

A Comparative Study of Supraclavicular Brachial Plexus Block using Bupivacaine-Lignocaine and Bupivacaine, Lignocaine with Dexmedetomidine in Patients Undergoing Forearm and Hand Surgery

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Abstract

Introduction: When used with local anaesthetic in different regional blocks, dexmedetomidine lengthens both the duration of the block and the duration of postoperative analgesia. The effectiveness of intrathecal, caudal, and epidural anaesthesia has reportedly been improved by it. Recently, its application in peripheral nerve blocks was described.

Aim and Objectives: To compare the effects of Bupivacaine- Lignocaine and Bupivacaine-Lignocaine with Dexmedetomidine combination in Supraclavicular brachial plexus block

Methodology: This prospective comparative study was conducted between June 2021 to June 2022 on patients undergoing elective upper limb surgery in Al-Falah school of medical science & Research centre Faridabad, Haryana on total of 60 study subjects (30 from each group) who follows inclusion and exclusion criteria, were included in our study.

Result: The mean duration of the motor block in group A was 6.80 ± 0.407 hr, and in group B it was 9.53 ± 0.94 hr. The mean duration of the sensory block in group A was 7.67 ± 0.479 hr, while the mean duration of the sensory block in group B was 11.20 ± 1.24 hr, and there was a significant difference between the two groups, with a p-value of 0.001, when the two groups were compared.

Conclusions: We conclude that there has been a statistically significant lengthening of the sensory and motor block in the dexmedetomidine group. Both groups' hemodynamic parameters fell within the normal range. The Dexmedetomidine group experiences much longer postoperative analgesia. In our study, there were no side effects recorded.

Keywords: Sensory Block, Motor Block, Analgesia, Dexmedetomidine

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Background

In order to prevent the undesirable effects of the anaesthetic medicines used in general anaesthesia, the localised nerve block approach has gained popularity in modern anaesthesia. In many upper limb procedures, perioperative and postoperative analgesia and anaesthesia are provided via supraclavicular brachial plexus blocks. Additionally, it keeps hemodynamic parameters stable without sedation, enabling early mobilisation and discharge from the hospital. A moderate-acting local anaesthetic is a bupivacaine. Dexamethasone, morphine, fentanyl, tramadol, clonidine, and midazolam are examples of adjuncts that are used to extend the effects of bupivacaine in the supraclavicular block [1].

The supraclavicular block is perfect for operations involving the arm and forearm, from the lower humerus to the hand, as it gives a rapid onset of deep anaesthesia of the arm with a single injection. As the brachial plexus is most tightly packed where the C5-T1 nerve roots form trunks, a nerve block at this level offers the greatest chance of obstructing all of the brachial plexus's branches, this leads to quick onset periods and, eventually, great success rates for surgery and analgesia of the upper extremity [2].

To benefit from the qualities of adjuvants and superior quality blocks, a variety of adjuvants are usually added to local anaesthetics. Opioids, steroids, sodium bicarbonate, hyaluronidase, α agonists, neostigmine, magnesium, and adrenalin are among the adjuvants that are frequently employed. Dexmedetomidine has sympatholytic, sedative, hypnotic, anxiolytic, analgesic, anti-shivering, and supports cardio-respiratory stability as well as neuroprotection. It is a highly selective α adrenoreceptor agonist. In a brachial plexus block, many local anaesthetic drugs may be

administered singly or in combination. Combining local anaesthetics, such as lignocaine with bupivacaine, results in a quicker onset of action, a longer duration of the block, and a lower frequency of hazardous side effects. Today's availability of numerous tools, including nerve stimulators, varied-sized needles, and technologies, has made supraclavicular blocks easier, better, and more successful [3].

When used with local anaesthetic in different regional blocks, dexmedetomidine lengthens both the duration of the block and the duration of postoperative analgesia [4]. It is said to increase the effectiveness of intrathecal, caudal, and epidural anaesthesia. Recently, its application in peripheral nerve blocks was described [5,6].

Aim and objective

Bupivacaine-Lignocaine and Bupivacaine-Lignocaine with Dexmedetomidine combination effects on supraclavicular brachial plexus block should be compared. The results were examined in terms of the time that sensory and motor blockage began and persisted, as well as the length of postoperative analgesia.

Materials and methods

A total of 60 study subjects (30 from each group) who adhered to the inclusion and exclusion criteria were included in our prospective comparative study, which was carried out between June 2021 and June 2022 on patients undergoing elective upper limb surgery in Faridabad, Haryana's Al-Falah School of Medical Science & Research Center. The institutional ethical committee granted clearance for the study, and each study participant provided signed informed consent.

Inclusion criteria

1. Patients between the ages of 18 and 60

2. Grades I and II of the ASA
3. Patients having elective surgery on the upper limbs (i.e. Elbow, forearm and hand surgeries.)

Exclusion criteria

1. People who have already experienced bleeding issues.
2. Patients who have a local infection at the block site.
3. People with known neuromuscular conditions.
4. Patients who have difficulty breathing.
5. People who have a known allergy to local anaesthetics.

Methodology

The allocation of 60 patients into groups I and II was done randomly. 15 minutes prior to the operation, all patients received intravenous injections of Fentanyl 0.5 mg/kg and injection of Midazolam 0.05 mg/kg. Basal heart rate, SBP, DBP, and SpO₂ were recorded. The non-operated arm was given an IV cannula of size 18 gauge (G), and lactated Ringer's solution was started. The patient was positioned in a supine position with their head turned to the opposite side when they received the supraclavicular brachial plexus block.

Patients in Group I received 15ml each of 0.5% Bupivacaine and 1% Lignocaine.

Patients in Group II got 15ml of 0.5% Bupivacaine, 15ml of 1% Lignocaine, and 0.75 µg/kg of dexmedetomidine.

The onset and duration of the sensory and motor block were calculated. Pin-prick testing was used to evaluate sensory block on a three-point scale:

- 0 indicates a typical feeling
- 1 indicates a loss of pinprick feeling.
- 2 equals a reduction of touch sensitivity

The modified Bromage scale was used to determine whether there was a motor block:

Grade 0: Full finger, wrist, and elbow flexion and extension and normal motor function

Grade 1: Reduced motor skills with limited finger movement ability

Grade 2: Totally immobile due to motor block, with no finger movement

Pinprick sensation loss was monitored every three minutes after it started, and then every 15 minutes until it stopped. Motor block was evaluated Every three minutes until the loss of movements, and then every 15 minutes until the movements were recovered. Every 15 minutes, HR, SBP, DBP, and SpO₂ were measured. In contrast to the motor block, which is defined as the period of time between the injection of local anaesthetic solution and the loss of movements, the sensory block was defined as the period of time between the administration of local anaesthetic solution and the loss of pin-prick sensation.

Duration of block

Sensory block: The period of time between the cessation of pinprick sensation and its re-emergence.

Motor block: The gap between a movement's loss and restoration.

Using the VAS, which has a scale from 0 to 10, the length of analgesia was measured. This scale was observed every 60 minutes following surgery until it reached. Following then, rescue analgesia was given. The medication used Inj. Diclofenac sodium (1.5 mg/kg) intramuscularly. The administration's time was noted. Throughout the operation and for 48 hours afterwards, all patients were watched for problems (if any). Each patient's observations and specifics were entered into the proforma that was enclosed.

Results

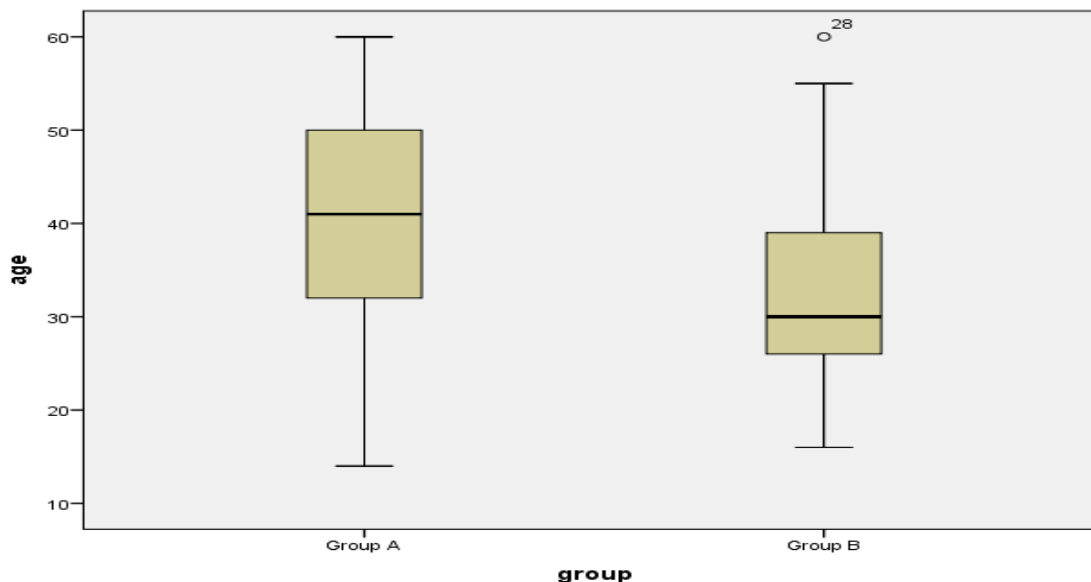


Figure 1: Distribution of study subjects as per age

This boxplot shows the distribution of study subjects as per age. In grp A the mean age of the study subjects was 39.40 ± 13.50 yrs, with a range of 14-60 years. Whereas in grp B the mean age of the study subjects was 33.03 ± 11.07 yrs, on comparing there is a significant difference between the two groups. There is a male predominance in both the group, In group A out of 30 study subjects 22 were male whereas, in group B 23 study subjects were male, and there is no significant difference between the two groups.

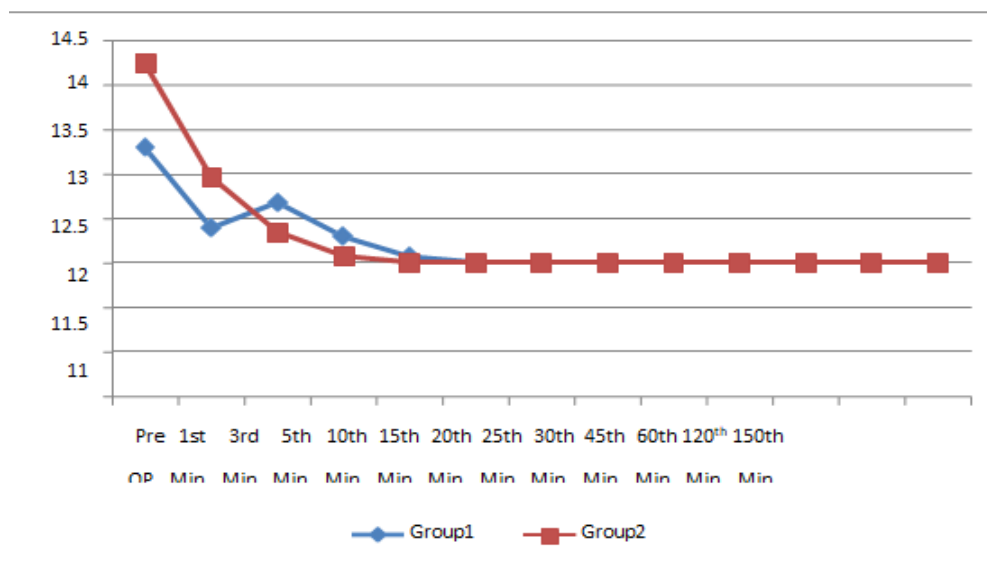


Figure 2: Mean Respiratory Rate at the different time interval

Figure 2 shows the Mean Respiratory Rate at a different time interval, Except pre-operatively respiratory rate at all the time interval had almost similar respiratory rate, for the initial interval, there is some difference, however, this difference is statistically not significant at any of the time interval.

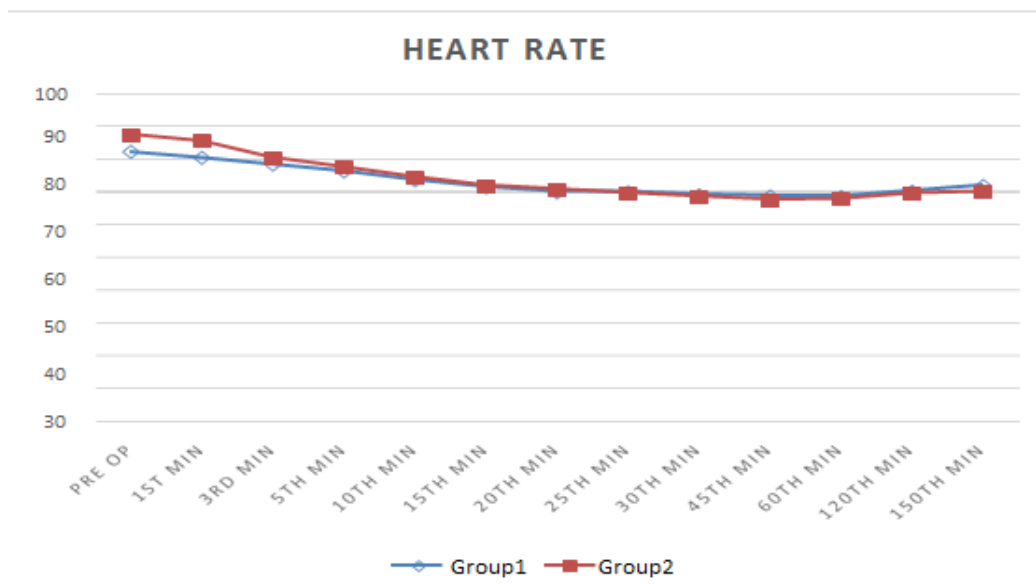


Figure 3: Mean Heart rate at the different time interval

Fig 3 shows the mean Heart rate in both the study groups, The mean heart rate at different time interval in both the study groups had very mild differences with there being a non-significant difference between both the groups at all the time interval.

Table 1: The mean duration of motor block in both the study groups

Group	Mean (hr)	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	T-test applied, t value- 14.67, p-value- <0.001, significant
Group A	6.80	30	.407	.074	6	7	
Group B	9.53	30	.937	.171	7	10	
Total	8.17	60	1.553	.201	6	10	

Table 1 shows the mean duration of motor block in both the study groups, the mean duration of motor block in group A was 6.80±0.407 hr, whereas in group B it was 9.53±0.94 hr, on comparing the two groups there is a significant difference between the two groups, with p value< 0.001

Table 2: The mean duration of sensory block in both the study groups

Group	Mean (hr)	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	T-test applied, t value- 14.54, p-value- <0.001, significant
Group-A	7.67	30	.479	.088	7	8	
Group-B	11.20	30	1.243	.227	8	13	
Total	9.43	60	2.012	.260	7	13	

Table 2 shows the mean duration of sensory block in both the study groups, the mean duration of sensory block in group A was 7.67±0.479 hr, whereas in group B it was 11.20±1.24 hr, on comparing the two groups there is a significant difference between the two groups, with p value< 0.001

Table 3: The mean time for full sensory recovery

Group	Mean (hr)	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	T-test applied, t value- 14.32, p-value- <0.001, significant
Group-A	9.37	30	0.556	0.102	8	10	
Group-B	13.73	30	1.574	0.287	9	16	
Total	11.55	60	2.494	0.322	8	16	

Table 3 shows the mean time for full sensory recovery in both the study groups, the mean time for full sensory recovery in group A was 7.67 ± 0.479 , whereas in group B it was 11.20 ± 1.24 hr, on comparing the two groups there is a significant difference between the two groups, with p value < 0.001

Table 4: The mean time for full motor recovery

Group	Mean (hr)	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	T-test applied, t value- 12.39, p-value- <0.001, significant
Group-A	8.30	30	0.596	0.109	7	9	
Group-B	10.70	30	0.877	0.160	9	12	
Total	9.50	60	1.420	0.183	7	12	

Table 4 shows the mean time for full motor recovery in both the study groups, the mean time for full motor recovery in group A was 8.30 ± 0.596 , whereas in group B it was 10.70 ± 0.877 hr, on comparing the two groups there is a significant difference between two groups, with p value < 0.001

Discussion

This prospective comparative study was conducted between June 2021 to June 2022 on patients undergoing elective upper limb surgery in Al-Falah school of medical science & Research centre Faridabad, Haryana on a total of 60 study subjects (30 from each group) who follows inclusion and exclusion criteria.

The study individuals in our current study in Grp A ranged in age from 14 to 60 years, with a mean age of 39.40 ± 13.50 yr. There is a significant difference between the two groups, with grp B's study subjects having a mean age of 33.03 ± 11.07 years, compared to grp B's 33.03 ± 11.07 years. According to a study by Dr Basim Herez Ali *et al.*[2], mean age was 37.45 ± 10.80 years in group C,

whereas mean age was 34.05 ± 10.0 years in group dexmedetomidine.

There is a male predominance in both groups; group A had 22 male study subjects out of a total of 30, while group B had 23 male study subjects. However, there was no discernible difference between the two groups.

According to a study by Alisha Shreshta *et al.* The male to female ratio was 2.28, with male predominance in both groups being 2.83 for Grade I and 1.87 for Grade II. According to a study by Dr Basim Herez Ali *et al.*[2], males outnumbered females in every group. The use of dexmedetomidine as a supplement to local anaesthetics in a supraclavicular block has lately gained popularity. The alpha-2 agonist dexmedetomidine is more selective for alpha-2 receptors than alpha-1 receptors.

When used in perineural injection in brachial plexus block, it prolongs the efficacy of local anaesthetic drugs without worsening the side effects. Additionally, it has sedative, anaesthetic, analgesic, and hemodynamic stabilising properties. Additionally, it causes a semi-sedative, arousable state.

It takes roughly 5 to 15 minutes for it to start working and lasts for 3 to 4 hours. Dexmedetomidine's mechanism of action is unclear, however, it may be mediated by reduced norepinephrine release and an inhibitory impact on the action potential of nerve fibres that are not dependent on receptors.

Many studies have revealed that DEX is a great option for enhancing the features of peripheral nerve blocks when used as an adjuvant to LA.

In their studies with DEX as adjuvant LA in peripheral nerve block, Choi *et al.* [8] and Brummett *et al.* [9] note that the mechanism of action of DEX was complex. While Masuki *et al.* [10] and Yoshitomi *et al.* [11] and Talke *et al.* [12] explained the effect of DEX as inducing vasoconstriction through its action on 2 adrenoceptors or producing analgesia peripherally by increasing the potassium conduction and decreasing norepinephrine release in C and A-delta neurons, which are responsible for passing on pain stimulus, while it produces analgesia. Except for pre-operatively, all time intervals in our current investigation had respiratory rates that were almost equal. For immediate post-operative, there is some difference, but this difference is statistically insignificant at other time intervals post-operative.

The mean heart rate in both study groups varied only slightly over time, with no statistically significant difference between the two groups at any given time interval. Esmoglu *et al.* study, in which 100 g of dexmedetomidine was combined with bupivacaine, had bradycardia. Due to the decreased Dexmedetomidine dose we employed, there was a lower incidence of bradycardia in our trial. Dexmedetomidine was utilised in our investigation at a dosage of 0.75 µg per kilogramme, up to a maximum of 50 µg. Alisha Shreshtha and colleagues'

study [1] Two patients in Group A had bradycardia, and one had hypertension.

Two patients in Group A and three in Group B became awake throughout the surgery and were put to sleep with 2 mg of intravenous midazolam. In group B, the mean motor block lasted 9.53 hours, compared to 6.80 hours in group A, which indicates a significant difference between the two groups with a p-value of 0.001. In comparison to group B, group A had a mean sensory block duration of 11.20 hours as opposed to 7.67 hours.

This difference between the two groups is significant, with a p-value of 0.001. It shows that Group B experienced complete and effective analgesia for a longer period of time than Group A. Bupivacaine alone and Bupivacaine plus Dexmedetomidine were compared in an ultrasound-guided infraclavicular brachial plexus block, according to Amany S. et al.

They stated that the Dexmedetomidine group had a shorter onset time, longer duration of the motor and sensory block, and first analgesic use was at a lesser interval. Similar effects on the lengthening of sensory and motor blocks' duration were also noted by Aliye Esmoglu *et al.* [4]. Throughout the procedure and for up to 48 hours afterwards, all patients were watched closely for complications. Each patient's observations and specifics were entered into the proforma that was enclosed. In both trial groups, there were no notable side effects.

Conclusions

Based on our study, we draw the conclusion that, as compared to group A, the combination of Bupivacaine, Lignocaine, and Dexmedetomidine had increased sensory and motor block duration and the difference is statistically significant. Both groups' hemodynamic parameters fell within the normal range. The Dexmedetomidine group

experiences much longer postoperative analgesia. No side effects were recorded in both groups.

References

1. Shrestha A. Dexmedetomidine as an adjunct to bupivacaine and xylocaine with adrenaline in ultrasound-guided supraclavicular brachial plexus block in upper limb surgeries. 9(1):25–31.
2. Ali BH, Hussain MF, Isa RJ. Comparative Study Between Dexmedetomidine and Dexamethasone as Adjuvants to Bupivacaine in Supraclavicular Brachial Plexus Block. 2020;11(11):643–9.
3. Modh DB, Parmar M, Solanki S. Effect of dexmedetomidine as adjuvant in the supraclavicular block for upper limb orthopedic surgeries. 2017;4(5):1510–5.
4. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg* 2010;111:1548-51.
5. Obayah GM, Refaie A, Aboushanab O, Ibraheem N, Abdelazees M. Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. *Eur J Anaesthesiol* 2010;27:280-4.
6. Rancourt MP, Albert NT, Cote M, Letourneau DR, Bernard PM. Posterior tibial nerve sensory blockade duration prolonged by adding dexmedetomidine to ropivacaine. *Anesth Analg.* 2012; 115: 958–62.
7. Brown, D.L., Brachial plexus anesthesia: an analysis of options. *The Yale journal of biology and medicine*, 1993; 66(5): 415.
8. Choilly, J.E., *Peripheral nerve blocks: a color atlas*. 2009: Lippincott Williams & Wilkin Brummett CM, Amodeo FS, Janda AM, Padda AK, Lydic R. Perineural dexmedetomidine provides an increased duration of analgesia to a thermal stimulus when compared with a systemic control in a rat sciatic nerve block. *Reg Anesth Pain Med* 2010;35:427-31.
9. Masuki S, Dinunno FA, Joyner MJ, Eisenarch JH. Selective alpha2-adrenergic properties of dexmedetomidine over clonidine in the human forearm. *J Appl Physiol* 2005;99:587-92.
10. Yoshitomi T, Kohjitani A, Maeda S, Higuchi H, Shimada M, Miyawaki T. Dexmedetomidine enhances the local anesthetic action of lidocaine via an alpha-2A adrenoceptor. *Anesth Analg* 2008;107:96-101.
11. Talke P, Chen R, Thomas B, Aggarwall A, Gottlieb A, Thorborg P, Heard S, Cheung A, Son SL, Kallio A. The hemodynamic and adrenergic effects of perioperative dexmedetomidine infusion after vascular surgery. *Anesth Analg.* 2000 Apr;90(4):834-9.
12. Ammar AS, Mahmoud KM. Ultrasound guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. *Saudi J Anaesth* 2012;6:109-14.