



**CROSS SECTIONAL RANDOMISED CONTROLLED STUDY EVALUATING
DEXMEDETOMIDINE AS AN ADJUVANT ADDED TO A LOCAL ANAESTHETIC MIXTURE OF
BUPIVACAINE, LIGNOCAINE WITH ADRENALINE IN AXILLARY PLEXUS BLOCK AS
COMPARED TO AXILLARY PLEXUS BLOCK WITH LOCAL ANAESTHETIC MIXTURE ALONE**

Anaesthesiology

**Dr Guntupalli
Sowmya**

Post graduate, Department of Anaesthesiology Alluri Sitarama Raju Academy of Medical sciences Eluru, West Godavari District Andhra Pradesh 534005 India

Dr K Shailaja*

Assistant Professor Department of Anaesthesiology Alluri Sitarama Raju Academy of Medical Sciences Eluru, West Godavari District Andhra Pradesh 534005 India*Corresponding Author

**Dr R Rajeswar
Reddy**

Assistant Professor Department of Anaesthesiology Alluri Sitarama Raju Academy of Medical Sciences Eluru, West Godavari District Andhra Pradesh 534005 India

ABSTRACT

BACKGROUND: Regional anaesthesia in the form of Brachial plexus block is an attractive option when compared to General anaesthesia, since it has the advantages of post-operative pain relief as well as decreased nausea and vomiting. This makes regional anaesthesia the preferred technique in day care surgery. Axillary plexus block is one of the most commonly performed regional nerve block for upper limb surgeries. The proximity of the nerves of brachial plexus to the axillary artery makes the identification of structures easy with both nerve stimulator and ultrasound guided block. **AIM:** To compare the efficacy of dexmedetomidine added to local anaesthetic mixture versus local anaesthetic mixture alone in axillary plexus block. **METHODS:** This study is a cross sectional randomized controlled study. The study involved 60 patients. They were randomly divided into two groups, Group D received axillary plexus block with 50 microgram of dexmedetomidine added to local anaesthetic mixture and Group L received axillary plexus block with local anaesthetic mixture alone. Both the groups were followed up for the onset of sensory and motor blockade and the duration of analgesia using the Visual Analog Scale score. **RESULTS:** Both the study and control groups were comparable in terms of age, height, weight and BMI. The mean arterial pressure of the patients in the dexmedetomidine group was 80.27 ± 6.39 mmHg whereas the mean arterial pressure in the control group was 97.47 ± 8.16 mmHg at the 45th minute. The mean pulse rate of the patients in the dexmedetomidine group was around 70 bpm and around 85 bpm in the control group but none of the patients required atropine. The onset time of sensory block in the dexmedetomidine group was found to be 9.37 ± 1.7 minutes whereas in the control group it was found to be 15.83 ± 1.18 minutes. The onset time of motor block in the dexmedetomidine group was found to be 12.23 ± 1.85 minutes whereas in the control group it was found to be 18.77 ± 1.22 minutes. The mean duration of analgesia in the dexmedetomidine group was found to be 16.53 ± 1.41 hours whereas the mean duration of analgesia in the control group was found to be 9.70 ± 1.44 hours. **CONCLUSION:** Dexmedetomidine in the dose of 50 microgram when added as an adjuvant to local anaesthetic mixture in axillary plexus block had a faster onset of sensory, motor block and significantly prolonged the duration of analgesia. They caused a minimal decrease in the mean arterial pressure and heart rate which did not warrant treatment.

KEYWORDS

Dexmedetomidine, axillary block, Visual Analog Scale(VAS)

INTRODUCTION:

Axillary plexus block is one of the most commonly performed regional nerve block for upper limb surgeries. The axillary plexus block is the safest of the approaches to the brachial plexus. It does not cause pneumothorax or phrenic nerve palsy caused by the other approaches of brachial plexus block. It has many advantages over general anaesthesia like reduced risk of aspiration, increased post-operative pain relief and decreased postoperative opioid requirements. Local anaesthetic combinations of lignocaine with adrenaline and bupivacaine are injected into the axillary sheath to provide axillary plexus blockade. Different agents have been tried as adjuvants, added to the local anaesthetics to fasten the onset and prolong the duration of sensory and motor blockade. Alpha – 2 agonists like clonidine and dexmedetomidine have multiple benefits like analgesia, anaesthesia, sedation and sympatholysis. Dexmedetomidine is a centrally acting, selective alpha – 2 adrenergic agonist and is more potent than clonidine. Dexmedetomidine produces sedation, anxiolysis, decreases anaesthetic requirement and maintains good hemodynamic stability intraoperatively. When a low dose of dexmedetomidine is added to the local anaesthetic mixture, it provides a faster onset of sensory and motor blockade and prolongs the duration of sensory and motor blockade without much hemodynamic instability. Dexmedetomidine has different mechanisms of action like: 1. Direct action on peripheral nerve 2. Central action and 3. Attenuation of inflammatory response.

AIM:

To compare the efficacy of dexmedetomidine added to local anaesthetic mixture versus local anaesthetic mixture alone in axillary plexus block.

OBJECTIVES:

To compare the 1. Onset of sensory and motor blockade 2. Duration of analgesia between the two groups of patients who underwent upper limb surgeries under axillary block, with or without Dexmedetomidine

3. Quality of Analgesia(VAS score) 4. Haemodynamic parameters.

MATERIALS AND METHODS:

“Cross sectional randomized controlled study evaluating dexmedetomidine as an adjuvant added to a local anaesthetic mixture of bupivacaine, lignocaine with adrenaline in axillary plexus block as compared to axillary plexus block with local anaesthetic mixture alone”. After getting approval from the ethical committee the study was done on 60 patients for upper limb surgical and orthopaedic procedures below the mid-humerus level at ALLURI SITARAMARAJU ACADEMY OF MEDICAL SCIENCES.

INCLUSION CRITERIA: 18 – 60 years of age, ASA physical status 1 or 2, Patients undergoing elbow, forearm and hand surgeries, Patients who gave valid informed consent.

EXCLUSION CRITERIA: Lack of written informed consent, Patients with diabetes and renal disease, Pregnancy, Patients with baseline heart rate less than 60bpm, Patients on sedatives, opioids in the week prior to surgery.

PRE-OPERATIVE ASSESSMENT: All the patients were duly examined on the day before surgery and pre-operative assessment chart was checked. Any specific complaints of the patient like pain, anxiety must be sought out. The height and weight of the patient was measured. The airway assessment and the nutritional status of the patient was examined. All the systems were examined in detail. All the pre-operative investigations like complete blood count, haematocrit, renal function tests, blood grouping and typing, chest radiography and electrocardiography were evaluated and the risk was stratified based on American Society of Anaesthesiologist's grading.

PRE-MEDICATION: All the patients were kept nil per oral for 8 hours and were premedicated with tablet alprazolam 0.5mg, tablet

ranitidine 150mg and tablet metoclopramide 10mg on the night prior to surgery.

PREPARATION: All the patients on arrival into the operating room, electrocardiography, pulse oximetry and non-invasive blood pressure monitors were connected and basal parameters recorded. An intravenous access with 18 gauge cannula was started. Patients were randomly allocated into either of the two groups – group D or group L by slips in the box technique

MATERIALS: DRUGS IV Dexmedetomidine ,0.5% bupivacaine ,2% lignocaine with adrenaline ,Emergency resuscitation drugs

EQUIPMENTS : Insulated stimulator needle ,Peripheral nerve stimulator , ECG electrode ,Two 20ml(Luerlock) syringes , One tuberculin syringe of 1ml ,Two stainless sterile bowls on each for iodine and spirit , Sterile gauze pieces , Equipment for administration of General Anaesthesia, if required.

TECHNIQUE:

AXILLARY PLEXUS BLOCK (Nerve Stimulator technique):The patient is placed in the supine position with the head facing opposite to the side being blocked. The arm is abducted to 90 degrees. Axilla was aseptically cleaned and draped. The operator stood on the side to be blocked so that for a left side block the palpation was done with the left hand and the needle is manipulated with the right and the operator stands on the left side. The axillary artery is palpated as high up in the axilla and is fixed firmly against the humerus between the index and middle finger of the palpating hand. The artery is fixed firmly throughout the procedure. Local infiltration of 1ml of 2% lignocaine given. An insulated needle will be used to perform this technique. The needle is connected to nerve locator by the electrodes and is properly grounded with the help of ECG leads.

Group D receives 20ml of 0.5% bupivacaine, 10ml of 2% lignocaine with adrenaline and 1ml of 50microgram dexmedetomidine. Group L receives 20ml of 0.5% bupivacaine, 10ml of 2% lignocaine with adrenaline and 1ml of normal saline. The stimulation is started with an intensity of 2.0 mA and a pulse width of 100 microseconds. Once the skin is entered, the needle is inserted to a depth of 1 -2 cm below the artery until a desired response – extension of wrist and fingers are obtained. 10 – 15ml of local anaesthetic is injected after negative aspiration of blood. The needle is then withdrawn upto the skin and inserted above the artery until the response – flexion of the fingers and wrist is obtained. The needle is inserted till further until the median nerve twitch appears. 5 – 10 ml of local anaesthetic is injected after negative aspiration of blood. The needle is then inserted into the bulk of coracobrachialis till the biceps branchii twitch occurred and the remaining 5 – 10ml of local anaesthetic is injected. As a goal we decided to elicit an isolated muscle twitch in the fingers either in flexion or extension for the desired response. Wrist flexion and extension of fingers is taken as the acceptable response and the current is gradually reduced till the twitch appears above 0.5 mA. 3 minute massage is done to facilitate an even drug distribution.

BLOCK EVALUATION: Sensory block is assessed using pinprick method using the end of a 27 gauge needle at 0, 2, 5, 10, 15, 20 and 30 minutes in the median, ulnar, radial and musculocutaneous nerve distribution. GRADES OF SENSORY BLOCKADE: GRADE 0 - Sharp pain felt GRADE 1 - Analgesia, dull sensation felt GRADE 2 - Anaesthesia, no sensation felt.

Motor block is evaluated at 0, 10, 20 and 30 minutes. GRADES OF MOTOR BLOCKADE: GRADE 0 - Normal motor function with full flexion and extension of elbow, wrist and fingers. GRADE 1 - Decreased motor strength with ability to move the fingers only. GRADE 2 - Complete motor block with inability to move the fingers. ONSET TIME: The onset time of sensory and motor blockade is defined as the time interval between the end of local anaesthetic injection and Loss of sensation to pin prick (sensory score – 1) and Paresis (motor scale – 1) in the distribution of all peripheral nerves respectively.

Post-operative follow up is carried out in the recovery and post-operative ward for the Visual Analog score. VAS score of 4 indicated moderate pain and the rescue analgesic is administered at a VAS score of 4 or more. VAS SCORE 0 – 2 : No pain ,VAS SCORE 2 – 4 :Mild pain ,VAS SCORE 4 – 6 :Moderate pain, VAS SCORE 6 – 8 :Severe pain, VAS SCORE 8 – 10 :Unbearable pain.

RESULTS:

TABLE 1:ONSET OF SENSORY BLOCKADE

	GROUP D		GROUP L		t value	P value	Significant
	Mean	Sd	Mean	Sd			
Sensory	9.37	1.10	15.83	1.18	22.01	0.000	Significant

TABLE 2:ONSET OF MOTOR BLOCKADE

	GROUP D		GROUP L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Motor	12.23	1.85	18.77	1.22	16.13	0.000	Significant

TABLE 3:DURATION OF ANALGESIA

	GROUP D		GROUP L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Analgesia	16.53	1.41	9.7	1.44	18.57	0.000	Significant

TABLE 4:VISUALANALOG SCALE

TIME	VAS Score	GROUP D		GROUP L	
		Number	Percentage	Number	Percentage
0-4 hrs	V0	30	100	28	93.33
	V2	0	0	2	6.67
4-8 hrs	V0	30	100	5	16.67
	V2	0	0	23	76.67
	V4	0	0	2	6.67
8-12 hrs	V0	23	76.67	0	0
	V2	7	23.33	5	16.67
	V4	0	0	25	83.33
12-16 hrs	V2	23	76.67	0	0
	V4	7	23.33	30	100
16-20 hrs	V4	30	100	30	100

TABLE 5:HEART RATE

	Group D		Group L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Pre	79.40	7.81	80.47	8.80	0.50	0.62	NS
0 min	78.00	6.87	81.00	7.53	1.61	0.11	NS
15 min	75.80	7.90	83.27	7.02	3.87	0.000	Significant
30 min	71.87	8.71	84.80	6.72	6.44	0.000	Significant
45 min	69.27	7.82	85.27	7.23	8.23	0.000	Significant
60 min	68.87	7.98	84.13	6.45	8.15	0.000	Significant

TABLE 6:SYSTOLIC BLOOD PRESSURE

	GROUP D		GROUP L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Pre	118.33	12.69	117.53	12.61	0.25	0.81	NS
0 min	109.20	20.56	120.20	11.29	2.57	0.01	Significant
15 min	109.07	7.08	122.60	11.68	5.43	0.000	Significant
30 min	108.33	8.52	124.33	10.82	6.37	0.000	Significant
45 min	106.40	6.90	124.80	9.58	8.54	0.000	Significant
60 min	107.80	7.58	125.27	8.97	8.15	0.000	Significant

TABLE 7:DIASTOLIC BLOOD PRESSURE

	GROUP D		GROUP L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Pre	76.33	10.98	77.20	12.01	0.29	0.77	NS
0 min	74.13	8.53	80.60	9.12	2.84	0.01	Significant
15 min	71.67	8.98	82.40	10.14	4.34	0.000	Significant
30 min	69.20	8.95	84.73	10.29	6.24	0.000	Significant
45 min	67.20	6.49	83.80	7.80	8.96	0.000	Significant
60 min	67.80	7.01	86.20	8.23	9.32	0.000	Significant

TABLE 8:MEAN ARTERIAL PRESSURE

	GROUP D		GROUP L		t value	p value	Significant
	Mean	Sd	Mean	Sd			
Pre	90.33	11.39	90.64	12.06	0.10	0.92	NS
0 min	85.82	10.64	93.80	9.61	3.05	0.003	Significant
15 min	84.13	7.82	95.80	10.30	4.94	0.000	Significant
30 min	82.24	8.55	97.93	10.15	6.48	0.000	Significant

45 min	80.27	6.39	97.47	8.16	9.09	0.000	Significant
60 min	81.13	6.94	99.22	8.10	9.29	0.000	Significant

DISCUSSION:

Axillary block is one of the most commonly performed regional nerve block for upper limb surgeries. Adjuvants have been added to local anaesthetic mixtures to fasten the onset of sensory and motor block and to prolong the duration of anaesthesia.

Local anaesthetics produce blockade of sodium channels resulting in decreased sodium entry into the cells thereby preventing the depolarisation of the cells. Thus the nerve signals and the action potential cannot be propagated.

Alpha 2 adrenergic agonists have been used for the treatment of hypertension and for drug withdrawal. Alpha 2 agonists produce diverse responses like analgesia, anxiolysis, sedation and sympatholysis. Recently the FDA approved the usage of two novel alpha 2 agonists – clonidine and dexmedetomidine for the usage in Intensive Care Unit sedation. Dexmedetomidine is a more selective alpha – 2 agonist than clonidine and has been found to prolong the effects of local anaesthetics in epidural, intrathecal and peripheral nerve blocks with the advantages of minimal respiratory depression and cardiovascular stability.

MECHANISM OF ACTION: 1. Inhibits the adenylate cyclase enzyme responsible for the production of 3,6 – cyclic adenosine monophosphate resulting in decreased availability of cyclic AMP. Cyclic AMP mediates phosphorylation of many of the intra-cellular target proteins. This results in hyper-polarisations of the neuronal cell membrane which results in decreased firing rate of excitable cells. 2. N-type voltage gated calcium channels are inhibited resulting in decreased entry of calcium ions which results in decreased catecholamine secretion. 3. Activates the alpha 2 adrenoreceptor in the pre-synaptic region resulting in decreased release of sympathetic neurotransmitters. There is no clear mechanism by which the alpha 2 agonists produce analgesia. Possible mechanisms may be supra-spinal effect in the locus ceruleus and spinal effects in the substantia gelatinosa resulting in the production of analgesia. On addition of dexmedetomidine, the excitable nerve cells can neither fire nor propagate the signal to the neighbouring cells resulting in analgesia by central, spinal and peripheral actions. The ratio of alpha 2 : alpha 1 activity for dexmedetomidine is 1620 : 1 and 220 : 1 for clonidine. Hence dexmedetomidine is a more selective alpha 2 adrenergic agonist than clonidine. **CLINICAL USES:** Attenuation of stress response, As an adjuvant to general anaesthesia, neuraxial anaesthesia, peripheral nerve blocks, In monitored anaesthesia care, Sedation in ICU. **ADDITIONAL BENEFITS:** Dexmedetomidine has antisialagogue, antishivering and decongestant properties. Dexmedetomidine has minimal respiratory depression compared to other drugs with a better hemodynamic stability. **ADVERSE EFFECTS:** The most notable side effects of dexmedetomidine are bradycardia, hypotension, dry mouth, nausea and vomiting. Transient hypertension can be seen in large doses and sudden discontinuation can lead to a withdrawal syndrome with agitation, irritability and hypertensive crisis. It is classified as a Category C drug in pregnancy (Animal studies have observed risk but well controlled human studies not available).

CONCLUSION:

Dexmedetomidine in the dose of 50 microgram when added as an adjuvant to local anaesthetic mixture in axillary plexus block had a faster onset of sensory and motor block (9.37 ± 1.1 and 12.23 ± 1.85 minutes) and significantly prolonged the duration of analgesia (16.53 ± 1.41 hours). They caused a minimal decrease in the mean arterial pressure and heart rate which did not warrant treatment.

REFERENCES:

1. Don Sebastian RM. Comparison of Dexmedetomidine and Clonidine as Adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Nerve Blocks. IOSR-JDMS. 2015;14.
2. Almarakbi WA, Kaki AM. Addition of dexmedetomidine to bupivacaine in transversus abdominis plane block potentiates post-operative pain relief among abdominal hysterectomy patients: A prospective randomized controlled trial. Saudi J Anaesth. 2014;8(2):161–6.
3. Zhang Y, Wang C-S, Shi J-H, Sun B, Liu S-J, Li P, et al. Perineural administration of dexmedetomidine in combination with ropivacaine prolongs axillary brachial plexus block. Int J Clin Exp Med. 2014 Mar 15;7(3):680–5.
4. Biswas Saumya, 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 Jul 31;24(3):203–8.
5. Hem Anand Nayagam NRS. A prospective randomised double blind study of intrathecal fentanyl and dexmedetomidine added to low dose bupivacaine for spinal anaesthesia for lower abdominal surgeries. Indian J Anaesth. 2014;58(4):430–5.

6. Basuni AS, Ezz HAA. Dexmedetomidine as supplement to lowdose levobupivacaine spinal anesthesia for knee arthroscopy. Egypt J Anaesth. 2014 Apr;30(2):149–53.
7. Marhofer D, Kettner SC, Marhofer P, Pils S, Weber M, Zeitlinger M. Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: a volunteer study. Br J Anaesth. 2013 Mar 1;110(3):438–42.
8. Maharani B, Prakash MS, Kalaiah P, Elango NC. DEXMEDETOMIDINE AND BUPRENORPHINE AS ADJUVANT TO SPINAL ANAESTHESIA - A COMPARATIVE STUDY. Int J Curr Res Rev. 2013;5(11):97–103.
9. Kim JE, Kim NY, Lee HS, Kil HK. Effects of Intrathecal Dexmedetomidine on Low-Dose Bupivacaine Spinal Anesthesia in Elderly Patients Undergoing Transurethral Prostatectomy. Biol Pharm Bull. 2013;36(6):959–65.
10. 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 Jun;73(3):103–11.