaine volume with 1 mcg/kg Dexmedetomidine diluted to 1 ml. The addition of Dexmedetomidine significantly expediate the sensory blockade onset with mean and standard deviation of 7.4 ± 1.02 minutes compared with Ropivacaine alone which recorded mean and standard deviation as 9.9 ± 1.16 minutes. The study concluded that group RD has significant faster sensory block onset.

Neena et al. (2017)^[6] conducted study to evaluate the analgesic effects and safety of adding Buprenorphine to 0.5% Ropivacaine in USG supraclavicular brachial plexus blocks for upper limb surgeries. Including 60 adult patients of ASA I and II, participants were divided into two groups: Group B received 30 ml volume of 0.5% Ropivacaine with 1ml buprenorphine (0.3 mg), and 30 ml volume of 0.5% Ropivacaine with 1 ml normal saline was received by Group C. The study assessed the mean sensory block onset in Buprenorphine group was around 8.60 ± 2.82 min. The study concluded that onset was significantly faster in Buprenorphine group than control group.

Anshul et al. (2022)^[7] conducted a comparative clinical study on 60 patients aged 19 to 65 of ASA I and II grades to assess the analgesic effects of 0.5% Ropivacaine combined with either Dexmedetomidine or Buprenorphine on the complete motor and sensory blockade onset and duration in supraclavicular brachial plexus block. The participants were divided into two groups: one group (Group C) received 25 mL volume of 0.5% Ropivacaine with 300 µg of Buprenorphine, while the other group (Group L) was administered the same volume of Ropivacaine with 1 µg/kg of Dexmedetomidine. The study explored that the onset of sensory blockade in the buprenorphine group was 9.72 ± 1.51 min and in the Dexmedetomidine group it was 10.53 ± 2.30 min. The discrepancy of onset time compared to present study could be attributed to usage of different concentrations of the drugs, specific patient characteristics. The study concluded the onset was significantly faster in Buprenorphine group than Dexmedetomidine group.

Rajeev et al. (2024)^[8] explored effects of adding Buprenorphine to Ropivacaine for supraclavicular brachial plexus block in upper limb procedures, aiming to prolong analgesia duration on 60 ASA grsde I and II patients aged 25 to 60 years, subjects were equally divided into two groups: one receiving 19 ml volume of 0.75% Ropivacaine with 1 ml normal saline (Group RP) and the other receiving the same Ropivacaine volume with 75mcg Buprenorphine (Group RB).The study reported

that the onset of sensory block was 4.5 ± 0.57 minutes in Buprenorphine group and 6.7 ± 0.51 minutes in Ropivacaine group. The study found that onset was faster in Buprenorphine group than control group.

In current study, the sensory block onset was observed to be 8.10 ± 2.040 minutes in Group RD (Ropivacaine with Dexmedetomidine) and 6.36 ± 1.709 minutes in Group RB (Ropivacaine with Buprenorphine). This study concluded that Buprenorphine group has significantly faster sensory block onset compared to the Dexmedetomidine group. When compared to above studies, this study results show a more rapid onset time, highlighting the potential benefits of these adjuvants in clinical practice. These differences underscore the importance of considering various factors such as drug concentration, patient population, and study design when interpreting and applying these findings to clinical settings.

Sri Lakshmi et al. (2022)^[9] conducted a study to compare the efficacy of adding Buprenorphine versus Dexmedetomidine to 2% lignocaine with adrenaline for supraclavicular brachial plexus blocks in forearm surgeries. This study, focusing on a widely used regional anesthesia technique, aimed to assess both sensory and motor blockades onset and duration, alongside the duration of postoperative analgesia. Eighty ASA Grade 1 & 2 patients, ranging from 18 - 60 years and of both genders, participants were split into two groups: Group A received 7mg/kg of 2% lignocaine with adrenaline plus $3\mu\text{g}/\text{kg}$ Buprenorphine, and Group B received the same lignocaine dosage with $1\mu\text{g}/\text{kg}$ Dexmedetomidine. The study explored the sensory block onset was 11-13 minutes for the Buprenorphine group and 13 minutes for the Dexmedetomidine group when combined with local anaesthetic. The study concluded that sensory block onset time was faster with buprenorphine group when compared to dexmedetomidine group.

Onset of Motor Block

Liu et al. (2018)^[4] studied the motor block onset between combination group (Ropivacaine and Dexmedetomidine) and Ropivacaine alone group in upper limb surgeries. The study found a significantly faster motor block onset of 7.5 minutes in combination group compared to 12.8 minutes in the Ropivacaine alone group. The study concluded that motor block has faster onset in Dexmedetomidine group when compared to Ropivacaine alone group.

Mahima et al. (2022)^[5] assessed the impact of adding Dexmedetomidine to Ropivacaine in ultrasound-guided parasagittal supraclavicular brachial plexus blocks. The study found that the addition of Dexmedetomidine significantly accelerated the motor block onset, with Group RD (Ropivacaine with Dexmedetomidine) experiencing within 10.25 ± 1.13 minutes compared to 13.28 ± 1.22 minutes for Group RN (Ropivacaine with normal saline). The study concluded onset was faster with Dexmedetomidine group than control group.

Neena et al. (2017)^[6] evaluated the motor block onset between combination group (Ropivacaine with Buprenorphine) and Ropivacaine group in supraclavicular brachial plexus blocks for upper limb procedures. The study found that the onset of motor blockade was 11.33 ± 1.24 minutes in combination group when compared to 14.18 ± 1.45 minutes in Ropivacaine alone group. The study concluded that onset was faster in Buprenorphine group.

Anshul et al. (2022)^[7] assessed the motor block onset between group RD (Ropivacaine with Dexmedetomidine) and group RB (Ropivacaine with Buprenorphine) in supraclavicular brachial plexus block. The findings revealed that in Buprenorphine group the motor blockade onset was (12.46 ± 1.98 minutes) and in the Dexmedetomidine group the onset was (14.12 ± 4.18 minutes). The study concluded that motor block onset was faster in Buprenorphine group.

Rajeev et al. (2024)^[8] explored the effects of adding Buprenorphine to Ropivacaine for USG supraclavicular brachial plexus block in upper limb procedures. The study compared motor block onset between Ropivacaine with Buprenorphine group versus Ropivacaine alone. The study found that in Buprenorphine with Ropivacaine group the motor block onset time was around 6.1 ± 0.54 min when compared to Ropivacaine group the onset was (9.3 ± 0.53 min). The study concluded that motor block onset was significantly faster in combination group (Ropivacaine with Buprenorphine) group than Ropivacaine alone group.

In present study, we evaluated the motor block onset when using Ropivacaine combined with either Dexmedetomidine (Group RD) or Buprenorphine (Group RB) for supraclavicular brachial plexus blocks in upper limb surgeries. The results indicated that the motor block onset was observed at 12.63 ± 2.965 minutes in Group RD and 11.00 ± 2.779 minutes in Group RB. The statistical analysis yielded a P value of 0.023, demonstrating that the difference between the two groups was statistically significant. This concludes that while two adjuvants are effective in inducing motor block, Buprenorphine allows for a slightly quicker onset compared to Dexmedetomidine.

SriLakshmi et al. (2022)^[9] assessed motor block between Buprenorphine versus Dexmedetomidine added to 2% lignocaine with adrenaline for supraclavicular brachial plexus blocks in forearm surgeries. The study found that motor blockade with faster onset, was seen within 11-13 minutes in Buprenorphine group, while Group B (Dexmedetomidine) experienced motor block onset after 13 minutes. The study concluded that Buprenorphine had significantly faster motor block onset than Dexmedetomidine group.

Duration of Sensory Block

A comprehensive review of multiple studies reveals the comparative durations of sensory blocks when different adjuvants are supplemented to local anesthetics for supraclavicular brachial plexus blocks, particularly focusing on Dexmedetomidine and Buprenorphine. Each study shows how these combinations affect sensory block onset and duration, contributing to a deeper understanding of their clinical efficacy.

Liu et al. (2018)^[4] investigated the sensory block duration between combination of Ropivacaine with Dexmedetomidine group and Ropivacaine alone group in brachial plexus block for upper limb trauma surgery. Their findings indicated that the sensory block lasted for 482.1 ± 39.4 minutes when Dexmedetomidine was added, compared to 380.2 ± 37.2 minutes with Ropivacaine alone. The study concluded that sensory block was significantly longer in combination group (Ropivacaine with Dexmedetomidine) when compared to control (Ropivacaine alone) group. This significant increase highlights the efficacy of Dexmedetomidine in prolonging the sensory block duration. The present research's Group RD duration of 704.97 ± 97.038 minutes surpasses Liu et al.'s findings, reinforcing the efficacy of Dexmedetomidine as an adjuvant. This suggests that the specific protocols and possibly higher dosages in the present research contributed to the enhanced duration.

Mahima et al. (2022)^[5] demonstrated the sensory block duration between Dexmedetomidine with Ropivacaine compared to Ropivacaine with normal saline in ultrasound-guided parasagittal supraclavicular brachial plexus blocks in upper limb orthopaedic surgeries. The study found that the sensory block duration was around 536.62 ± 9.61 minutes in combination group (Ropivacaine with Dexmedetomidine), while it was 413.79 ± 15.61 minutes in Ropivacaine with normal saline. The study concluded that sensory block duration was significantly longer in combination group when compared to Ropivacaine with saline group.

Neena et al. (2017)^[6] study demonstrated that duration of sensory block between two groups, Buprenorphine with Ropivacaine group and Ropivacaine alone group in supraclavicular brachial plexus blocks for upper limb surgeries. The sensory block duration in combination group was 525.8 ± 50 minutes which was significantly longer than Ropivacaine alone group which was 373 ± 53.78 minutes indicating Buprenorphine's effectiveness in extending sensory block duration. In this study Group RB's duration of 641.03 ± 111.204 minutes is significantly longer than Neena et al.'s findings, indicating that the dosage and concentration of Buprenorphine in the present research were more effective in prolonging the sensory block.

Anshul et al. (2022)^[7] conducted a comparative study to evaluate the effects of Ropivacaine combined with either Buprenorphine or Dexmedetomidine on sensory block duration in supraclavicular brachial plexus blocks. They found that the sensory block lasted for 7.83 ± 2.51 hours (469.8 ± 150.6 minutes) with Buprenorphine, whereas it extended to 9.17 ± 3.49 hours (550.2 ± 209.4 minutes) with Dexmedetomidine. Despite both adjuvants effectively prolonging the sensory block, Dexmedetomidine has significantly longer sensory block duration compared to Buprenorphine.

Rajeev et al. (2024)^[8] explored the effects of adding Buprenorphine to Ropivacaine for USG supraclavicular brachial plexus block in upper limb surgeries. The sensory block duration was 334.33 ± 15.01 minutes with Ropivacaine alone and significantly extended to 606.17 ± 88.29 minutes with the addition of Buprenorphine. The study concluded that sensory block was longer in combination group (Ropivacaine with Buprenorphine) group compared to Ropivacaine group alone. This significant increase demonstrates Buprenorphine's effectiveness in enhancing sensory block duration.

SriLakshmi et al. (2022)^[9] conducted a study comparing the addition of Buprenorphine versus Dexmedetomidine added to 2% lignocaine with adrenaline for brachial plexus blocks in forearm surgeries. The study found that sensory block duration with Buprenorphine group was 409.75 ± 70.94 minutes compared to 298 ± 16.97 minutes in Dexmedetomidine group, concluding that duration of sensory block was significantly longer in Buprenorphine group.

Current Study

In this study, we evaluated the sensory block duration when adding either Buprenorphine or Dexmedetomidine to Ropivacaine in supraclavicular brachial plexus blocks for upper limb surgeries. The study found that the sensory block duration was 641.03 ± 111.204 minutes with Buprenorphine (Group RB) while the same with Dexmedetomidine was 704.97 ± 97.038 with p value of 0.003 indicating statistically significant. In comparison, the addition of Dexmedetomidine (Group RD) resulted in a significantly longer duration, indicating its superior efficacy in prolonging sensory block. This supports with previous findings from Mathew et al. (2018)^[10] and Liu et al. (2018), which also highlighted the superior efficacy of Dexmedetomidine in prolonging sensory block duration. While Buprenorphine effectively extends the sensory block, as supported by studies from Neena et al. (2017) and Rajeev et al. (2024), the effect of Dexmedetomidine is consistently more pronounced. The variability in sensory block duration across studies can be attributed to several factors, including differences in drug dosages, concentrations, administration techniques (such as ultrasound guidance), patient demographics, and surgical conditions. These studies consistently found that adjuvants like Dexmedetomidine and Buprenorphine significantly enhance the efficacy of Ropivacaine, providing prolonged analgesia and improved postoperative pain management.

Duration of Motor Block

A comprehensive review of multiple studies reveals the comparative motor block durations when different adjuvants are supplemented to local anesthetics for supraclavicular brachial plexus blocks, particularly focusing on Dexmedetomidine and Buprenorphine. Each study shows how these combinations affect the duration of motor blocks, contributing to a deeper understanding of their clinical efficacy.

Liu et al. (2018)^[4] compared motor block duration between Ropivacaine with Dexmedetomidine versus Ropivacaine alone for brachial plexus block in upper limb trauma surgery. The study revealed motor block duration of 430.1 ± 35.7 minutes in Dexmedetomidine group Versus 350.1 ± 32.4 minutes in Ropivacaine alone group. The study concluded that motor block duration was significantly longer in Dexmedetomidine with Ropivacaine group compared to Ropivacaine alone group. This significant increase highlights the efficacy of Dexmedetomidine in prolonging the motor block duration.

Mahima et al. (2022)^[5] conducted a study comparing two groups between Dexmedetomidine with Ropivacaine versus Ropivacaine with normal saline in ultrasound-guided parasagittal supraclavicular brachial plexus blocks in upper limb orthopaedic surgeries. The study found that Dexmedetomidine resulted in a longer motor block duration (430.13 ± 11.68 minutes) compared to Ropivacaine with normal saline (298.12 ± 15.36 minutes). The study concluded that motor block was significantly prolonged in Dexmedetomidine group, highlights it's efficacy in prolonging the duration of motor block.

Neena et al. (2017)^[6] evaluated the efficacy of adding Buprenorphine to Ropivacaine versus Ropivacaine with normal saline in upper limb surgeries. The findings indicated that Buprenorphine group had significantly prolonged motor block duration (451.8 ± 57.18 minutes) compared to the normal saline group (320.5 ± 43.62 minutes).

Anshul et al. (2022)^[7] conducted a study to compare the motor block duration of Ropivacaine combined with either Buprenorphine or Dexmedetomidine in supraclavicular brachial plexus blocks. The study found Dexmedetomidine was shown significantly prolonged motor block duration that the motor block duration (11.53 ± 3.99 hours, or 691.8 ± 239.4 minutes) compared to Buprenorphine (9.56 ± 2.48 hours, or 573.6 ± 148.8 minutes), indicating the superior efficacy of Dexmedetomidine in prolonging motor block.

Rajeev et al. (2024)^[8] explored the efficacy of duration of motor block between Buprenorphine with Ropivacaine versus Ropivacaine with normal saline for USG supraclavicular brachial plexus blocks. The study found that Buprenorphine had a considerably longer motor block duration the motor block duration (517.67 ± 103.94 minutes) compared to Ropivacaine with saline (228.67 ± 11.958 minutes). This significant increase highlights the efficacy of buprenorphine in prolonging the duration of motor block.

SriLakshmi et al. (2022)^[9] conducted a study comparing Buprenorphine and Dexmedetomidine as local anaesthetic adjuvants for supraclavicular brachial plexus blocks in forearm surgeries. The study found longer motor block duration in Buprenorphine group which was 349.75 ± 70.94 when compared to 240 ± 17.75 in Dexmedetomidine group. The study concluded that Buprenorphine prolonged motor block longer than Dexmedetomidine.

Current Study

In this study, we evaluated the motor block duration by adding either Buprenorphine or Dexmedetomidine to Ropivacaine in supraclavicular brachial plexus blocks for upper limb surgeries. The study found that Dexmedetomidine group(Group RD) had a substantially longer motor block

duration (689.17 ± 102.111 minutes) compared to Buprenorphine (Group RB) (605.23 ± 101.692 minutes), with a P value of 0.010 indicating statistically significant. This proves that both adjuvants effectively prolong the duration of motor block, but Dexmedetomidine provides a more extended motor block duration compared to Buprenorphine.

The review of the studies indicates that adding Dexmedetomidine or Buprenorphine to Ropivacaine significantly prolongs motor block compared to using Ropivacaine alone. Dexmedetomidine generally provides a longer duration compared to Buprenorphine. These studies found that both adjuvants are effective, but Dexmedetomidine may offer superior prolongation of motor block in supraclavicular brachial plexus blocks for upper limb surgeries.

Duration of Analgesia

A comprehensive review of multiple studies reveals the comparative durations of analgesia when different adjuvants are used with local anesthetics for supraclavicular brachial plexus blocks, particularly focusing on Dexmedetomidine and Buprenorphine. Each study describes how these combinations affect the duration of analgesia, contributing to a deeper understanding of their clinical efficacy.

Liu et al. (2018)^[4] This study investigated the duration of analgesia between Ropivacaine with Dexmedetomidine versus using Ropivacaine alone for brachial plexus block in upper limb trauma surgery. The study found that combination group experienced longer analgesia duration (590.2 minutes) compared to the Ropivacaine alone group (532.1 minutes) which is significant statistically. This suggests that Dexmedetomidine prolong duration of analgesia of Ropivacaine, providing more extended postoperative pain relief.

Mahima et al. (2022)^[5] conducted a randomized single-blinded prospective clinical study to evaluate the effects of adding Dexmedetomidine to Ropivacaine for ultrasound-guided supraclavicular brachial plexus blocks. The study revealed that the addition of Dexmedetomidine significantly prolonged the analgesic duration to 646.82 minutes, whereas the Ropivacaine-alone group had 484.78 minutes. This further supports the beneficial role of Dexmedetomidine in extending the duration of analgesia when used with Ropivacaine.

Neena et al. (2017)^[6] evaluated the analgesic efficacy of adding Buprenorphine to 0.5% Ropivacaine in USG supraclavicular brachial plexus blocks. The study shows that the group receiving Buprenorphine experienced a significantly longer mean duration of analgesia (868.2 ± 77.8 minutes) compared to Ropivacaine alone group (439.3 ± 51.19 minutes). This substantial increase demonstrates the effectiveness of buprenorphine as an adjuvant to Ropivacaine for prolonged analgesia.

Anshul et al. (2022)^[7] conducted clinical study to assess the analgesic effects of 0.5% Ropivacaine combined with either Dexmedetomidine or Buprenorphine in supraclavicular brachial plexus blocks. The study found that the Dexmedetomidine group experienced a longer duration of analgesia (10.17 ± 2.88 hours) when compared to Buprenorphine group (8.14 ± 2.31 hours) for postoperative analgesia. The study concluded that while both adjuvants extend analgesia duration, Dexmedetomidine provides a longer duration of analgesia compared to Buprenorphine.

Rajeev et al. (2024)^[8] explored analgesia duration between Buprenorphine with Ropivacaine versus Ropivacaine with normal saline for USG supraclavicular brachial plexus blocks. The study concluded that Buprenorphine had a substantially longer duration of analgesia (687.83 ± 19.059 minutes) compared to Ropivacaine with saline (317.50 ± 15.57 minutes).

SriLakshmi et al. (2022)^[9] conducted a study comparing Buprenorphine and Dexmedetomidine as adjuvants to local anaesthetic for brachial plexus blocks. The study revealed



that duration of analgesia in Buprenorphine group was 420.00 ± 70.85 minutes when compared to 308.50 ± 17.76 minutes in Dexmedetomidine group. The study found that duration of analgesia was significantly longer in Buprenorphine group compared to Dexmedetomidine group.

Current Study

The duration of analgesia for the Dexmedetomidine (group RD) was 761.31 ± 129.16 minutes and in Buprenorphine (group RB) the analgesia duration was 701.13 ± 121.14 minutes with a p value of 0.024 indicating statistically significant. The study concluded that duration of analgesia was longer in Dexmedetomidine group compared to Buprenorphine group.

The studies collectively highlight the benefits of using adjuvants such as Dexmedetomidine and Buprenorphine to prolong the analgesia in brachial plexus blocks. Both adjuvants significantly enhance local anesthetics analgesic effects, with Dexmedetomidine providing a longer duration compared to Buprenorphine in some cases. These combinations can improve patient outcomes by prolonging postoperative analgesia.

Side Effects

A comprehensive review of multiple studies reveals the adverse effects of different adjuvants added to various local anesthetics for supraclavicular brachial plexus blocks, particularly focusing on Dexmedetomidine and Buprenorphine. Each study evaluates the safety and adverse reactions of these combinations, contributing to a deeper understanding of their clinical implications.

Liu et al. (2018)^[4] studied the effects of Ropivacaine combined with Dexmedetomidine versus Ropivacaine alone for brachial plexus block in upper limb trauma surgery. The study found that the Dexmedetomidine group experienced significantly lower heart rate and mean arterial pressure, higher peripheral capillary oxygen saturation, and fewer adverse reactions overall.

Mahima et al. (2022)^[5] conducted a comparative study by adding Dexmedetomidine to Ropivacaine compared to Ropivacaine with normal saline in upper extremity orthopedic surgeries. The study found that there were no significant side effects in either group, indicating that Dexmedetomidine can be safely added to Ropivacaine without increasing the risk of adverse reactions.

Neena et al. (2017)^[6] evaluated the effects of adding Buprenorphine to Ropivacaine in comparison to Ropivacaine with normal saline in USG supraclavicular brachial plexus blocks in upper limb procedures. The study report no specific side effects, but it highlighted the overall safety of Buprenorphine as an adjuvant, noting no significant adverse reactions.

Anshul et al. (2022)^[7] conducted a comparative study between Ropivacaine combined with either Buprenorphine or Dexmedetomidine in supraclavicular brachial plexus blocks. The study found that while both groups presented with some side effects, the Dexmedetomidine group had fewer adverse reactions overall compared to the Buprenorphine group. This study concluded that Dexmedetomidine may be safer.

Rajeev et al. (2024)^[8] conducted a study to evaluate the effects between Ropivacaine alone and Ropivacaine with Buprenorphine. Although the study focussed on sensory and motor block efficacy, the study noted a higher incidence of nausea and vomiting in the Buprenorphine group.

SriLakshmi et al. (2022)^[9] conducted a study comparing between Buprenorphine versus Dexmedetomidine as adjuncts to 2% lignocaine with adrenaline in forearm surgeries. The study reported that Buprenorphine showed a higher incidence of side effects, such as nausea and vomiting, compared to Dexmedetomidine.

In this study we evaluated the side effects of adding either Buprenorphine or Dexmedetomidine to Ropivacaine in supraclavicular brachial plexus blocks for upper limb surgeries. There was a clear difference in side effects across groups. In Group RD (Dexmedetomidine), there were no side effects. Conversely, in Group RB (Buprenorphine), there were 4 cases of vomiting, accounting for 13.3% of the group. The P value of 0.03 shows significant group difference. These findings suggest that Dexmedetomidine may be safer compared to Buprenorphine, particularly in terms of reducing the risk of some side effects such as vomiting.

CONCLUSION

This study concludes that both Buprenorphine and Dexmedetomidine are effective adjuvants to 0.5% Ropivacaine in ultrasound-guided supraclavicular blocks for elective upper limb surgeries. Compared to Ropivacaine alone, the addition of these adjuvants significantly prolongs the duration of sensory and motor blocks, as well as postoperative analgesia. Among the two, Dexmedetomidine demonstrates prolonged duration of sensory and motor blocks, prolonged duration of analgesia and fewer mild adverse effects compared to Buprenorphine which has faster sensory and motor block onset time. Therefore, Dexmedetomidine is recommended as the preferred adjuvant for improving regional anesthesia in upper limb surgeries, while Buprenorphine remains a viable alternative, particularly in cases where Dexmedetomidine may be contraindicated or unavailable.

Summary

In our study, comparing Ropivacaine plus Buprenorphine group (RB) with Ropivacaine with Dexmedetomidine (RD) group in ultrasound-guided supraclavicular brachial plexus block, we found:

1. Sensory and motor block onset time was significantly faster in Ropivacaine with Buprenorphine (RB) group compared to Ropivacaine with Dexmedetomidine (RD) group.
2. Statistically significant increase in the sensory block duration in the Ropivacaine with Dexmedetomidine (RD) group.
3. Statistically significant increase in the motor block duration in the Ropivacaine plus Dexmedetomidine (RD) group.
4. Statistically significant increase in the postoperative analgesia duration in the Ropivacaine plus Dexmedetomidine (RD) group compared to the Ropivacaine plus Buprenorphine (RB) group.
5. No side effects were reported in the Ropivacaine plus Dexmedetomidine (RD) group, but 4 patients (out of 30) had incidents of postoperative vomiting in the Ropivacaine plus Buprenorphine (RB) group.

REFERENCES

- [1] Kooloth RA, Patel SN, Mehta MK. A comparison of 0.5% Ropivacaine and 0.5% Bupivacaine in supraclavicular brachial plexus block. National Journal of Medical Research 2015;5(01):67-70.
- [2] Srihari K, Kumari A, Rajput A, et al. A study to evaluate the effectiveness of bupivacaine (0.5%) versus ropivacaine (0.5%, 0.75%) in patients undergoing upper limb surgery under brachial plexus block. India J Clin Anaesth 2016;4:153-9.
- [3] Singh B, Singh I. Comparison of 0.5% ropivacaine and 0.5% bupivacaine in supraclavicular brachial plexus block for upper limb surgery.



- [4] Liu Z, Jiang M, Xu T, et al. Analgesic effect of Ropivacaine combined with Dexmedetomidine on brachial plexus block. *BMC anesthesiology* 2018;18:1-6.
- [5] Balakrishnaiah MK, Sheshadri KG, Ramegowda S, et al. Dexmedetomidine as an adjuvant to ropivacaine in ultrasound guided brachial plexus block using supraclavicular parasagittal approach for upper limb orthopedic surgeries. *Arch Anesth Crit Care* 2022;8(3):230-5.
- [6] Jain N, Khare A, Khandelwal S, et al. Buprenorphine as an adjuvant to 0.5% ropivacaine for ultrasound-guided supraclavicular brachial plexus block: a randomized, double-blind, prospective study. *Indian Journal of Pain* 2017;31(2):112-8.
- [7] Agarwal A, Singh R, Mittal T. Prospective randomized comparative clinical study of buprenorphine with 0.5% ropivacaine versus dexmedetomidine with 0.5% ropivacaine in peripheral nerve stimulator-guided supraclavicular brachial plexus block. *International Journal of Advanced and Integrated Medical Sciences* 2023;8:14-8.
- [8] Rajeev M, Alkire MT, Hudetz AG, et al. Bibliography current world literature Vol 22 No 5 October 2009. *Anesth Analg* 2009;108:1512-21.
- [9] Sreelakshmi V, Niyaz PV, Nagaraju T, et al. To compare the effects of adding buprenorphine vs dexmedetomidine in patients undergoing forearm surgeries under supraclavicular brachial plexus block. *International Journal of Health Sciences* 2022;6(S1):8488-98.
- [10] Mathew S, Prasad S, Krishna R, et al. Ultrasound guided supraclavicular brachial plexus block using plain ropivacaine and ropivacaine with additives. *Sri Lankan J Anaesthesiol* 2018;26(1):15-21.

