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Original Research Paper

Anaesthesiology

A COMPARATIVE STUDY TO KNOW THE EFFECTS OF DEXMEDETOMIDINE AS AN ADJUVANT WITH 0.75% ROPIVACAINE FOR ULTRASOUND GUIDED AXILLARY BRACHIAL PLEXUS BLOCK FOR FOREARM AND HAND SURGERIES

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ABSTRACT

Background: Dexmedetomidine is an selective alpha-2-receptor agonist.Various studies have been done to describe the effects of dexmedetomidine as an additive to local anaesthetics in peripheral nerve blocks.With the use of ultrasound guidance axillary brachial plexus block has been easier with reduced drug dosage and with lesser complications. **Objectives:** To compare the effects of addition of dexmedetomidine with 0.75% ropivacaine for axillary brachial plexus block in reference to onset of sensory and motor block and duration of analgesia. **Methods:** 60 patients of ASA grade I and II posted for forearm and hand surgeries were allocated randomly into two groups of 30 each,Group R will receive 0.75% ropivacaine 20ml + Nacl 0.9%(1ml) Group D will receive 0.75% ropivacaine 20ml + dexmedetomidine 1ml(100μg).Under ultrasound guidance axillary block was administered.Onset of sensory block was assessed by pin prick method,modified bromage scale was used to assess the motor block,patients would be assessed post operatively for the duration of sensory and motor blockade. **Results:** present study showed that onset of sensory and motor blocks was significantly faster in group D as compared to group R.Also duration of motor block and duration of analgesia was prolonged in group D as compared to group R. No statistically significant changes in intraoperative MAP and HR,BP, spo_2 among two groups. **Conclusion:** It was concluded that addition of dexmedetomidine(100μg) to 0.75% ropivacaine shortens the sensory and motor onset time, with increased duration of analgesia and motor blockade when used for axillary brachial plexus block under ultrasound guidance without any adverse effects.

KEYWORDS : Dexmedetomidine, ropivacaine, axillary brachial plexus block, ultrasound guidance

INTRODUCTION

Brachial plexus block is commonly used form of regional anaesthesia for upper limb, forearm and hand surgeries. Axillary brachial plexus block is most popular because of its safety,reliability and ease.It is the block performed at the distal part of brachial plexus[1].

With the advent of ultrasound in regional anaesthesia it had gained popularity over conventional technique of nerve stimulation.With the use ultrasound technique real time visualization of the anatomical structures,needle placement and local anaesthetic spread have shown to increase the block success rate and decreased complications like vascular puncture when performing axillary brachial plexus block.The amount of local anaesthetic required for the block is reduced due to accurate placement of the needle and the spread of the injectate as guided by ultrasound[2,3].

Ropivacaine is a local anaesthetic with amide group.When compared to bupivacaine it is less lipophilic ,fewer central nervous system adverse effects and less cardiotoxicity is because of its stereo selective property.It is a newer drug used for regional anaesthesia nowadays[4,5,6].

Dexmedetomidine is a highly selective alpha 2 agonist ,it is used along with local anaesthetics as an adjuvant to improve the quality and duration of analgesia.This effect is obtained at a doses of 50-100μg with reduced risk of side effects. Dexmedetomidine is widely used as an adjuvant with local anaesthetics for various regional anaesthesia techniques[7,8,9].

Based on the pharmacological properties and its drug interaction the present study of axillary brachial plexus block was conducted using ropivacaine 0.75% alone and ropivacaine 0.75% with dexmedetomidine(100μg) under ultrasound guidance.Aim of the study is to compare the onset and duration of sensory and motor block and adverse effects if any between the two groups.

MATERIALS AND METHOD

A prospective randomized double blind study was planned,using 60 patients of ASA physical status 1 and 2 who are of age group between 18- 50years who will be scheduled to undergo forearm and hand surgeries.These patients will be grouped into two groups of 30 each using computer generated randomization into Group R will receive 0.75% ropivacaine 20ml + Nacl 0.9%(1ml) and Group D will receive 0.75% ropivacaine 20ml + dexmedetomidine 1ml(100μg).

The person who prepared the drug combination were not allowed to participate in the monitoring or assessment of the patient.The anaesthetist who performed the axillary block and monitoring was blinded to the groups the patients belongs.

Inclusion Criteria:

a)Age group between 18- 50 years
b) ASA physical status 1 and 2
c)Patients with the body weight of 50- 80kgs
d)Who gives written informed consent

Exclusion Criteria:

a)Patients not willing to give informed consent
b)Patients with major organ disorders like cardiac, respiratory, hepatic and renal failure.
c)Injection site local pathology
d)History of bleeding disorders,convulsions,severe neurological deficit and allergy.

Methodology:

Institutional ethical committee clearance were obtained and those patients who fulfill the inclusion criteria were selected for the study, a written informed consent were obtained. Patients undergoing upper limb forearm and hand surgeries were taken for the study. Pre anaesthetic evaluation were done on all the patients and the necessary routine investigations were obtained. Patients who come under ASA physical status I and II category were selected and were explained about the procedure in detail. 60 patients who have enrolled in the study were randomly allocated into two groups of 30 each by computer generated randomization. Patients of Group R will receive 0.75% ropivacaine 20ml + Nacl 0.9%(1ml) and

patients of Group D will receive 0.75% ropivacaine 20ml + dexmedetomidine 1ml(100μg).

All the patients of the study were given 0.5mg of alprazolam and 150mg of ranitidine to be taken orally on the previous night of the surgery.Patients were asked to be nil per orally after 10pm onwards on the night before surgery.

On the day of surgery ensuring the nil per oral status,patient is shifted inside the operation theater and made to lie down in supine position on the OT table and all the necessary monitors were connected such as HR,NIBP,ECG and SPO_2 as per the standard ASA guidelines.An 18G intravenous access was secured,injection midazolam 0.04mg/kg was administered as premedication before the procedure.Patients are placed in supine position with upperlimb to be blocked is kept with the arm abducted to 90° and the elbow flexed.Under aseptic precautions with the help of ultrasound guidance median nerve,ulnar nerve and radial nerve which lie at 11° clock,2° clock and 6° clock positions respectively in relation to the axillary artery were identified.Musculocutaneous nerve which lies between biceps and corocobrachialis slight laterally will be identified.Study drug is injected into the neurovascular sheath after confirming the position of the needle using in plane method under ultrasound guidance.

The onset of sensory blockade was tested using pin prick method, it is made every 1 minute and thereafter till patients feels no pain to pin prick. Modified Bromage scale is used to assess motor blockade. Once the surgical procedure is completed patients were monitored and assessed for the sensory and motor blockade duration and the time noted. A VAS(visual analogue scale) is used for the assessment of sensory blockade. When the patients asks for rescue analgesia the time is noted and it is taken as cessation of analgesia. Any untoward effects during the procedure will be noted down.

Scoring Systems

Sensory Block

The sensory block will be tested with a 22-gauge hypodermic needle by pin prick test

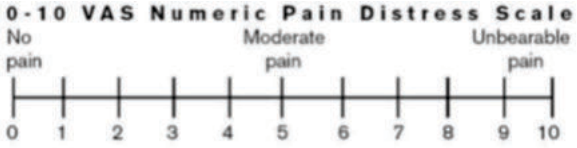
Sensory Block

0.Sharp pain
1.Touch sensation only
2.Not even touch sensation

Pain Rating Scale

Visual Analouge Scale

A simple assessment tool consisting of a 10 cm line with 0 on one end, representing no pain, and 10 on the other, representing the worst pain over ever experienced, with a patient marks to indicate the severity of his or her pain



Motor Block

Modified Bromage Scale

0 - Able to raise the extended arm to 90° for a full 2 secs
1 - Able to flex the elbow and move the fingers but unable to raise the extended arm.
2 - Unable to flex the elbow but able to move the fingers
3 - Unable to move the arm, elbow or fingers

Onset of motor blockade will be considered when there will be Grade 1 motor blockade. Peak motor block will be considered when there will be Grade 3 motor blockade.

Statistical Analysis

Statistical analysis were done using SPSS software version 16.0,continous data were analysed using independent student t test and categorical data were analysed using chi-square test.A P value < 0.05 were considered statistically significant.

RESULTS AND OBSERVATION

We were found that demographic profile such as age, sex and weight between two groups were similar and comparable making it statistically insignificant between the two groups.

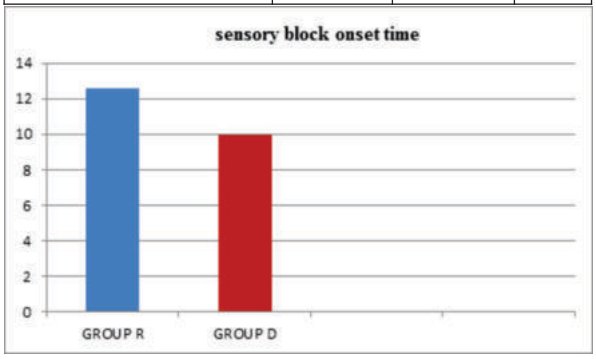
Block Characteristics

Sensory Block Onset Time

The mean time for sensory block onset time in group R was 12.6±1.344 minutes and in group D it was 9.95±0.926 minutes.A statistically significant difference exists between the two groups in terms of sensory block onset time.p value (<0.05)

Table:1 Sensory Block Onset Time

	Group R Mean ± SD	Group D Mean ± SD	P-Value
Sensory block onset time in minutes	12.6±1.344	9.95±0.926	0.001



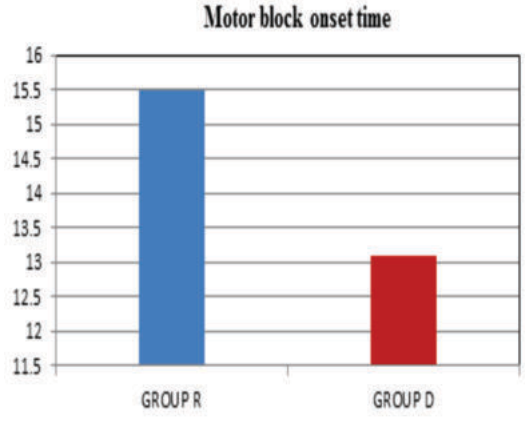
Graph 1: Sensory Block Onset Time

Motor Block Onset Time

The mean time for motor block onset time in group R was 15.5±1.586 minutes and in group D it was 13.1±0.923 minutes.A statistically significant difference exists between the two groups in terms of motor block onset time.p value (<0.05)

Table:2 Motor Block Onset Time

	Group R Mean ± SD	Group D Mean ± SD	P-Value
Motor block onset time in minutes	15.5±1.586	13.1±0.923	0.034



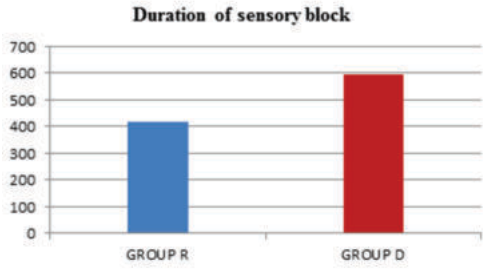
Graph 2: Motor Block Onset Time

Duration Of Sensory Block

The mean time for duration of sensory block in group R was 418.6±9.645 minutes and in group D it was 595.33±10.867 minutes.A statistically significant difference exists between the two groups in terms of duration of sensory block .p value (<0.05)

Table:3 Duration Of Sensory Block

	Group R Mean ± SD	Group D Mean ± SD	P-Value
Duration of sensory block in minutes	418.6±9.645	595.33±10.867	0.0027



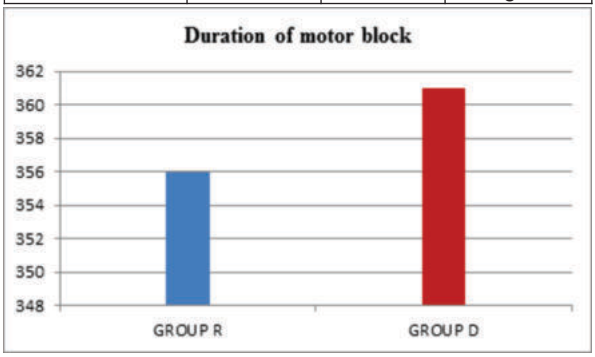
Graph 3: Duration Of Sensory Block

Duration Of Motor Block

The mean time for duration of motor block in group R was 356.68±9.70 minutes and in group D it was 361.00±8.4 minutes.A statistically not significant difference exists between the two groups in terms of duration of motor block .p value (>0.05)

Table:4 Duration Of Motor Block

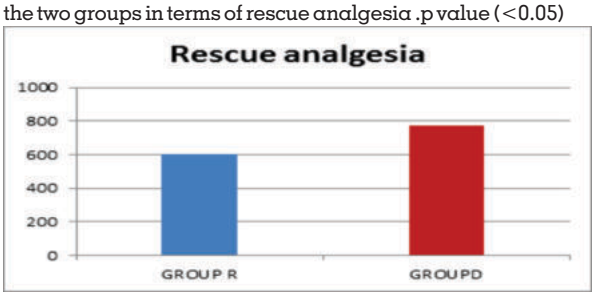
	Group R Mean ± SD	Group D Mean ± SD	P-Value
Duration of motor block in minutes	356.68±9.70	361.00±8.4	0.32 Not significant



Graph :4 Duration Of Motor Block

Rescue Analgesia

The mean time for rescue analgesia in group R was 606.33±13.60 minutes and in group D it was 772.66±10.72 minutes.A statistically significant difference exists between the two groups in terms of rescue analgesia .p value (<0.05)



Graph :5 Rescue Analgesia

Table:5 Rescue Analgesia

	Group R Mean ± SD	Group D Mean ± SD	P-Value
Rescue analgesia in minutes	606.33±13.60	772.66±10.72	0.001

Haemodynamic Parameters

Post block haemodynamic parameters like heart rate,systolic blood pressure,diastolic blood pressure,mean arterial pressure,peripheral oxygen saturation(SPO_2) were within normal limits in both the groups requiring no intervention,and there was no statistical difference between the two groups.

DISCUSSION

The present clinical study with the title" A comparative study to know the effects of dexmedetomidine as an adjuvant with 0.75% ropivacaine for ultrasound guided axillary brachial plexus block for forearm and hand surgeries" were conducted to compare the effects of 0.75% ropivacaine 20ml + Nacl 0.9%(1ml) with 0.75% ropivacaine 20ml + dexmedetomidine 1ml(100μg) with respect to block characteristics,based on its objectives. Institutional ethical committee clearance were obtained and those patients who fulfill the inclusion criteria were selected for the study, a written informed consent were obtained. Patients who come under ASA physical status I and II category were selected and were explained about the procedure in detail.60 patients who have enrolled in the study were randomly allocated into two groups of 30 each by computer generated randomization. Patients of Group R will receive 0.75% ropivacaine 20ml + Nacl 0.9%(1ml) and patients of Group D will receive 0.75% ropivacaine 20ml + dexmedetomidine 1ml(100μg).Under aseptic precautions under ultrasound guidance all the patients were given axillary brachial plexus block using the study drug and the various parameters were studied.

In our study ultrasound guidance was used for administering axillary brachial plexus block. With the advent of ultrasound in regional anaesthesia it had gained popularity over conventional technique of nerve stimulation.With the use ultrasound technique real time visualization of the anatomical structures,needle placement and local anaesthetic spread have shown to increase the block success rate and decreased complications like vascular puncture when performing axillary brachial plexus block.The amount of local anaesthetic required for the block is reduced due to accurate placement of the needle and the spread of the injectate as guided by ultrasound[1,2,3].

Commonly used local anaesthetics for nerve blocks were lignocaine and bupivacaine.In our study we used ropivacaine for the reasons like ropivacaine is a local anaesthetic with amide group.When compared to bupivacaine it is less lipophilic ,fewer central nervous system adverse effects and less cardiotoxicity is because of its stereo selective property.It is a newer drug used for regional anaesthesia nowadays [4,5].

In the studies done by Vandana Mangal et al,and Sweta et al they used the volume of 20ml of 0.75% ropivacaine for giving axillary brachial plexus block under ultrasound guidance. From the above studies it was concluded that the volume required for the axillary brachial plexus block under ultrasound guidance was 20ml.So a volume of 20ml 0.75% ropivacaine was chosen in our present study[8,10].

The advantage of adding dexmedetomidine as an adjuvant to ropivacaine was rapid onset of sensory and motor blockade, and also prolongs the duration of sensory and motor blockade, prolongs duration of post operative analgesia. Many studies had been done using dexmedetomidine as an adjuvant in various doses by many researcher namely Ananda Bangera et al, Sa Ribeiro Karl Nicholas et al,Vandana Mangal et al[5,7,8]. In many of these

studies dexmedetomidine as an adjuvant had been used in the dose of 100μg and been found to be not associated with sedation,decrease in heart rate,blood pressure and any other untoward side effects.So with reference to the above studies we decided to take dexmedetomidine at a dose of 100μg as an adjuvant in the present study.

Sensory Block

Sensory Block Onset Time

The mean time for sensory block onset time in group R was 12.6±1.344 minutes and in group D it was 9.95±0.926 minutes.A statistically significant difference exists between the two groups in terms of sensory block onset time.p value (<0.05).These results obtained from our study were comparable with the studies conducted by Koraki E et al, Sa Ribeiro Karl Nicholas et al[6,7].

Motor Block

Motor Block Onset Time

The mean time for motor block onset time in group R was 15.5±1.586 minutes and in group D it was 13.1±0.923 minutes.A statistically significant difference exists between the two groups in terms of motor block onset time.p value (<0.05).These results obtained from our study were comparable with the studies conducted by Ananda Bangera et al Koraki E et al [5,6].

Duration Of Sensory Block

The mean time for duration of sensory block in group R was 418.6±9.645 minutes and in group D it was 595.33±10.867 minutes.A statistically significant difference exists between the two groups in terms of duration of sensory block .p value (<0.05). These results obtained from our study were comparable with the studies conducted by Ananda Bangera et al Koraki E et al, Vandana Mangal et al [5,6,8].

Duration Of Motor Block

The mean time for duration of motor block in group R was 356.68±9.70 minutes and in group D it was 361.00±8.4 minutes.Eventhough various studies done by Ananda Bangera et al Koraki E et al, Sweta et al[5,6,10] showed significant increase in duration of motor blockade,our study showed a statistically not significant difference existence between the two groups in terms of duration of motor block .p value (>0.05).

Rescue Analgesia

The mean time for rescue analgesia in group R was 606.33±13.60 minutes and in group D it was 772.66±10.72 minutes.A statistically significant difference exists between the two groups in terms of rescue analgesia .p value (<0.05). These results obtained from our study were comparable with the studies conducted by Ananda Bangera et al, Koraki E et al, Sa Ribeiro Karl Nicholas et al, Vandana Mangal et al [5,6,7,8].

Hemodynamic Parameters:

The pulse rate,systolic,diastolic and mean arterial pressures were within normal limits during both intraoperative and post operative periods in both the groups requiring no intervention.

Adverse Effects:

None of the patients among both the groups had any side effects like bradycardia,hypotension,intravascular injection,post block nausea and vomiting and pneumothorax requiring no intervention.

CONCLUSION:

From our study it can be concluded that onset of sensory block,onset of motor block,duration of sensory and duration of analgesia was better with dexmeditomidine as an adjuvant group as compared to placebo group.

Hence from this study it was concluded that addition of dexmedetomidine (100μg) as an adjuvant to 0.75% ropivacaine produces faster onset of sensory and motor blockade,prolongs the duration of sensory and duration of analgesia when used for axillary brachial plexus block under ultrasound guidance without causing any adverse effects.

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