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A COMPARATIVE STUDY BETWEEN TWO DIFFERENT DOSES OF DEXMEDETOMIDINE AS ADJUVANT TO 0.5% LEVOBUPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT **Background & Aims:** The supraclavicular block is a safe and simple technique for providing surgical or postoperative analgesia of the entire upper extremity from the level of the mid-humerus down to the hand. Ultrasound guided supraclavicular brachial plexus block facilitate more accurate and effective method of drug administration. Here we study the comparision of the combination of levobupivacaine (0.5%) with two different doses of dexmedetomidine (0.5 microgram/kg and 1 microgram per kg) in USG guided supraclavicular brachial plexus block." **Materials And Methods:** Sixtyeight patients aged 18 to 65 years belonging to amereican society of anaesthesiology Grade 1& 2 posted for elective surgeries of the midarm, forearm, and hand were enrolled in this prospective randomized control trial and divided randomly into two groups of 32 each by sealed envelope method. Group LD1 received USG guided supraclavicular block with 20 mL Levobupivacaine(0.5%) plus Dexmedetomidine (0.5 microg/kg) diluted to a total of 21 mL and Group LD2 received USG guided supraclavicular block with 20 mL Levobupivacaine (0.5%) + Dexmedetomidine (1 microg/kg) diluted to a total of 21 mL. **Results:** The LD2 group with one microgram per kilogram of dexmedetomidine exhibited faster onset of sensory and motor block, as well as increased durations of sensory block, motor block, and analgesia. One microgram per kilogram of dexmedetomidine produces higher incidence of bradycardia and sedation as compared to 0.5 microgram per kilogram of dexmedetomidine which requires close monitoring. **Conclusion:** Our study concludes that in ultrasound guided supraclavicular brachial plexus block addition of 1 microgram per kilogram of dexmedetomidine as an adjuvant to 20 ml 0.5% Levobupivacaine hastens the onset of sensory block and motor block and increases the duration of sensory and motor block as well as duration of analgesia compared to 0.5 microgram per kilogram of dexmedetomidine as an adjuvant to 20 ml 0.5% levobupivacaine.

KEYWORDS : Supraclavicular Block, Levobupivacaine ,Dexmedetomidine

INTRODUCTION:

Supraclavicular brachial plexus block has evolved into an excellent substitute to general anaesthesia for upper limb surgeries. It curtails the stress response and using minimal anaesthetic drugs it provides intraoperative analgesia along with prolonged postoperative pain relief. Ultrasound guided supraclavicular brachial plexus block facilitate more accurate and effective method of drug administration. Ultrasound technology provides a safe and non-invasive way to visualize tissues, allowing for precise placement and optimal spread of anesthetic drug around nerves. (1)(2)(3)(4) This not only improves pain relief but also minimizes the risk of accidental injection into nerves or blood vessels. Levobupivacaine is used for this study as it has advantages of long acting and less cardiotoxic and neurotoxic.(5)(6)(7)(8)(9) Levobupivacaine has recently been used more for supraclavicular brachial plexus block due to the above-mentioned advantages. The idea behind using an adjuvant with local anaesthetic is to reduce the requirement of analgesics in the post operative period. Various adjuvants have been studied for prolonging the effect of supraclavicular blocks. Alpha 2 adrenoreceptor agonist such as clonidine and dexmedetomidine are the two most commonly used drugs.(10)(11)(12)(13) They have shown sedation, analgesia, sympatholysis, cardiac stabilization and anaesthetic sparing properties. Out of these dexmedetomidine an imidazole compound is eight times more sedative than clonidine. Dexmedetomidine causes analgesia by its action at supraspinal (locus coeruleus) or at spinal level or even at peripheral Alpha 2 receptors by the reduction of transmission of nociceptive stimulus. (14)(15)(16)

This study compares the effects of two different doses of dexmedetomidine as an adjuvant added to 0.5% Levobupivacaine. In our study we are using ultrasound guided technique for supraclavicular brachial plexus block.

In this study we hypothesise that two different doses of dexmedetomidine (0.5 & 1 microgram per kg) are equally effective.

MATERIALS AND METHODS:

- After approval of the institutional Ethical Committee a prospective randomized double-blind clinical study was conducted in 64 patients. The study was registered with clinical trial registry (CTRI registration no 2023/02/050078). Written informed and valid consent were taken. The patients were allocated randomly by sealed envelope method into two groups of 32 each.
- Inclusion criteria were the patients aged between 18 to 65 years of both sexes , American Society of Anesthesiology I-II , scheduled for elective surgeries of the midarm, forearm, and hand under regional anaesthesia.
- Exclusion criteria were, patients who did not consent to the study, age < 18 years and >65 years ,body mass index ≥30 kg/m2 , skin infection at the puncture site, allergy to levobupivacaine and dexmedetomidine, pregnant women, patients on beta blockers having coagulopathies, presence of 1st, 2nd, or 3rd degree heart block, and pre-existing peripheral neuropathy.
- Baseline demographic variables were collected like age, weight, height, BMI, education, occupation, religion, income, address, type of family, socioeconomic status, and co-morbidities , All routine investigations were carried out, detailed history of the patient as well as detailed general and systemic examination was done and Fitness was confirmed. At the time of the pre-anaesthetic check-up, the patients were informed about the Visual Analog Scale (VAS) score.(17) Informed consent was taken from all patients after explaining the procedure. On the operative day, after confirming the nil by mouth status the patient was taken to operation theatre and necessary monitors like chest leads, BP cuff, and Pulse Oximeter probe were attached to the multipara monitor. Pre-operative parameters such as heart rate, mean blood pressure, and oxygen saturation was recorded. Oxygen supplementation was given by Venti mask. Then IV line was be secured with a 20G needle & Ringer lactate was started.
- The supraclavicular brachial plexus block was performed using an

ultrasound machine (SONOSITE) with a high-frequency 6-13 Hz linear probe, under strict aseptic precautions.Patient was lying supine; the head will be turned 45 degrees contralateral. The ultrasound transducer was positioned in the supraclavicular fossa, using a coronal oblique plane to achieve a transverse sectional view of the brachial plexus. Using a 26G needle 2mL of local anaesthetic (1% xylocaine) was injected. Block needle insertion was done using a plane technique, lateral to medial direction towards the brachial plexus. 20 mL of 0.5% Levo-bupivacaine plus dexmedetomidine was injected incrementally to obtain a uniform spread around the plexus according to the groups allowed. Group LD1 was given 20 mL of 0.5% Levobupivacaine combined with 0.5 microg/kg of dexmedetomidine. Group LD2 was given 20 mL of 0.5% Levobupivacaine along with 1 microg/kg of dexmedetomidine.

- Sensory block in the distribution of the Radial nerve was assessed using the cold swab method.Using cold testing [alcohol swab], a 3-point scale was employed:

1 No sensory block [cold sensation felt]
2 Analgesia [patient cannot feel cold but can feel touch]
3 Anaesthesia [patient cannot even feel touch

Motor block was assessed using a 3-point scale:
1 = No motor blockade [normal motor function]
1 = Paresis [reduced motor strength]
2 = Paralysis [complete loss of motor strength]

The period from the end of local anaesthetic administration to the achievement of complete sensory or motor block was described as sensory or motor block onset time.Complete sensory block is defined as a score of 2 on radial nerve territories on the anaesthetic sensory block scale.Complete motor block is defined as the absence of voluntary movements or a scale score of 2.The surgery was allowed to start at a scale score of 2. Failure in establishing the block is defined as a 0 score in both sensory and motor scales even after 20 minutes of block.

If there was any failure in establishing the block, the patient was avoided from further study and was given general anaesthesia.

Intraoperative hemodynamic parameters (heart rate and mean arterial pressure) were recorded every 10 minutes till the end of surgery, then every 4 hours till the administration of rescue analgesia. Pain postoperatively was evaluated using a 10-point Visual Analogue Scale (VAS) every 4 hours until the first administration of rescue analgesia.Tramadol, administered either upon patient demand or when the VAS* score exceeded 4, was given as a slow IV infusion at a dosage of 1 mg/kg following a prior IV injection of 4 mg ondansetron.Side effects of drug and complications of the technique such as hypotension and bradycardia were monitored and appropriately treated.Treatment of choice for hypotension was with IV fluids and vasopressors (If the mean arterial pressure is less than 20% of baseline).

Quantitative data were expressed in form of Mean±SD for statistical analysis. Shapiro-Wilk test was used to test normality. Median and Interquartile ranges were calculated for all non-nominal data.For qualitative data Pearson's chi-square test was used to test the relationship of categorized independent and dependent variables as a test of significance. If the expected number in any cell is less than 5 in a table, Fisher's exact test (Ex 2-sided) was done. All statistical analysis was made using SPSS 20 Windows (Statistical package for Social Science). A $P \leq 0.05$ at a 95% confidence interval was considered statistically significant.

RESULTS

Study population consisted of 64 patients scheduled for elective surgeries of the midarm, forearm, and hand. They were divided into 2 groups of 32 each . Group LD1 was given 20 mL of 0.5% Levobupivacaine combined with 0.5 microg/kg of dexmedetomidine. Group LD2 was given 20 mL of 0.5% Levobupivacaine along with 1 microg/kg of dexmedetomidine.The study was conducted on patients in age group from 18 - 65 years.

Group LD-1 has a mean age of 36.96 years with a standard deviation of 15.42 years, while Group LD-2 has a mean age of 40.87 years with a standard deviation of 15.69 years. The table also presents the t-value (0.633) and p-value (0.301), which likely indicate that the age difference between the two groups is not statistically significant.

Group LD-1, 65% (21 patients) are male and 35% (11 patients) are female. In Group LD-2, 63% (20 patients) are male and 37% (12 patients) are female. The chi-square test statistic is 0.872 with a p-value of 0.111-0.300, which suggests that the sex distribution between the two groups is likely not statistically significant.

Group LD-1 has a mean weight of 60.47 with a standard deviation of 7.45, while Group LD-2 has a mean weight of 59.44 with a standard deviation of 8.89. The table also presents the t-value (0.50) and p-value (0.617), which likely indicate that the weight difference between the two groups is not statistically significant.

Group LD-1 has a mean procedure time of 2.17 hours, and Group LD-2 has a mean procedure time of 2.30 hours. The table also presents the t-value (0.934) and p-value (0.783), which suggests that the difference in procedure time between the two groups is likely not statistically significant.

Group LD-1 has a mean onset time of 12.53 minutes with a standard deviation of 2.15 minutes, whereas Group LD-2 has a faster mean onset time of 9.53 minutes with a standard deviation of 1.39 minutes.The t-value is 6.61 and the p-value is 0.000. A p-value less than 0.05 generally indicates statistical significance, meaning the observed difference is unlikely due to random chance. In this instance, the p-value is significantly below 0.05, providing strong evidence that the difference in onset time between the two groups is meaningful.Therefore, the time to achieve sensory block is faster in Group LD-2 compared to Group LD-1.

Group LD-1 has a mean onset time of 16.5 minutes with a standard deviation of 1.41, whereas Group LD-2 has a faster mean onset time of 13.5 minutes with a standard deviation of 1.46. The t-value is 8.46 and the p-value is 0.000. A p-value less than 0.05 generally indicates statistical significance, meaning the observed difference is unlikely due to random chance. In this case, the p-value is much lower than 0.05 means it was statistically significant.Therefore, the time to achieve motor block is faster in Group LD-2 compared to Group LD-1.

Group LD-1 has a mean duration of 660 minutes with a standard deviation of 69.6, whereas Group LD-2 has a longer mean duration of 760 minutes with a standard deviation of 94.9. The t-value is 4.82 and the p-value is 0.000. A p-value less than 0.05 generally indicates statistical significance, meaning the observed difference is unlikely due to random chance. In this case, the p-value is much lower than 0.05, providing strong evidence that the difference in duration between the two groups is statistically significant.Therefore, the duration of sensory block is longer in Group LD-2 compared to Group LD-1.

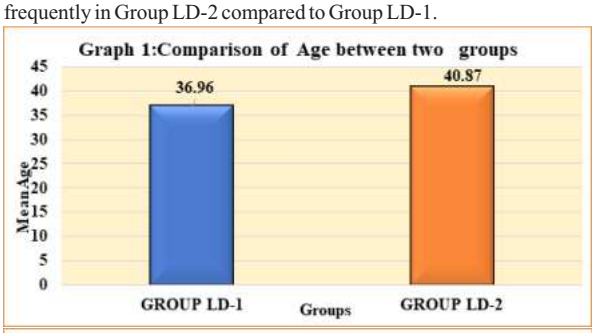
Group LD-1 has a mean duration of 600 minutes with a standard deviation of 69.9, whereas Group LD-2 has a longer mean duration of 740 minutes with a standard deviation of 102.The t-value is 6.41 and the p-value is 0.000. A p-value less than 0.05 generally indicates statistical significance, meaning the observed difference is unlikely due to random chance. In this case, the p-value is much lower than 0.05, providing strong evidence that the difference in duration between the two groups is statistically significant.Therefore, the duration of motor block is longer in Group LD-2 compared to Group LD-1.

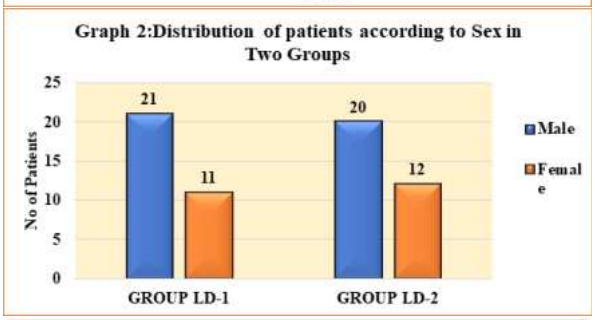
Group LD-1 has a mean post operative analgesia duration of 702 minutes with a standard deviation of 85.6, whereas Group LD-2 has a longer mean duration of 840 minutes with a standard deviation of 132. The t-value is 4.97 and the p-value is 0.000. A p-value less than 0.05 generally indicates statistical significance, meaning the observed difference is unlikely due to random chance. In this case, the p-value is much lower than 0.05, providing strong evidence that the difference in duration between the two groups is statistically significant.Therefore, the duration of post operative analgesia is longer in Group LD-2 compared to Group LD-1.

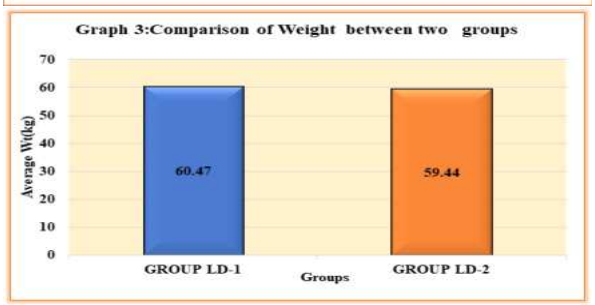
In sedation score P-Value of both group indicate the statistical significance of the difference in medians between the two groups. A p-value below 0.05 is typically regarded as statistically significant, suggesting that the observed difference is probably not due to random chance.The sedation score is not significant at 0 minute, 5 minute 15 minute and 20 minute. From 40 minutes onwards, there are statistically significant differences in sedation scores between the groups (p-value < 0.05) until 1360 minute. This suggests Group LD-2 might have

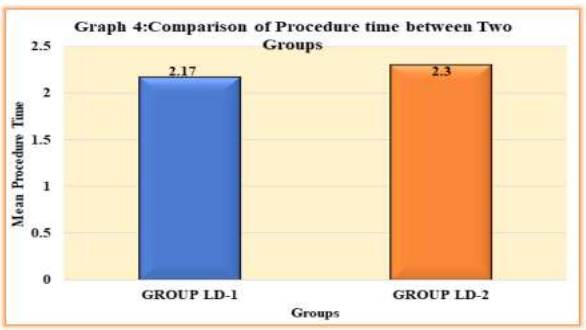
experienced deeper sedation compared to Group LD-1 during this time period.

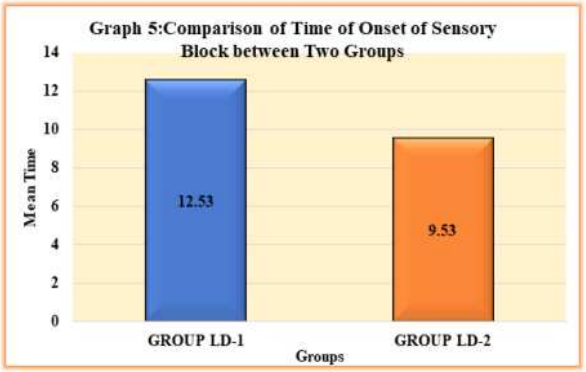
In Group LD1 ,Out of 32 patients 4 patient had bradycardia and none had hypotention, rather In Group LD2 Out of 32 patients 20 patient had bradycardia and none had hypotention. P value indicates the statistical significance of the difference in the number of cases between the two groups for each complication. A p-value less than 0.05 is commonly regarded as statistically significant. Bradycardia occurred more frequently in Group LD-2 compared to Group LD-1.

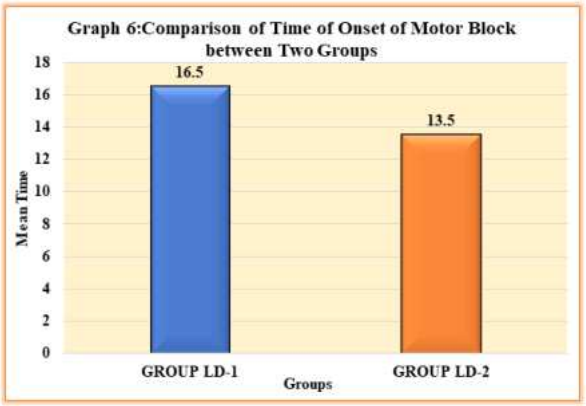


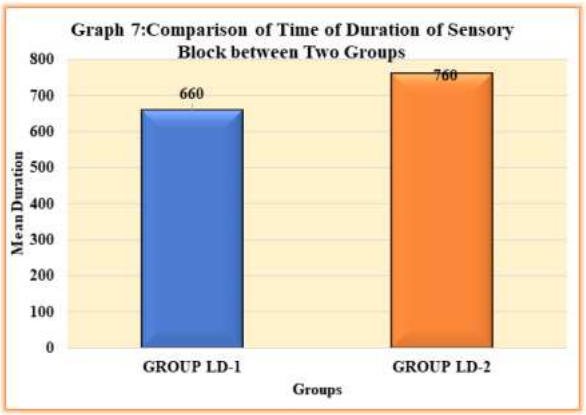


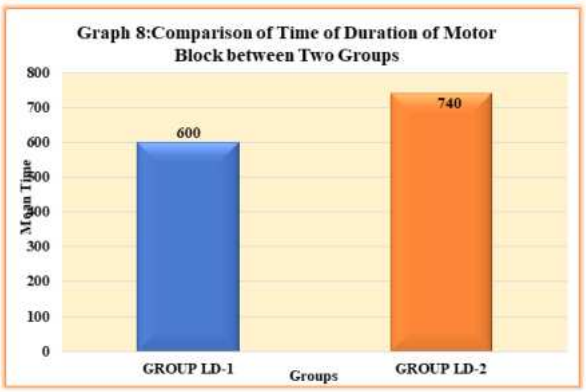


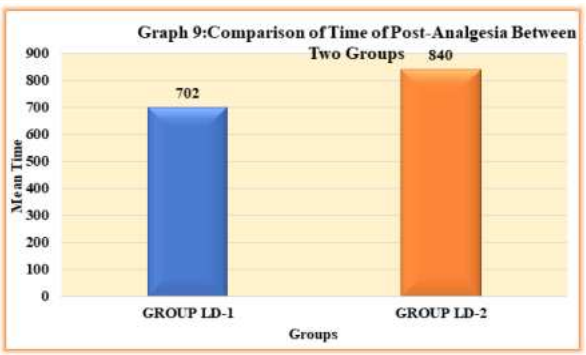












DISCUSSION

Ultrasound guided supraclavicular brachial plexus block has evolved into an excellent substitute to general anaesthesia for upper limb surgeries. It curtails the stress response and using minimal anaesthetic drugs it provides intraoperative analgesia along with prolonged postoperative pain relief. Various adjuvants have been studied for prolonging the effect of supraclavicular blocks. [4] Alpha 2 adrenoreceptor agonist such as clonidine and dexmedetomidine are the two most commonly used drugs. This present study was conducted to study the effect of two different doses 0.5 microgram per kg and 1 microgram per kg of dexmedetomidine added to 20 ml Levobupivacaine. In this study, 80 patients were screened initially,

with 68 patients aged 18-65 years enrolled subsequently. After obtaining permission from the ethical committee and securing patient consent, we divided them into two groups of 34 participants each using convenient sampling. Group LD1 received 20 ml 0.5 % Levobupivacaine with 0.5 microgram per kilogram dexmedetomidine and Group LD2 received 20 ml 0.5% Levobupivacaine with 1 microgram per kilogram dexmedetomidine. If the block failed to establish (defined as achieving a score of 0 on both sensory and motor scales even after 20 minutes), general anaesthesia was administered, and the patient was subsequently excluded from the study.

In our study, the onset of sensory block was 12.53±2.15 minutes in Group LD1 which received 20 ml Levobupivacaine plus 0.5 mcg/kg Dexmedetomidine and in Group LD-2 Levobupivacaine with 1 mcg per kg Dexmedetomidine was 9.53 + 1.39 minutes. The onset time difference between the two groups was statistically significant (P=0.000), with Group LD2 exhibiting a faster onset of sensory block compared to Group Ld1.

Group LD1 received Levobupivacaine with 0.5 mcg/kg Dexmedetomidine, and the onset of motor blockade was 16.5 ± 1.41 minutes. Group LD2, which received Levobupivacaine with 1 mcg/kg Dexmedetomidine, showed an onset of motor blockade at 13.5 ± 1.46 minutes. The onset time difference between the two groups was statistically significant (P=0.000), with Group LD2 demonstrating a quicker onset of motor block compared to Group Ld1.

In our study, Group LD1 exhibited a sensory block duration of 660 ± 69.6 minutes, while Group LD2 showed a duration of 760 ± 94.9 minutes. The duration of sensory block in Group LD2 in our study is comparable with Group I in the former study. LD2 group with 1 microgram per kg of dexmedetomidine provides more duration of sensory block compared to LD1 Group with 0.5 microgram per kg of dexmedetomidine.

In Group LD1 of our study, the motor block duration was 600 + 69.9 minutes, while in Group LD2, it was 740 + 102 minutes. Group LD2 in our study showed a motor block duration comparable to that of Group LD1 in the former study.In LD2 group with 1 microgram per kg of dexmedetomidine provides more duration of motor block compared to LD1 Group with 0.5 microgram per kg of dexmedetomidine.

In Group LD1 of our study, the duration of analgesia is 702 + 85.6 minutes, whereas in Group LD2, it is 840 + 132 minutes.In our study, the duration of analgesia in LD1 group is comparable to Group LD2 in the former study. So we can say that in LD2 group with 1 microgram per kg of dexmedetomidine provides more duration of analgesia compared to LD1 Group with 0.5 microgram per kg of dexmedetomidine.

Group LD2 experienced a higher incidence of bradycardia compared to Group LD1. In our study we found that 4 patients in Group LD1 and 20 patients in Group LD2 had bradycardia. This was statistically significant with p value<0.05. In neither group was there any case of bradycardia requiring administration of Inj. Atropine. The bradycardia in both the groups was not given any treatment because the mean arterial pressure was more than 60 in both groups. So we can say that increased dose of dexmedetomidine can cause bradycardia. We did not encounter any case with hypotension in both LD1 and LD2 group. It was not statistically or clinically significant (p value > 0.05) at all the time intervals from 0 minute to 1600 minutes.

Sedation score was higher in Group LD2 compared to Group LD1. It was significant statistically (p value<0.05.

During our study, neither of the two groups displayed any intraoperative side effects such as nausea, vomiting, or hypotension. No postoperative complications, including local hematoma, nerve injury, pneumothorax, or surgical emphysema, were observed in both groups.

We came across 4 patients in the entire study in which we failed to establish block. The study groups exhibited similarity in demographic characteristics such as age, sex, and weight.

The LD2 group with one microgram per kilogram of dexmedetomidine exhibited faster onset of sensory and motor block, as well as increased durations of sensory block, motor block, and analgesia. One microgram per kilogram of dexmedetomidine produces higher incidence of bradycardia and sedation as compared to 0.5 microgram per kilogram of dexmedetomidine which requires close monitoring.

LIMITATIONS :

Even after using ultrasound-guided techniques, we attributed four cases of block failure, which we believed were due to anatomical variations in those patients and another limitation of our study was the use of fixed dose of Levobupivacaine. Another limitation is monitoring BIS value would have provided objective evaluation of sedation state compared to clinical scoring systems.

CONCLUSION:

Our study concludes that in ultrasound guided supraclavicular brachial plexus block addition of 1 microgram per kilogram of dexmedetomidine as an adjuvant to 20 ml 0.5% Levobupivacaine hastens the onset of sensory block and motor block and increases the duration of sensory and motor block as well as duration of analgesia compared to 0.5 microgram per kilogram of dexmedetomidine as an adjuvant to 20 ml 0.5% levobupivacaine

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