

## CLONIDINE VERSUS DEXMEDETOMIDINE AS ADJUVANT TO 0.5% ROPIVACAINE IN INFRACLAVICULAR VERTICAL BRACHIAL PLEXUS BLOCK- A RANDOMISED CONTROL STUDY

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### ABSTRACT

#### BACKGROUND

Adjuvants/adjuncts are the drugs, which when added to local anaesthetics tend to improve the quality of block and increase duration of analgesia. The purpose of this study was to compare two novel alpha-2 agonist clonidine and dexmedetomidine when added as adjuvant to 0.5% ropivacaine in infraclavicular vertical brachial plexus block in respect to onset, duration of sensory and motor block along with duration of analgesia.

#### MATERIALS AND METHODS

A total of 60 patients confirming to inclusion criteria, undergoing elective upper limb surgeries under BPB in VIMSAR, Burla, were enrolled for the study over a period of one year. Sensory block was evaluated by Hollmen scale. Onset time of sensory block, time for complete sensory block and total duration of sensory block were recorded. Motor block was evaluated by using Bromage scale. Onset time of motor block, time for complete motor block and total duration of motor block were recorded. Level of sedation was assessed using the Ramsay sedation score. Postoperatively, sensory block and motor block and postoperative pain (by visual analogue scale) were assessed.

#### RESULTS

The sensory motor block was significantly rapid and the duration of analgesia was significantly prolonged in dexmedetomidine group as compared to clonidine group.

#### CONCLUSION

Addition of 1 µg/kg of dexmedetomidine as adjuvant to 0.5% ropivacaine for infraclavicular vertical brachial plexus block is better as compared to 1 µg/kg of clonidine.

#### KEYWORDS

Ropivacaine, Dexmedetomidine, Clonidine, Infraclavicular Vertical Brachial Plexus Block.

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#### BACKGROUND

"For all the happiness mankind can gain- is not in pleasure, but in rest from pain"- John Dryden. The International Association for the Study of Pain defines pain as an "unpleasant sensory and emotional experience associated with actual damage or potential tissue damage or described in terms of such damage."<sup>1</sup>

The Joint Commission on Accreditation of Healthcare Organizations has coined the phrase "Pain- The 5th Vital Sign" to elevate awareness of pain treatment among healthcare professionals.<sup>2,3</sup> Peripheral Nerve Block (PNB) is achieved by injecting local anaesthetic solution around a nerve root, cord or trunk to produce anaesthesia in the distribution of that nerve without any distortion of the neural tissue.<sup>4</sup> There are many advantages of a single shot PNB, example rapid onset, predictable and dense anaesthesia, a relatively simpler technique, good muscle relaxation, adequate postoperative analgesia.

It also means early ambulation, early oral intake, avoiding intubation and its complications with lesser systemic side effects and fewer postoperative side effects.<sup>5</sup>

Brachial Plexus Block (BPB) is a commonly adopted technique for surgery of the upper extremity as it imparts excellent operative condition, anaesthesia and analgesia at one go.

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The infraclavicular vertical brachial plexus block is deemed to be a procedure that is safe and low risk, easy on the patient and simple for the anaesthesiologist to perform.

The various local anaesthetics used in brachial plexus block are quite effective, but the duration of analgesia being a major limiting factor. Various opioids and non-opioid agents have been studied as adjuvant to brachial plexus blockade. Clonidine and dexmedetomidine have shown greater promise as  $\alpha_2$  agonists.

Clonidine, the older drug is a selective  $\alpha_2$  adrenergic agonist with some  $\alpha_1$  agonist property. In clinical studies, the addition of clonidine to local anaesthetic solutions has shown reduction in the onset time of the block and a more efficient peripheral nerve block with longer postoperative analgesia. Clonidine possibly enhances or amplifies the sodium channel blockade action of local anaesthetics by opening up the potassium channels resulting in membrane hyperpolarisation, a state in which the cell is unresponsive to excitatory input.<sup>6</sup>

Dexmedetomidine, the newer drug, is a potent  $\alpha_2$  adrenoceptor-agonist and about eight times more selective towards the  $\alpha_2$  adrenoceptor than clonidine. In humans, it has been used in various strengths as an adjunct to local anaesthetics to prolong the duration of block and postoperative analgesia in various peripheral blocks.<sup>7,8</sup>

This current study is designed to test the hypothesis that dexmedetomidine when added as adjuvant to mixture of 0.5% ropivacaine in infraclavicular vertical brachial plexus block enhances the onset and duration of sensory and motor block and duration of analgesia as compared with clonidine without causing any major haemodynamic instability or any other systemic side effects.

### AIMS AND OBJECTIVES

To compare clonidine versus dexmedetomidine as adjuvant to mixture of 0.5% ropivacaine in infraclavicular brachial plexus block in respect to-

1. Onset time of sensory block, time for complete sensory block and total duration of sensory block.
2. Onset time of motor block, time for complete motor block and total duration of motor block.
3. Level of sedation.
4. Level of sensory block, motor block and pain perception postoperatively.

### MATERIALS AND METHODS

#### Source of Data

Inpatients scheduled for upper limb surgery in VIMSAR, Burla, were selected for the study over a period of one year from December 2015 to November 2016.

Type of Study- Randomised, comparative observational study.

#### Selection of Patient

Convenience type of non-probability sampling was used for selection of study subjects. A total of 60 patients posted for elective upper limb surgeries in Department of Anaesthesiology, VIMSAR, Burla, were included in the study

after obtaining permission from the Hospital Ethics Committee.

#### Inclusion Criteria

1. Age more than 18 years of either sex.
2. ASA physical status I and II.
3. Patients listed for upper limb surgeries involving arm and forearm.

#### Exclusion Criteria

1. Neurological lesions in the upper limb to be operated upon.
2. Diabetic neuropathy.
3. Psychiatric patients.
4. History of allergy to local anaesthetics.
5. Infection/swelling at proposed site of injection.
6. Bleeding disorders or patients on anticoagulant.
7. Any skeletal abnormality hindering surface markings.
8. Failure of block or conversion to GA.

### METHODOLOGY

After taking detailed history and clinical examination, routine and specialised investigations and obtaining informed written consent, the patients were advised overnight fasting, Tab. Lorazepam 2 mg, Tab. Ranitidine 150 mg at bedtime. On arrival in the operation theatre, patient's baseline heart rate, noninvasive blood pressure and oxygen saturation were recorded and noted and then these were recorded every five minutes till end of the surgery. The patients were randomly divided into two groups of 30 each.

All patients received infraclavicular vertical brachial plexus block by an experienced anaesthesiologist by aid of peripheral nerve stimulator who was blinded to the grouping.

Block was administered using the following combination of drugs.

Group I- 0.5% ropivacaine 30 mL plus Inj. Clonidine 1  $\mu$ g/kg.  
Group II- 0.5% ropivacaine 30 mL plus Inj. Dexmedetomidine 1  $\mu$ g/kg.

Total volume of the injectate in both the groups were made 40 mL by addition of normal saline.

#### Intraoperative Monitoring

Continuous monitoring of pulse, blood pressure, mean arterial pressure, respiratory rate and oxygen saturation were done and recordings were noted from baseline at intervals of five min. for the first one hour and then at ten min. interval till the end of surgery. Postoperatively, the same vital parameters were observed immediately after the end of surgery, every 30 minutes for the next 4 hours and thereafter every time we visit the patient for noting the effect of block and VAS score.

Sensory block was evaluated by Hollmen score, motor block was evaluated by Bromage score and pain was evaluated by VAS score and sedation by Ramsay sedation score.

Holmen score (3) was used to test the adequacy of sensory block at two min. interval from the time of injection to complete sensory block, i.e. = 4.

Sedation was assessed by Ramsay sedation scale at ten min. interval from the time of performing the block.

Pain was assessed by Visual Analogue Scale (VAS). VAS will be recorded and assessed at an interval of every 30 minutes.

Effect on sensory and motor block and postoperative analgesia was assessed every 30 minutes for first 2 hours, every 60 minutes for next 4 hours and then at 9, 12, 18 and 24 hours.

**RESULTS AND OBSERVATIONS**

- All the observations were collected, compiled, tabulated and statistical analysis was performed using Student’s t-test, ANOVA test for parametric data and Chi-square test for non-parametric data.
- Data are collected as mean±SD.
- P value <0.05 taken as statistically significant.

Variables	Group RC	Group RD
Age in years Mean±SD	37.28	35.4
Sex (M:F)	30:30	35:25
ASA (I/II)	45:15	45:15

**Table 1. Demographic Parameter**

There was no statistically significant difference between the demographics (age, sex and ASA grade) of the two groups.

Variable	Group	Number	Mean	SD	p-value
OTSB	RC	30	13.1	1.4	<0.05
	RD	30	9.5	1.5	
CTSB	RC	30	20.8	1.5	<0.05
	RD	30	15.5	1.6	
TDSB	RC	30	330.5	33.7	<0.05
	RD	30	600.8	87.4	

**Table 2. Sensory Block Characteristics**

The onset of sensory block was significantly faster in dexmedetomidine group compared to clonidine group (9.5 vs. 13.1 minutes).

Also, the duration of sensory block was significantly longer (600.8 vs. 330.5 minutes) in the dexmedetomidine group.

Variable	Group	Number	Mean	SD	p-value
OTMB	RC	30	20.4	2	<0.05
	RD	30	15.7	1.7	
CTMB	RC	30	24.4	1.5	<0.05
	RD	30	19.9	1.7	
TDMB	RC	30	351	40.4	<0.05
	RD	30	503	28.8	

**Table 3. Motor Block Characteristics**

The onset of motor block was significantly early in dexmedetomidine group compared to clonidine group (15.7 vs. 20.4 minutes) and the duration of block was also significantly longer (503.1 vs. 351 minutes) in the dexmedetomidine group.

Variable	Group	Number	Mean	SD	P-value
Duration of Analgesia (in min.)	RC	30	534	30.7	<0.05
	RD	30	721.3	88.3	

**Table 4. Duration of Analgesia**

Duration of analgesia was significantly more in dexmedetomidine group compared to clonidine group (721.3 vs. 534 minutes).

- The haemodynamic parameters were comparable in both groups.
- No cases of clinically significant bradycardia and hypotension were noticed in any of the groups.
- The respiratory rate, oxygen saturation were comparable in both the groups and did not show any fall.
- No side effects requiring any intervention were noticed in either group.
- Clinically, all the patients were arousable and responding to verbal stimuli.
- No patients in the study demonstrated any signs or symptoms of local anaesthetic drug toxicity.

**DISCUSSION**

A prospective randomised double-blind study was designed to access the efficacy of two α-2 agonists as adjuvant to ropivacaine in infraclavicular vertical brachial plexus block. Brachial plexus block is one of the most commonly performed peripheral nerve blocks in day today practice. Many approaches can be used for brachial plexus block; axillary, supraclavicular and infraclavicular approaches. The infraclavicular block is characterised by compact anatomical distribution of the plexus allowing single injection of local anaesthetics and the lesser incidence of pneumothorax.

In our study, we choose infraclavicular vertical brachial plexus block. This technique has many advantages like clearly defined guide points, high success rate, good patient acceptance due to comfortable positioning and no hindrance to tourniquet placement.

In our study, the drugs selected for infraclavicular block were ropivacaine, dexmedetomidine and clonidine. Ropivacaine has structural similarity to bupivacaine, but without cardiotoxic effects of bupivacaine.<sup>10</sup> Dexmedetomidine and clonidine has been studied by various authors as an adjuvant to local anaesthetic in supraclavicular block. Few studies are available on ropivacaine with dexmedetomidine and clonidine for infraclavicular block. Hence, ropivacaine with dexmedetomidine and clonidine combination was selected for our study.

A few groups have compared the effects of the alpha-2 agonist clonidine and dexmedetomidine with bupivacaine<sup>11</sup>

and with 0.75% ropivacaine.<sup>12</sup> We wanted to compare the two drugs as adjuvants to solution of 0.5% ropivacaine.

Presynaptic activation of alpha-2A adrenoceptor in the locus coeruleus inhibits the release of norepinephrine and results in the sedative and hypnotic effects.<sup>13</sup> In addition, the locus coeruleus is the site of origin for the descending medullospinal noradrenergic pathway known to be an important modulator of nociceptive neurotransmission. Stimulation of alpha-2 adrenoceptors in this area terminates the propagation of pain signals leading to analgesia. Postsynaptic activation of alpha-2 receptors in the CNS results in decrease in sympathetic activity leading to hypotension and bradycardia.<sup>14</sup> Alpha-2 adrenoceptors present on primary afferent terminal (peripheral and spinal endings) in the superficial laminae of the spinal cord and within several brainstem nuclei have been implicated in the analgesia, supports the possibility of analgesic action of alpha agonist at peripheral, spinal and brainstem site. The direct action of clonidine on the nerve can be explained by enhancing activity-dependent hyperpolarisation generated by the Na/K pump during repetitive stimulation increases the threshold for initiating the action potential causing slowing or blockage of conduction.<sup>15,16</sup>

Our study found that the onset of sensory block was significantly faster in the dexmedetomidine group (RD) when compared to the clonidine group (RC) (9.5 vs. 13.1 mins.). Also, the total duration of sensory block was also significantly longer in Gp1 (600.8 vs. 330.5 mins.). Similar observations were noted in a study by Swami SS et al<sup>11</sup> who studied the effect of adding clonidine 1 µg/kg and dexmedetomidine 1 µg/kg to bupivacaine 0.25% (35 cc) with duration of sensory blocks with dexmed of 413.97±87.13 mins. versus 227.00±48.36 mins. in the clonidine group.

In our study, the onset of motor block was also significantly early in dexmedetomidine group (15.7 vs. 20.4 minutes). Also, the duration of block was significantly longer in Gp1 (503.1 vs. 351 minutes). Harshvardhan HS in his study comparing the effects of adding clonidine and dexmedetomidine to 0.75% ropivacaine for supraclavicular nerve blocks also found a significantly faster onset time and duration of motor block with the addition of dexmedetomidine.<sup>12</sup> Our study however showed a slightly longer onset time for both sensory and motor blocks in both groups as compared to studies by Harshvardhan.<sup>11</sup>

In our study, duration of analgesia was also found to be significantly greater in dexmedetomidine group (721.3 vs. 534 minutes). This is similar to findings from the study by Harshvardhan HS<sup>12</sup> and Swamy SS et al.<sup>11</sup> In 2012, Gandhi R et al<sup>17</sup> conducted a study to compare the postoperative analgesic efficacy and safety of dexmedetomidine for brachial plexus blockade along with bupivacaine. They observed that dexmedetomidine group had prolonged postoperative analgesia.

Patients in both the groups did not require sedation intraoperatively and they were comfortable throughout the surgery with arousable sedative effects. This can be explained on the basis that some amount of systemic

absorption of drug could be present.<sup>18</sup> No patients in either study group had any haemodynamic instability, bradycardia or significant hypotension. In a study conducted by Singh S et al, the effects of clonidine (150 µg) added to bupivacaine was compared with bupivacaine alone on supraclavicular brachial plexus block. No side effects were observed in both the clonidine and the control group throughout the study period.<sup>19</sup> A study by Swami S S et al in their study comparing dexmedetomidine and clonidine in bupivacaine in supraclavicular brachial plexus blocks also reported no significant side effects during the first 24 hours in the postoperative period in both the groups.<sup>11</sup>

## CONCLUSION

We can conclude that dexmedetomidine when used as adjuvant to ropivacaine enhances the quality of block and has a prolonged sensory and motor block as compared to clonidine.

## LIMITATIONS

The lack of ultrasound device for nerve block was a major limiting factor of our study. Further multicentric trials will validate the use of dexmedetomidine as an adjuvant to ropivacaine for BPB.

## REFERENCES

- [1] Suchdev PK. Pathophysiology of pain. In: Warfield CA, Fausett HJ. Manual of pain management. 2<sup>nd</sup> edn. Philadelphia: Lippincott Williams and Wilkins 2002:6-12.
- [2] Asdourian CP. Acute pain management. In: Warfield CA, Fausett HJ. Manual of pain management. 2<sup>nd</sup> edn. Philadelphia: Lippincott Williams and Wilkins 2002:215-222.
- [3] Kavita J, Vidhu B, Swapna P, et al. Comparative evaluation of Alpha2 agonist dexmedetomidine and clonidine as adjuvants for ultra sound guided supraclavicular block. A randomized double blind study. International Journal of Healthcare and Biomedical Research (IHBR) 2015;3(3):20-31.
- [4] Wedel DJ, Horlocker TT. Nerve blocks. In: Miller RD. Miller's anesthesia. 7<sup>th</sup> edn. Philadelphia: Churchill Livingstone 2010:1639-1674.
- [5] Urmev W. Upper extremity blocks. In: Brown D, ed. Regional anaesthesia and analgesia. Philadelphia: WB Saunders Company 1996:254-278.
- [6] Chakraborty S, Chakraborty J, Mandal MC, et al. Effect of clonidine as adjuvant in bupivacaine-induced supraclavicular brachial plexus block: a randomized controlled trial. Indian Journal of Pharmacology 2010;42(2):74-77.
- [7] Esmoğlu A, Yegenoglu F, Akin A, et al. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. Anesth Analg 2010;111(6):1548-1551.
- [8] Obayah GM, Refaie A, Aboushanab O, et al. Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia

- after cleft palate repair. *Eur J Anaesthesiol* 2010;27(3):280-284.
- [9] Singh R, Gupta D, Jain A. The effect of addition of intrathecal clonidine to hyperbaric bupivacaine on postoperative pain after lower segment caesarean section: a randomized control trial. *Saudi J Anaesth* 2013;7(3):283-290.
- [10] Simpson D, Curran MP, Oldfield V, et al. Ropivacaine: a review of its use in regional anaesthesia and acute pain management. *Drugs* 2005;65(18):2675-2717.
- [11] Swami SS, Keniya VM, Ladi SD, et al. Comparison of dexmedetomidine and clonidine (alpha 2 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):243-249.
- [12] Harshvardhan HS. Efficacy of dexmedetomidine compared to clonidine added to ropivacaine in supraclavicular nerve blocks: a prospective, randomized, double blind study. *Int J Med Health Sci* 2014;3(2):127-132.
- [13] Jones ME, Maze M. Can we characterize the central nervous system actions of alpha-2 adrenergic agonists? *Br J Anaesth* 2001;86(1):1-3.
- [14] Derbyshire DR, Chmielewski A, Fell D, et al. Plasma catecholamine response to tracheal intubation. *Br J Anaesth* 1983;55(9):855-859.
- [15] Brummett CM, Norat MA, Palmisano JM, et al. 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):502-511.
- [16] Eisenach JC, De Kock M, Klimscha W. Alpha(2)-adrenergic agonists for regional anesthesia. A clinical review of clonidine (1984-1995). *Anesthesiology* 1996;85(3):655-674.
- [17] Gandhi R, Shah A, Patel I. Use of dexmedetomidine along with bupivacaine for brachial plexus block. *Natl J Med Res* 2012;2(1):67-69.
- [18] Popping DM, Elia N, Marret E, et al. Clonidine as an adjuvant to local anesthetics for peripheral nerve and plexus blocks: a meta-analysis of randomized trials. *Anesthesiology* 2009;111(2):406-415.
- [19] Singh S, Aggarwal A. A randomized controlled double-blinded prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries. *Indian J Anaesth* 2010;54(6):552-557.