



**PROSPECTIVE RANDOMISED CONTROLLED STUDY EVALUATING DEXMEDETOMIDINE ASANADJUVANT 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. Muddada. Sameera**

Post graduate, Department of Anaesthesia, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh 534005, India.

**Dr. Kondapaneni. Ushasree**

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

**D. M. Nalini\***

Assistant professor, Department of Anaesthesia, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh 534005, India. \*Corresponding Author

### 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 blocks 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 analgesic efficacy of dexmedetomidine added to bupivacaine, lignocaine with adrenaline mixture versus bupivacaine, lignocaine with adrenaline mixture alone in axillary plexus block for upper limb surgeries. **Materials And Methods:** This study is a prospective randomized controlled study. The study involved 60 patients. They were randomly divided into two groups, Group RD received axillary plexus block with 50 micrograms of dexmedetomidine added to local anaesthetic mixture and Group RL 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  $80.27 \pm 6.39$  mmHg whereas the mean arterial pressure in the control group was  $97.47 \pm 8.16$  mmHg at the 45<sup>th</sup> 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  $9.37 \pm 1.7$  minutes whereas in the control group it was found to be  $15.83 \pm 1.18$  minutes. The onset time of motor block in the dexmedetomidine group was found to be  $12.23 \pm 1.85$  minutes whereas in the control group it was found to be  $18.77 \pm 1.22$  minutes. The duration of analgesia in the dexmedetomidine group was found to be  $16.53 \pm 1.41$  hours whereas the mean duration of analgesia in the control group was found to be  $9.70 \pm 1.44$  hours. **CONCLUSION:** Dexmedetomidine in the dose of 50 micrograms 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. The study caused a minimal decrease in the mean arterial pressure and heart rate which did not warrant treatment.

### KEYWORDS

Dexmedetomidine, axillary block, Visual Analog Scale

### INTRODUCTION

Brachial plexus block, a regional anaesthesia technique, is a desirable alternative to general anaesthesia for upper limb surgeries because it provides effective post-operative analgesia and also reduces nausea and vomiting, systemic opioid requirement thus making it a preferred technique in day care surgery<sup>(1)</sup>. Axillary approach of brachial plexus block is one of the most commonly performed and preferred regional nerve block for upper limb surgeries<sup>(2)</sup>. 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. The axillary approach is the safest of the four approaches to the brachial plexus<sup>(3)</sup> as it does not cause phrenic nerve palsy or pneumothorax.

Axillary approach was described by Halstead in 1884<sup>(4)</sup>. It can be used for surgeries involving the elbow, forearm and hand surgeries providing excellent analgesia and anaesthesia<sup>(5)</sup>. 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.

Dexmedetomidine is a centrally acting, selective  $\alpha_2$  adrenergic agonist. It produces sedation, anxiolysis<sup>(6)</sup>, 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<sup>(7)</sup> like:

- Direct action on peripheral nerve
- Central action
- Attenuation of inflammatory response.

In this study we investigated the addition of dexmedetomidine as an adjuvant to the local anaesthetic mixture in axillary plexus block, in comparison with local anaesthetic mixture alone in order to evaluate the beneficial effects of dexmedetomidine.

### MATERIALS AND METHODS

This is a prospective 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, in 60 patients undergoing upper limb surgeries (below mid-humerus level) at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari district, Andhra Pradesh during the period April 2023-March 2024. After obtaining permission from the ASRAMS institutional ethics committee, the study subjects were selected by a simple random sampling method. A written consent was taken from the study subjects after explanation about the purpose of the study.

#### Inclusion Criteria:

- 1) 18–60 years of age of either sex
- 2) ASA physical status I or II
- 3) Patients undergoing elective elbow, forearm and hand surgeries under brachial plexus block
- 4) Patients who gave valid informed consent

#### Exclusion Criteria:

- 1) Lack of written informed consent
- 2) Patients with peripheral neuropathy or coagulopathy
- 3) Pregnancy
- 4) Patients with baseline heart rate less than 60 bpm
- 5) Patients allergic to local anaesthetic

Total 60 patients are included in the study. Pre - anaesthetic evaluation was done a day prior to the elective surgery. History of present complaints, history of allergy to study drugs and any other drugs, any

co-existing disease, medication, previous surgery, hospitalization etc. were noted. A thorough physical and systemic examination (including weight of the patient, height of the patient, vital signs, spine, air way assessment, etc.) was done. 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 intra-venous access with 18 Gauge cannula was started. Patients were randomly allocated into either of the two groups – group RD or group RL.

**Group RD** receives 20ml of 0.5% bupivacaine, 10ml of 2% lignocaine with adrenaline and 1ml of 50microgram dexmedetomidine.

**Group RL** receives 20ml of 0.5% bupivacaine, 10ml of 2% lignocaine with adrenaline and 1ml of normal saline.

### PROCEDURE:

In both the groups; under all aseptic precautions local site was prepared. The Positive electrode of the nerve stimulator was connected to an ECG lead and fixed on the ipsilateral arm. 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 axillary 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 up to the skin and inserted above the axillary 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 brachii 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.

### OBSERVATION AND 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  $80.27 \pm 6.39$  mmHg whereas the mean arterial pressure in the control group was  $97.47 \pm 8.16$  mmHg at the 45<sup>th</sup> 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  $9.37 \pm 1.7$  minutes whereas in the control group it was found to be  $15.83 \pm 1.18$  minutes. The onset time of motor block in the dexmedetomidine group was found to be  $12.23 \pm 1.85$  minutes whereas in the control group it was found to be  $18.77 \pm 1.22$  minutes. The mean duration of analgesia in the dexmedetomidine group was found to be  $16.53 \pm 1.41$  hours whereas the mean duration of analgesia in the control group was found to be  $9.70 \pm 1.44$  hours.

| Block parameters                        | Group RD | Group RL | P value |
|-----------------------------------------|----------|----------|---------|
| Onset of sensory blockade (min)         | 9.37     | 15.83    | 0.000   |
| Onset of motor blockade (min)           | 12.23    | 18.77    | 0.000   |
| Success rate (at 16 <sup>th</sup> hour) | 76.66%   | 0%       | -       |
| Complications                           | -        | -        | 0       |
| Duration of analgesia(hr)               | 16.53    | 9.70     | 0.000   |

### DISCUSSION:

This prospective randomised controlled study conducted in 60 patients who underwent elective upper limb surgeries under axillary plexus block demonstrated that dexmedetomidine in the dose of 50microgram when added to local anaesthetic mixture prolonged the duration of analgesia significantly. Both the study and control groups were comparable in terms of age, weight, height and BMI.

The grades of sensory and motor block were checked every 5 minutes after performance of the axillary approach of brachial plexus block using pin prick and Modified Bromage Scale respectively. 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 pinprick (sensory score – 1) and paresis (motor scale – 1) in the distribution of all peripheral nerves respectively.

The onset time of sensory block in the dexmedetomidine group was found to be  $9.37 \pm 1.7$  minutes whereas in the control group it was found to be  $15.83 \pm 1.18$  minutes. The onset time of motor block in the dexmedetomidine group was found to be  $12.23 \pm 1.85$  minutes whereas in the control group it was found to be  $18.77 \pm 1.22$  minutes. On statistical analysis by the independent sample test and the t test for equality of means has showed a faster onset times of sensory and motor block significantly with a p value of 0.0001.

The patients were followed in the post-operative ward every 2 hours for the presence of pain by the Visual Analog Scale. The presence of VAS score 4 is taken as the endpoint of analgesia. The duration of analgesia is taken as the time from the performance of the block till the appearance of VAS score 4.

The mean duration of analgesia in the dexmedetomidine group was found to be  $16.53 \pm 1.41$  hours whereas the mean duration of analgesia in the control group was found to be  $9.70 \pm 1.44$  hours. At the 16<sup>th</sup> hour the number of patients with a VAS score of 4 in the dexmedetomidine group was 7 whereas in the control group all the 30 patients had a VAS score of 4. At the 20<sup>th</sup> hour all the 60 patients in both the groups had a VAS score of 4.

All the patients in our study both study and control groups were monitored in the post-operative ward and were given supplemental oxygen at the rate of 2 litres/min. Dexmedetomidine has the unique property in causing arousable sedation without any respiratory depression.

### CONCLUSION:

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

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