Comparison of the efficacy of bupivacaine versus levobupivacaine in supraclavicular brachial plexus block- A prospective observational study

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ABSTRACT

Aim: To compare the effecticacy of bupivacaine versus levobupivacaine in supraclavicular brachial plexus block

Methods: 120 Patients posted electively for upper limb orthopedic and soft tissue lesion, between the age of 20 and 58 years, weighing above 62 kilograms with ASA Grade I and II were included in the study. The first category was administered 1 ml (100μg) dexmedetomidine with 39 ml of 0.5% Levobupivacaine. The category II was given 1 ml of 0.9% normal saline and 39 ml of 0.5% Levobupivacaine as anesthetic agent. The heart rate, respiratory rate, SBP, DBP, pulse rate and oxygen saturation were monitored and noted immediately on entering the OT. Ringer lactate was started in the already secured intravenous line. Brachial plexus block was applied through the supraclavicular approach.

Results: In the Category I males and females were 61.67% and 38.33% respectively. In Category II, it was 58.33% and 41.67% respectively. There was no statistical significance between the two Category. The mean age in Category I and category II were 34.02 and 35.12 respectively. The mean age in Category I and category II were 64.22 and 63.55 respectively. Both the results were statistically remarkable. All the study participants in Category I did not require post-operative analgesia while all in Category II were given Postoperative analgesia. 26.67% in Category I was slightly drowsy compared to 100% in Category I. Both the results are statistically remarkable. The mean duration of onset of sensory and motor block was nearly 4 min earlier in Category I compared to Category II.(5.44 vs 9.29 min) Onset of motor blockade was also 4 minutes earlier in Category I compared to Category II (8.49 vs 12.39 min). The mean duration of sensory block (548 vs 938 min) and motor block(569 vs 958 min) were 392 minutes lesser respectively between both the Category . The duration post-operative analgesia was 404 min lesser between both the Category (579 vs 979 min). All the results are statistically significant.

Conclusion: dexmedetomidine is more effected as compare to other for upper limb surgeries applying brachial plexus block.

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INTRODUCTION

Supraclavicular brachial block is the popular and widely used nerve block technique for perioperative anesthesia and analgesia for surgery of upper extremity. The block is performed at the level of distal trunks and origin of the divisions, where the brachial plexus is confined to its smallest surface area, thus producing a rapid and reliable blockade of brachial plexus. Local anesthetics are compounds that have the ability to interrupt the transmission of the action potential of excitable membranes by binding to specific

receptors in the Na+ channels. Large volumes of local anesthetics required to produce desirable effects may result in systemic side effects.[1] Levobupivacaine has the duration of action ranging from three to eight hours and hence it is the most commonly used local anesthetic drug.[2] This anesthetic drug has established itself as cheaper and safer for many years.[3] But patchy or incomplete analgesia and delayed onset are few of the practical constraints. Few drugs are added to levobupivacaine in trial to decrease these limitations, to upsurge the quality, prolong the duration of action and analgesia.

To prolong the duration of brachial plexus block and improve the quality, vasoconstrictors like α-adrenergic agonists, hyaluronidase, neostigmine, opioids, can be utilized. But these vasoconstrictors have been found to cause certain side effects. There arise the need to identify the ideal additive and many researchers tried the novel alpha 2 adrenergic agonists.

Alpha 2 adrenergic agonists not only decrease the requirements of intraoperative anesthetic agents, but also they have cardiovascular stabilizing properties, sympatholytic analgesic and sedative property. In order to reduce the time of onset of nerve block, to prolong the duration of block and to improve the quality of blockade, these can be given in peripheral nerve blocks, intrathecal, epidural either alone or with local anesthetic agents.[4]

An $\alpha 2$ receptor agonist, dexmedetomidine, is eight times more sensitive than clonidine.[5,6] Researches have found that dexmedetomidine, when used in many animals and humans had improved the onset and duration of motor/ sensory blockade. When used as an adjuvant to local anesthetic agents in peripheral nerve blocks, it has increased the duration of analgesia.[7-14] The present study was designed to assess the effect of levobupivacaine 0.5% alone and with dexmedetomidine 100μg as an adjuvant to levobupivacaine 0.5% on the onset and duration of sensory and motor block, the duration of perioperative analgesia, complications and sedation score.

MATERIAL AND METHODS

After ethical approval from the institute, this comparative study was done in the department of Anaesthesia.120 Patients posted electively for upper limb orthopedic and soft tissue lesion, between the age of 20 and 58 years, weighing above 62 kilograms with ASA Grade I and II were included in the study. Patients with CKD, pregnant women, hypertension, DM, cerebrovascular accident, COPD, coronary artery disease on anticoagulants, those with history of bleeding disorders, were excluded from the study.

Complete history, body examination and fitness was done for all patients. Complete blood test and other tests like random blood sugar, blood urea, bleeding time, serum creatinine, clotting time, and ECG is mandatory for all the patients. all the patienrs were dived into two equal category.

The first category was administered 1 ml (100μg) dexmedetomidine with 39 ml of 0.5% Levobupivacaine. The category II was given 1 ml of 0.9% normal saline and 39 ml of 0.5% Levobupivacaine as anesthetic agent. The heart rate, respiratory rate, SBP, DBP, pulse rate and oxygen saturation were monitored and noted immediately on entering the OT. Ringer lactate was started in the already secured intravenous line. Brachial plexus block was applied through the supraclavicular approach.

Nerve locator was used for neural localization and it was achieved by connecting to a 22 G, 50-mm-long stimulating needle. The location end point was a distal motor response with an output lower than 0.5 milliamperes in the median nerve region. Local anaesthetic solution in the labelled coded syringe was injected following negative aspiration.

Pin prick method was used to assess the sensory block. Sensory onset was considered when there was dull sensation to pin prick along the distribution of any two of the following nerves like musculocutaneous nerve, radial nerve, median nerve, ulnar nerve. When there was complete loss of sensation to pin prick, we can consider it as complete sensory block. Modified Bromage scale. Motor and sensory blocks were assessed for 30 minutes for every 3 minutes until after injection, and then every 30 minute until they have resolved.[15]

Saturation of oxygen(SpO_2), heart rate, diastolic blood pressure, SBP, were noted at 0, 5, ten, 15, 30, 60, 90 and 120 minutes.

Side effects like HR less than 50% min (bradycardia) and BP less than 20% with respect to resting conditions (hypotension) were treated with appropriate measures. Then we noted the period of motor and sensory blocks once the surgery is started. When the subject's visual analogue score >5, a rescue analgesia like intramuscular diclofenac sodium 75mg (1.5mg/kg) was administered. Ramsay Sedation Scale (RSS) was used to assess the sedation before the block and 15 min then after.

RESULTS

In the Category I males and females were 61.67% and 38.33% respectively. In Category II, it was 58.33% and 41.67% respectively. There was no statistical significance between the two Category. (Table 1)

The mean age in Category I and category II were 34.02 and 35.12 respectively.

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All the study participants in Category Idid not require post-operative analgesia while all in Category IIwere given Postoperative analgesia. 26.67% in Category Iwas slightly drowsy compared to 100% in Category I. Both the results are statistically remarkable.Table.1

The mean duration of onset of sensory and motor block was nearly 4 min earlier in Category Icompared to Category II.(5.44 vs 9.29 min) Onset of motor blockade was also 4 minutes earlier in Category Icompared to Category II (8.49 vs 12.39 min). The mean duration of sensory block(548 vs 938 min) and motor block(569 vs 958 min) were 392 minutes lesser respectively between both the Category . The duration post-operative analgesia was 404 min lesser between both the Category (579 vs 979 min). All the results are statistically significant.

The diastolic blood pressure, systolic blood pressure, heart rate were comparatively maintained lesser than baseline for Category Ifrom fifth min after induction of drug till two hours. (Tables 2-4). 25% of Category Ihad bradycardia compared to none in Category II.

Table 1: Demographic profile of two categories

		Category I=60		Category II=60		Significance
Profile		No	%	No	%	
Sex	Male	37	61.67	35	58.33	NS
	Female	23	38.33	25	41.67	
Analgesia (Post operative)	Not needed	60	100	0	0	<0.001
	Needed	0	0	60	100	

Table 2: Heart rate of two categories

Time in min	Category II		Category II		P value
	Mean	Sd	Mean	Sd	
0	86.23	4.52	85.12	7.11	0.68
5	84.12	6.85	80.26	5.25	0.044
10	82.69	6.87	77.36	5.36	0.006
15	80.23	6.78	73.64	5.44	<0.001
30	77.45	5.87	70.87	5.78	<0.001
45	76.84	5.69	68.23	5.61	<0.001
60	76.12	5.12	68.54	4.58	<0.001
75	79.23	7.87	72.03	5.87	<0.001
90	80.58	6.33	72.61	6.33	<0.001
120	83.02	7.54	74.31	6.18	<0.001

Table 3: Systolic BP of two categories

Time in min	Category II		Category I		P value
0	132.22	8.11	135.02	8.03	0.21
5	127.69	4.63	125.36	4.36	0.14
10	122.41	5.69	116.03	5.78	<0.001
15	122.33	4.22	115.11	4.63	<0.001
30	121.02	4.36	114.36	4.22	<0.001
45	122.03	5.87	113.47	4.96	<0.001
60	122.15	7.87	115.66	5.87	<0.001
75	126.24	8.69	115.63	6.78	<0.001
90	127.54	8.69	116.33	7.33	<0.001
120	129.11	8.74	118.02	8.45	<0.001

Table 4: Diastolic BP of two categories

Time in min	Category II		Category I		
	Mean	Sd	Mean	Sd	
0	82.03	8.03	80.22	7.11	0.31
5	80.23	7.37	77.66	6.54	0.19
10	76.03	7.14	72.54	4.32	0.016
15	74.23	5.88	70.54	4.12	0.019
30	74.02	5.97	67.03	4.78	<0.001
45	74.11	5.71	68.11	4.88	<0.001
60	74.31	6.15	68.12	4.36	<0.001
75	76.61	6.97	68.22	5.88	<0.001
90	78.37	7.66	72.12	7.03	<0.001
120	80.11	8.12	73.22	7.00	<0.001

DISCUSSION

This cross-sectional study was done while applying supraclavicular brachial plexus block in upper limb surgeries to assess the impact of dexmedetomidine as an adjuvant drug to levobupivacaine. There is no statistical significance in age, sex and weight between both the groups signifying both the groups were similar before the start of the study and the sampling methods were followed appropriately.

Dexmedetomidine 100 μg when used as an adjuvant to levobupivacaine 0.5% reduces the onset of sensory and motor blockade, prolongs the analgesic effect of motor and sensory block. The mechanism of action of α2 agonists causing sedation and analgesia is not completely known, but it seems to have multifactorial. Centrally, α2 agonists inhibits the substance P release at dorsal root neuron in the pain pathway and activates α2 adrenoceptors in the locus coeruleus and thereby causing analgesia and sedation. Peripherally, α2 agonists decrease the release of noradrenaline, produce analgesia and produces α2 receptor- independent restraints on nerve action potentials. Activation of cation current by hyperpolarization causes the peripheral action of dexmedetomidine. For subsequent firing the nerve will not return from hyperpolarized state to resting membrane state.[16-19] Studies done by various other authors have also showed that addition of dexmedetomidine reduces the onset time of motor and sensory block and prolongs the duration of postoperative analgesia.[20-24]

Addition of dexmedetomidine improves the hemodynamic stability of the patients. Similar findings were obtained in the several other researchers conducted world wide.25

Bradycardia was noted in one fifth of the patients who were administered dexmedetomidine. Which coincides with the findings of Talke et al.[26]

CONCLUSION

dexmedetomidine is more effected as compare to other for upper limb surgeries applying brachial plexus block.

REFERENCE

1. Vermeylen K, Engelen S, Sermeus I, Soetens F, Van de Velde M. Supraclavicular brachial plexus blocks: Review and current practice. Acta Anaesth Belg 2011;62:15-21
2. Krishan G, Mitra S, Verma AP, Agrawal M, Singh RP, Ahmad S. A comparative study between levobupivacaine with dexmedetomidine versus levobupivacaine with clonidine in ultrasound guided supraclavicular brachial plexus block for upper limb surgeries: a randomized double blind placebo controlled study. *Int J Contemp Med Res*. 2018;5(1):6–11.
3. Singh AP, Mahindra M, Gupta R, Bajwa SJS. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. *Anesth Essays Res*. 2016;10(3):414–9. doi:10.4103/0259-1162.176404.
4. Murphy DB, McCartney CJL, Chan VWS. Novel Analgesic Adjuncts for Brachial Plexus Block: A Systematic Review. *Anesth Analg*. 2000;90(5):1122–8. doi:10.1097/00000539-200005000-00023.
5. Kathuria S, Singh N, Gupta S. Dexmedetomidine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol*. 2020;36(2):238–43. doi:10.4103/joacp.joacp_176_19.
6. Virtanen R, Savola JM, Saano V, Nyman L. Characterization of the selectivity,

specificity and potency of medetomidine as an α2-adrenoceptor agonist. *Eur J Pharmacol*. 1988;150(1-2):9–14. doi:10.1016/0014-2999(88)90744-3.

7. Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural Administration of Dexmedetomidine in Combination with Bupivacaine Enhances Sensory and Motor Blockade in Sciatic Nerve Block without Inducing Neurotoxicity in Rat. *Anesthesiology*. 2008;109(3):502–11. doi:10.1097/aln.0b013e318182c26b.
8. 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(5):427–31. doi:10.1097/aap.0b013e3181ef4cf0.
9. Brummett CM, Hong EK, Janda AM, Amodeo FS, Lydic R. Perineural Dexmedetomidine Added to Ropivacaine for Sciatic Nerve Block in Rats Prolongs the Duration of Analgesia by Blocking the Hyperpolarization-activated Cation Current. *Anesthesiology*. 2011;115(4):836–43. doi:10.1097/aln.0b013e318221fcc9.
10. Kosugi T, Mizuta K, Fujita T, Nakashima M, Kumamoto E. High concentrations of dexmedetomidine inhibit compound action potentials in frog sciatic nerves without α2 adrenoceptor activation. *Br J Pharmacol*. 2010;160(7):1662–76. doi:10.1111/j.1476-5381.2010.00833.x.
11. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Jazzar MA, Alameddine MM, Al-Yaman R, et al. Effects of low dose Dexmedetomidine or clonidine on characteristics of spinal block. *Acta Anaesthesiol Scand*. 2006;50(2):222–7.
12. Memis D, Turan A, Karamanlioglu B, Pamukçu Z, Kurt I. Adding dexmedetomidine to lignocaine for IVRA. *AnesthAnalg*. 2004;98:835–40.
13. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine Added to Levobupivacaine Prolongs Axillary Brachial Plexus Block. *Anesth Analg*. 2010;111(6):1548–51. doi:10.1213/ane.0b013e3181fa3095.
14. 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(3):280–4. doi:10.1097/eja.0b013e3283347c15.
15. 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):203–8. doi:10.4314/ejhs.v24i3.3.
16. Eisnach JC, Kock MD, Klimscha W. Alpha-2-adrenergic agonists for regional anesthesia. A clinical review of clonidine (1984–1995). *Anesthesiology*. 1984;85:655–74.
17. Guo TZ, Jiang JY, Buttermann AE, Maze M. Dexmedetomidine Injection into the Locus Ceruleus Produces Antinociception. *Anesthesiology*. 1996;84(4):873–81. doi:10.1097/00000542-199604000-00015.
18. Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural Administration of Dexmedetomidine in Combination with Bupivacaine Enhances Sensory and Motor Blockade in Sciatic Nerve Block without Inducing Neurotoxicity in Rat. *Anesthesiology*. 2008;109(3):502–11. doi:10.1097/aln.0b013e318182c26b.
19. Khan ZP, Ferguson CN, Jones RM. Alpha-2 and imidazoline receptor agonistsTheir pharmacology and therapeutic role. *Anaesthesia*. 1999;54(2):146–65. doi:10.1046/j.1365-2044.1999.00659.x.
20. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine Added to Levobupivacaine Prolongs Axillary Brachial Plexus Block. *Anesth Analg*. 2010;111(6):1548–51. doi:10.1213/ane.0b013e3181fa3095
21. 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. doi:10.4103/0970-9185.125701.

22. Kaygusuz K, Kol IO, Duger C, Gursoy S, Ozturk H, Kayacan U, et al. Effects of Adding Dexmedetomidine to Levobupivacaine in Axillary Brachial Plexus Block. *Curr Ther Res*. 2012;73(3):103–11. doi:10.1016/j.curtheres.2012.03.001.

23. Swami SS, Ladi SD, Keniya VM, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. *Indian J Anaesth*. 2012;56(3):243–9. doi:10.4103/0019-5049.98767.

24. Mahmoud KM, Ammar AS. 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(2):109–14. doi:10.4103/1658-354x.97021.

25. Zhao J, Zhou C. The protective and hemodynamic effects of dexmedetomidine on hypertensive cerebral hemorrhage patients in the perioperative period. *Exp Ther Med*. 2016;12(5):2903–8

26. Talke P, Lobo E, Brown R. Systemically Administered α2-Agonist- induced Peripheral Vasoconstriction in Humans. *Anesthesiology*. 2003;99(1):65–70. doi:10.1097/00000542-200307000-00014