International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 12, December 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.12.2024.14

Original Research

Comparative Evaluation Of Levobupivacaine And Levobupivacaine With Dexmedetomidine For Supraclavicular Brachial Plexus Block - A Double-Blind Study

[1]Dr. Milind Thakur, [2]Dr. Parminder Kaur, [3]Dr. Anu Sharma, [4]Dr. Rajan Kumar

[1]Assisstant Professor, [2]Junior Resident, [3]Associate Professor, [4]Professor, Department of Anaesthesia Government Medical College, Amritsar, Punjab, India

Corresponding Author
Dr. Rajan Kumar
[4]Professor, Department of Anaesthesia Government Medical College, Amritsar, Punjab, India
Email: Rajan.Verma.0102@Gmail.Com

Received Date: 19 October, 2024 Accepted Date: 21 November, 2024

Abstract:-
Background-Supraclavicular brachial plexus block (SCB) is a commonly used regional anesthesia technique for upper limb surgeries, providing effective analgesia with fewer systemic complications compared to general anesthesia.
Aims-This study aims to compare the efficacy, onset, duration of action, and safety profile of levobupivacaine alone versus levobupivacaine combined with dexmedetomidine for supraclavicular brachial plexus block in patients undergoing upper limb surgeries.
Method-A double-blind, randomized controlled trial was conducted with 60 patients divided into two groups.
Group A (n=30): 29 ml of 0.5% Levobupivacaine + 1ml Normal saline
Group B (n=30): 29 ml of 0.5% Levobupivacaine + 1ml (100 microgram) Dexmedetomidine.
The primary endpoints included sensory and motor block onset times, block duration, and the need for rescue analgesia. Secondary endpoints assessed hemodynamic stability, adverse effects.
Results-Results showed that the combination of levobupivacaine with dexmedetomidine significantly reduced the onset time of both sensory and motor blocks compared to levobupivacaine alone. The block duration was prolonged in the levobupivacaine-dexmedetomidine group, with a longer analgesic effect and reduced requirement for postoperative analgesia. Hemodynamic parameters were stable in both groups, with no significant differences in side effects.
Conclusion-The combination of dexmedetomidine with levobupivacaine provided superior analgesia, faster onset, and extended block duration, while maintaining a comparable safety profile. This study supports the use of levobupivacaine with dexmedetomidine as an effective and safe alternative for supraclavicular brachial plexus blocks.

Introduction

Pain is multifaceted experience that includes sensory and discriminative affective aspects.[1] The International Association for the Study of Pain gave a definition for pain, i.e., "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."[2]

Obstruction in the brachial plexus pathway shows frequently renowned approach during the surgery of upper limbs. Here, the branches of nerves start from the neck till the axillary. The upper limbs region comprises both the sensory as well motor fibers. The foundation for regional type remains the knowledge of complex brachial plexus but these are placed in a particular manner above the clavicle. Even the chance of achievement is more in this type. This obstructs the ulnar nerve as well as the musculocutaneous nerve, i.e., sometimes being left via interscalene approach or via axillary method.[3]

The brachial plexus, which is formed by the anterior rami starting from fifth cervical vertebrae till first thoracic vertebrae, comprising cervical vertebrae and travels between the frontal and intermediate muscles of scalene. It then divides into upper, intermediate & lower

DOI: 10.69605/ijlbpr_13.12.2024.14

trunks. Each branch is again sub-divided into frontal & back terminals, which join together resulting in sideways, back & medial cords. As the brachial plexus travels down towards the clavicle, it can be obstructed using the anesthesia above the clavicle. This approach is often targeted at the division level, although it can block the brachial plexus from the distal trunks to the proximal cords. The supra-clavicular method is generally used in initial cases of regionally anesthezing at the time of surgery or after the surgical pain has been managed for upper limbs. It typically provides analgesia at middle of humerus till hands, but in some cases distal terminals, like the ulnar nerve, may be out of danger.[4]

Bupivacaine is extensively used LA for regional type of anesthesia. It is present as racemic solution with 2 isomers, levobupivacaine, S (−) and dextrobupivacaine, R (+) type. Many CNS & CVS complications are seen after i.v. injection or i.v. regional form of anesthesia is related with that of dextrobupivacaine isomer. Levo-bupivacaine represents quite good results along with lowered CVS & CNS complications.[5]

Dexmedetomidine given perineural increases the time for obstructing the sensation in the peripheries. In-vivo studies done in the animal revealed that this increases the time of sensation being felt along with the motor obstruction. But in-vitro studies among humans had revealed longer time for obstruction as well as analgesia after the surgery when used with different other methods for obstruction.[6, 7] Hence; it came to an end revealing comparatively evaluating the efficacy of levobupivacaine and levobupivacaine with dexmedetomidine for supraclavicular brachial plexus block.

Materials & methods

60 patients posted for upper limb surgery at Government Medical College Amritsar were taken for this study. Patients were randomly allocated into two groups A, and B of 30 each who belongs to ASA I, II. A double blinded study was conducted. The present study was done by making 60 coded slips. The person performing the procedure was prepare the solution and the observer were blinded to the drug solution injected.

Group A (n=30): 29 ml of 0.5% Levobupivacaine + 1ml Normal saline

Group B (n=30): 29 ml of 0.5% Levobupivacaine + 1ml (100 microgram) Dexmedetomidine

A detailed preanesthetic checkup was performed a day before surgery. Details pertaining to the patient's clinical history, general physical and systemic examinations was taken. Assessment of patients airway was done. Patients were instructed to fast for 6-8 hours for semi-solids and solids and 2-4 hours for clear fluids before surgery. Patients were explained in their own vernacular language about the supraclavicular brachial plexus block and linear visual analogue score using a 10 centimeter line, where 0 denoted "no pain" while 10 "worst pain imaginable". The patients were asked to mark the severity of pain experienced at that time in the postoperative period. Rescue analgesia was given if VAS score is >3.

Intravenous line was secured with 20 G angiocath. Patient was preloaded with Ringer Lactate solution. Multivital monitor was attached. Baseline parameters such as respiratory rate, pulse rate, non invasive blood pressure, SPO2, and ECG was recorded and continuous monitoring of baseline parameters was done. Double blinding was done. Anesthesiologist performing the sensory and motor block was different from the anesthesiologist preparing the drugs. For the performance of block, the patient was made to lie in supine position, arms by the sides and head turned 45 degrees to the contralateral site. Ipsilateral arm was abducted and the hand to extended toward the same knee as far as possible. Downward displacement of the shoulder facilitates the palpation of the landmarks. The area was cleaned with povidone iodine solution and draped properly. Midpoint of clavicle was identified and marked. The palpation of the posterior border of sternocleidomastoid muscle was done easily by having the patient briefly lift his /her head. Afterwards, by palpating the belly of anterior scalene muscle by moving towards interscalene groove with the fingers, a mark at approximately 1.5 to 2 cm posterior to the mid point of the clavicle was made. Landmark was confirmed by palpating the subclavian artery. A skin wheal was raised at entry point with 2 ml of 2% of xylocaine solution.

An insulated needle compatible with nerve stimulator was inserted. After inserting the needle contractions was elicited with the help of peripheral nerve stimulator starting from 2.0mA and going down to 0.5mA at a frequency of 1- 2Hz.When the contractions was elicited at a current of 0.5mA at this point needle was fixed and local anaesthetic solution was injected after repeated aspiration. IN GROUP A, 29 ml of 0.5% of levobupivacaine and 1 ml normal saline mixture was used. IN GROUP B, 29 ml of 0.5% of levobupivacaine and 1 ml (100 microgram) of dexmedetomidine mixture was used. The Anesthesiologist performing the block were blinded to the study drug. The following characteristics of the block was observed: Onset of sensory block: time elapsed between injection of drug and complete loss of pin prick sensation.

Sensory block assessment by Hollmen scale was used:

1. Normal sensation of pin prick
2. Pin prick felt as sharp pointed but weaker compared with the same area in other limb
3. Pin prick recognized as touch with blunt object
4. No perception of pin prick

The sensory block of grade 3 was considered beginning for surgery. Onset of motor block: time elapsed

DOI: 10.69605/ijlbpr_13.12.2024.14

between injection of drug to complete motor block. Motor block assessment by Bromage Scale was done.

0	Normal motor function
1	Decrease motor strength with ability to move fingers only
2	Complete motor block with inability to move fingers

The assessment of sensory block was done by loss of sensation to pin pricks using 27 gauge blunt hyperdermic needle every 3 minutes upto 30 minutes after injecting the drug, then every 30 minutes intra operatively, then hourly till the motor and sensory blockade effects resolve completely. The degree of motor block was assessed at the same interval by modified bromage scale. After establishment of block, surgery was started and time of beginning of surgery to be noted. Pulse, BP, SPO2, ECG monitoring every half hourly was done. Duration of sensory block: time elapsed between injection of drug and return of pin prick sensation. Duration of motor block: time elapsed between injection of drug to complete return of motor power. Duration of analgesia: from the time when block was performed and time for first administration of rescue analgesia.

Failed block- if occurred, was given general anaesthesia with endotracheal intubation was required in these patients. These patients were excluded from the result calculation Postoperative pain was evaluated using VAS (visual analog scale (0 -10) will be recorded at 2hrs, 4hrs, 6hrs, 8hrs, 12hrs, and 24hrs after the surgery.

Ramsay Sedation score:

1. Patient is anxious and agitated or restless or both.
2. Patient is cooperative,'oriented and tranquil.
3. Patient responds to commands only.
4. Patient exhibits brisk response to light glabellar tao pr loud auditory stimulus.
5. Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus.
6. Patient exhibits no response.

All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

Results

Mean age of the patients of group A and group B was 37.7 years and 35.7 years respectively. Both the groups were comparable in terms of gender-wise distribution.

Onset of sensory block-Mean onset of sensory block among patients of group A and group B was 11.03 minutes and 6.3 minutes respectively. While comparing the results, significant results were obtained.

Onset of motor block-Mean onset of motor block among patients of group A and group B was 12.6 minutes and 8.03 minutes respectively. While comparing the results, significant results were obtained.

Duration of sensory block- Mean duration of sensory block among patients of group A and group B was 8.8 hours and 17.5 hours respectively. While comparing the results, significant results were obtained.

Duration of motor block-Mean duration of motor block among patients of group A and group B was 7.8 hours and 16.1 hours respectively. While comparing the results, significant results were obtained.

Duration of analgesia- Mean duration of analgesia among patients of group A and group B was 12.73 hours and 21.87 hours respectively. While comparing the results, significant results were obtained.

Hemodynamics-While comparing the SBP among the two study groups, it was seen that mean SBP and DBP showed a significant decline among the patients of group B in comparison to Group A at different time intervals.

Sedation score- Mean sedation score among the patients of group A and group B was 2.2 and 4.1 respectively. Significant results were obtained while comparing the mean sedation score among the patients of the two study groups.

VAS score-Mean VAS among the patients of group B was significantly lower in comparison to patients of group B.

Analgesic requirement-Mean time to first analgesic requirement among the patients of group A and group B was 101.8 minutes and 239.1 minutes respectively. While comparing the results statistically, significant results were obtained.

Total dose of postoperative analgesic required among patients of group A and group B was 75 doses and 28 doses respectively. Significant results were obtained while comparing the total dose of postoperative analgesia required among the patients of the two-study group. Hypotension, Sedation and bradycardia was significantly higher among patients of group B.

DOI: 10.69605/ijlbpr_13.12.2024.14

Table 1: Onset of sensory block

Onset of sensory block (mins)	Group A	Group B
Mean	11.03	6.3
SD	1.56	1.93
p-value	0.001 (Significant)	

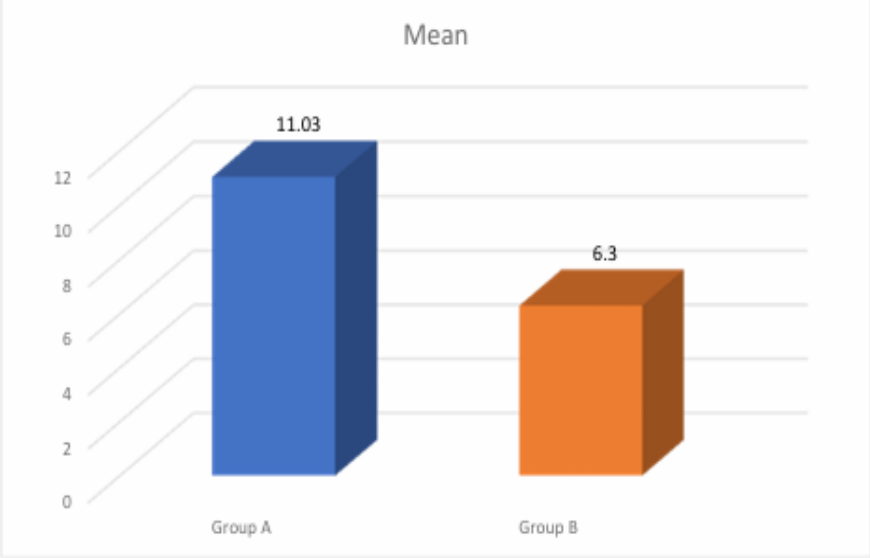
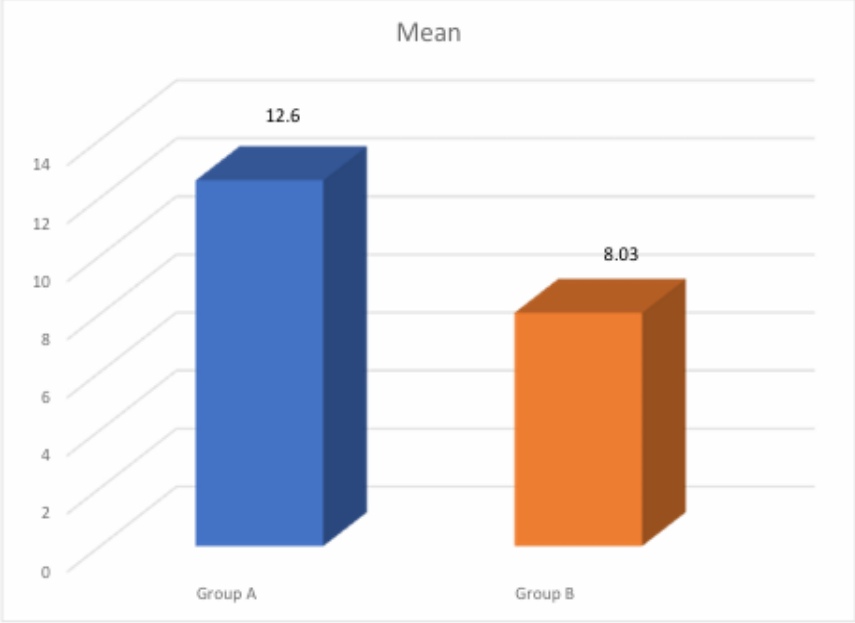


Table 2: Onset of motor block

Onset of motor block (mins)	Group A	Group B
Mean	12.6	8.03
SD	1.33	1.71
p-value	0.017 (Significant)	



DOI: 10.69605/ijlbpr_13.12.2024.14

Table 3: Duration of sensory block

Duration of sensory block (hours)	Group A	Group B
Mean	8.8	17.5
SD	1.45	2.08
p-value	0.003 (Significant)	

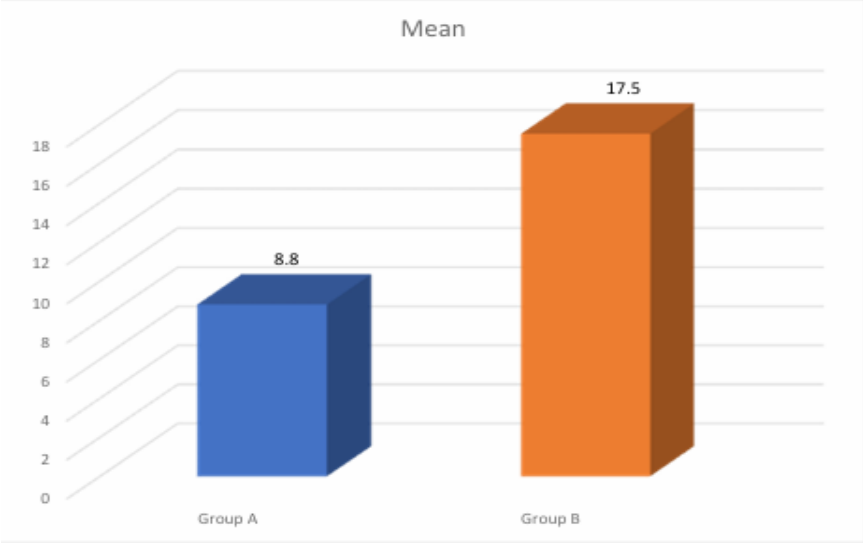


Table 4: Duration of motor block

Duration of motor block (hours)	Group A	Group B
Mean	7.8	16.1
SD	1.44	1.72
p-value	0.000 (Significant)	

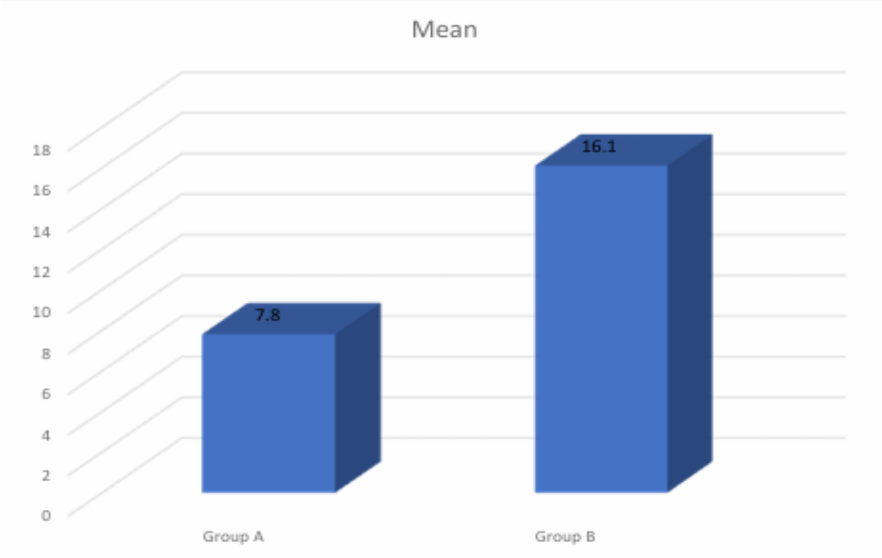


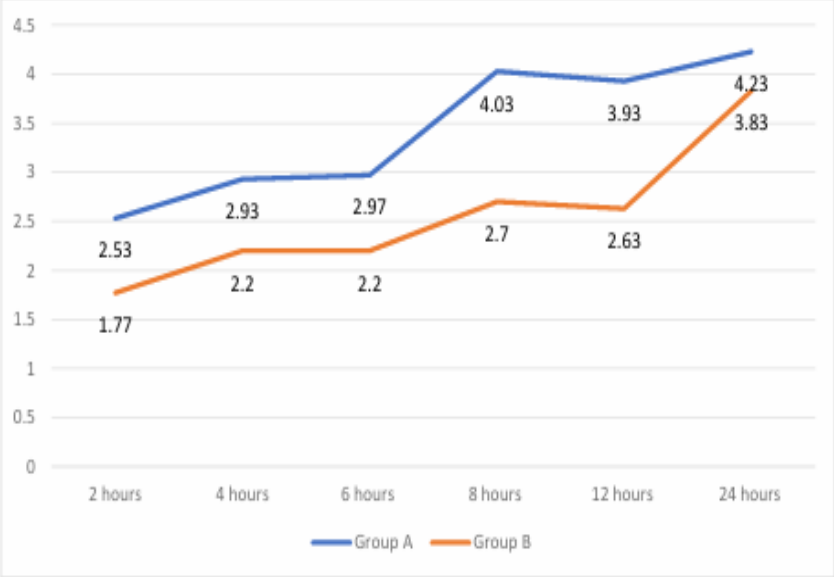
Table 5: Comparison of VAS at different time intervals

Time interval	Group A		Group B		p-value
	Mean	SD	Mean	SD	
2 hours	2.53	0.51	1.77	0.62	0.89
4 hours	2.93	0.25	2.20	0.81	0.00*

DOI: 10.69605/ijlbpr_13.12.2024.14

6 hours	2.97	0.32	2.20	0.81	0.00*
8 hours	4.03	0.96	2.70	1.09	0.00*
12 hours	3.93	0.69	2.63	0.62	0.00*
24 hours	4.23	0.56	3.83	0.91	0.044*

*: Significant



Discussion

Mean onset of sensory block among patients of group A and group B was 11.03 minutes and 6.3 minutes respectively. While comparing the results, significant results were obtained. In a similar study conducted by Kaur M et al, mean onset of sensory block among patients of Levobupivacaine group and Levobupivacaine + Dexmedetomidine group was 10.175 minutes and 6.913 minutes respectively (p-value < 0.05).[9] Ghazaly et al, in a similar study, reported that among patients of the Levobupivacaine group and Levobupivacaine + Dexmedetomidine group mean onset of Sensory block was 18.05 minutes hours and 12.4 minutes respectively (p-value < 0.05).[10]

Mean onset of motor block among patients of group A and group B was 12.6 minutes and 8.03 minutes respectively. While comparing the results, significant results were obtained. In a similar study conducted by Kaur M et al, mean onset of motor block among patients of Levobupivacaine group and Levobupivacaine + Dexmedetomidine group was 11.138 minutes and 8.075 minutes respectively (p-value < 0.05).[8] Ghazaly et al, in a similar study, reported that among patients of the Levobupivacaine group and Levobupivacaine + Dexmedetomidine group mean onset of motor block was 20.75 minutes hours and 13.75 minutes respectively (p-value < 0.05).[10]

Mean duration of sensory block among patients of group A and group B was 8.8 hours and 17.5 hours respectively. While comparing the results, significant results were obtained. Similar to our study, in research carried out by Biswas S et al, mean duration of sensory block among patients of the Levobupivacaine group and Levobupivacaine + Dexmedetomidine group was 10.75 hours and 14.97 hours respectively (p-value < 0.05).[11]

Mean duration of motor block among patients of group A and group B was 7.8 hours and 16.1 hours respectively. While comparing the results, significant results were obtained. Similar to our study, Singh AP et al, also reported significantly higher duration of motor block for patients of Levobupivacaine + Dexmedetomidine group (17.52 hours) in comparison to patients of levobupivacaine group (9.18 hours).[11]

By preventing sodium ions from passing through ion-selective sodium channels in the neuronal membranes, levobupivacaine causes conduction blockade, which stops the transmission of nerve impulses. When a local anesthetic is combined with an a-2 agonist such as dexmedetomidine, it causes vasoconstriction in the area around the injection site. This ultimately delays the absorption of the local anesthetic and increases the amount of levobupivacaine at the site of action. Dexmedetomidine causes an a2-receptor independent inhibitory impact on nerve fiber action potentials and decreases norepinephrine release in peripheral adrenoceptors. When combined, the distinct mechanisms of action of the two medications can have an additive impact, delaying the onset of sensory and motor blockage (Hariharsasudhan B et al).[12]

DOI: 10.69605/ijlbpr_13.12.2024.14

Mean duration of analgesia among patients of group A and group B was 12.73 hours and 21.87 hours respectively. While comparing the results, significant results were obtained. Similar findings were reported in the study conducted by Singh AP et al who reported significantly higher duration of analgesia among patients of Levobupivacaine + Dexmedetomidine group (21.2 hours) in comparison to patients of Levobupivacaine group (11 hours).[11] Similar to our study, in the study carried out by Kaur M et al, total duration of analgesia among patients of Levobupivacaine group (11.66 hours) was significantly shorter in comparison to the patients of the Levobupivacaine + Dexmedetomidine group (16.6 hours) (p-value < 0.05).[9]

Dexmedetomidine inhibits sympathetic activity by postsynaptic activation of a2-receptors thereby decreasing HR and BP. Persistence of bradycardia is attributed to central sympathetic inhibition. The normal baraoreceptor response and HR reflex to a vasopressor agent is however preserved with the use of dexmedetomidine thereby conferring feasibility to clinically tackle and treat hypotension and bradycardia providing haemodynamic control (Zhang X et al).[13] A similar observation with lower mean HR, SBP, and DBP in the dexmedetomidine group was also encountered by Agarwal S et al., on evaluating the efficacy of adding dexmedetomidine to bupivacaine in supraclavicular brachial plexus block.[14]

Mean sedation score among the patients of group A and group B was 2.2 and 4.1 respectively. Significant results were obtained while comparing the mean sedation score among the patients of the two study groups. In a similar study conducted by Ghazaly et al, authors reported that patients in the Levobupivacaine + Dexmedetomidine group were more sedated than those in the Levobupivacaine groups.[10] A study by Reddy found that the Levobupivacaine + Dexmedetomidine group experienced significantly more sedation than the Levobupivacaine group.[15] Furthermore, Balakrishnan et al found a significant increase in sedation scores in the Levobupivacaine + Dexmedetomidine group compared with those in Levobupivacaine + group.[16]

Mean VAS among the patients of group A was significantly lower in comparison to patients of group B. Ghazaly et al, in a similar study, reported that the postoperative VAS score in the Levobupivacaine + Dexmedetomidine group was lower than that in the Levobupivacaine group .[10]

Mean time to first analgesic requirement among the patients of group A and group B was 101.8 minutes and 239.1 minutes respectively. While comparing the results statistically, significant results were obtained. Ghazaly et al, in a similar study, reported that among patients of the Levobupivacaine group and Levobupivacaine + Dexmedetomidine group mean time of first rescue analgesic requirement was 376.2 minutes and 730.8 minutes respectively (p-value < 0.05).[10]

Total dose of postoperative analgesic required among patients of group A and group B was 75 doses and 28 doses respectively. Significant results were obtained while comparing the total dose of postoperative analgesia required among the patients of the two-study group. Similar to our study, in the studies carried out by Kaur M et al and Ghazaly et al, total rescue analgesia requirement among patients of Levobupivacaine group was significantly higher in comparison to the patients of the Levobupivacaine + Dexmedetomidine group (p-value < 0.05).[9, 10] Reddy et al reported that rescue analgesia in the form of diclofenac sodium injection was required in 15 percent of the patients in the 100-µg group.[17]

Conclusion

When used in conjunction with levobupivacaine, perineural infiltration of dexmedetomidine lengthens the duration of the motor and sensory blocks. It shortens the onset time. The length of time the analgesia lasts is so great that no more analgesics are required. It is potentially an adjuvant for nerve blocks due to its minimal adverse effects, hemodynamic stability, and additional benefit of conscious sedation.

References

1. Anand KJ, Craig KD. New perspectives on definition of pain. Pain 1996;67:3-6.
2. Morgan and Mikhail's Clinical Anesthesiology, 5thedition New York: McGraw Hill Company 2013;1025-31
3. Kulenkampff D. Brachial Plexus Anaesthesia: Its Indications, Technique, and Dangers. Ann Surg. 1928;87(6):883-91.
4. D'Souza RS, Johnson RL. Supraclavicular Block. [Updated 2023 Jul 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK519056/
5. Bajwa SJ, Kaur J. Clinical profile of levobupivacaine in regional anesthesia: A systematic review. J Anaesthesiol Clin Pharmacol. 2013;29(4):530-539.
6. Takrouri MS, Seraj MA, Channa AB, el-Dawlatly AA, Thallage A, Riad W, et al. Dexmedetomidine in intensive care unit: A study of hemodynamic changes. Middle East J Anesthesiol. 2002;16:587–95.
7. Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Saudi J Anaesth. 2015;9(2):148-154.
8. Biswas S, Das RK, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double blind prospective study. Ethiop J Health Sci. 2014;24(3):203-208.
9. Kaur M, Kaur R, Kaur S, Baghla N, Bansal A, Kalia A, Kumar S, Lall A. A Study to Compare the Analgesic Efficacy of Dexmedetomidine and Fentanyl as

DOI: 10.69605/ijlbpr_13.12.2024.14

Adjuvants to Levobupivacaine in Ultrasound-Guided Supraclavicular Brachial Plexus Block. Anesth Essays Res. 2018 Jul-Sep;12(3):669-673.

10. Ghazaly HF, Aly AAA, Zaher ZZ. 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 Anesthesiol. 2022; 22: 338.
11. Singh AP, Mahindra M, Gupta R, Bajwa SJ. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. Anesth Essays Res. 2016 Sep-Dec;10(3):414-419.
12. Hariharasudhan B, Savithasree S, Mane RS. 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; 15(3): UC06-UC09.
13. Zhang Y, Wang CS, Shi JH, Sun B, Liu SJ, Li P, et al. Perineural administration of dexmedetomidine in combination with ropivacaine prolongs axillary brachial plexus block. Int J Clin Exp Med. 2014;7:680–685
14. Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2014;30(1):36-40.
15. Reddy I, Aasim S, Kumar J. Comparative study of varying doses of dexmedetomidine combined with levobupivacaine in supraclavicular brachial plexus block: a randomized double-blind prospective study. Int J Res Rev. 2018;5:202–207.
16. Balakrishnan S, Kunikkakath S, Jacob KK, Shenoy M. Comparative study on the clinical profile of different doses of dexmedetomidine with levobupivacaine in supraclavicular brachial plexus block. Indian J Clin Anaesth. 2016;3:436.
17. Reddy BS, Gaude YK, Vaidya S, Kini GK, Budania LS, Eeshwar MV. Effect of dexmedetomidine on characteristics of ultrasound-guided supraclavicular brachial plexus block with levobupivacaine-A prospective double-blind randomized controlled trial. J Anaesthesiol Clin Pharmacol. 2021 Jul-Sep;37(3):371-377.