Section: Anaesthesiology

Research

COMPARISON OF EFFICACY OF 0.5% ROPIVACAINE ALONG WITH A COMBINATION OF 0.5% ROPIVACAINE AND DEXMEDETOMIDINE (1MIC/KG) IN ULTRASOUND-GUIDED AXILLARY BRACHIAL PLEXUS BLOCK FOR FOREARM AND HAND SURGERIES

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Abstract

Background: The Brachial Plexus Block is a popular regional anaesthetic procedure for upper extremity surgery. The study aims to compare the efficacy of Dexmedetomidine when administered as an adjuvant to 0.5% Ropivacaine in ultrasound-guided Axillary brachial plexus block for hand and forearm surgeries. **Materials and Methods:** The Randomized Interventional Double-blinded study was conducted in 60 patients were admitted for the forearm. Patients were randomly divided into two groups of 30 each: Group R: Patients in group R received (30ml) 0.5% Ropivacaine. Group D: Patients in group D received 30ml of 0.5% Ropivacaine + Dexmedetomidine (1mic/kg). **Result:** Of 60 patients, the male was 47, and the females was 13. There is no significant difference in gender between groups (p=0.754). There is no significant difference in the age (p=0.668), and weight between groups (p=0.601). There is a significant difference in the onset of sensory block (p=<0.0001), the onset of motor block (p=<0.0001), the duration of sensory block (p=<0.0001), the duration of motor block (p=<0.0001), and duration of analgesia (p=<0.0001) between groups. There is a significant difference in heart rate, and mean arterial pressure between groups. There is no significant difference in oxygen saturation between groups. During the intraoperative and postoperative periods, neither group experienced nausea, vomiting, hypotension, hypoxemia, or respiratory depression. **Conclusion:** Dexmedetomidine (1mic/kg) as an adjuvant to Ropivacaine (0.5 percent) in Axillary brachial plexus block resulted in a faster onset of sensory and motor block, as well as significant prolongation of postoperative analgesia.

INTRODUCTION

Regional anesthetic techniques are as effective as general anesthesia in providing effective anesthesia and analgesia in various orthopedic and surgical procedures and can reduce mortality, morbidity, and the demand for Reoperation. In contrast to Intravenous analgesics, Peripheral Nerve Block can provide site-specific, long-lasting, superior analgesia adequate postoperative analgesia, and sympathetic block with minimal side effects.[1]

The Brachial Plexus Block is a popular regional anaesthetic procedure for upper extremity surgery. The axillary approach for brachial-plexus block was the most popular technique due to its simplicity of performance, safety, and reliability of blockade. Terminal nerve branches of the brachial-plexus are blocked in this axillary approach.[2] In Axillary Block, due to shallow depth of the neuronal and vascular structures and a large amount of working room made this approach safe and effective approach and it provides surgical anesthesia of the more distal upper extremity and elbow.[3]

The use of ultrasound guidance in the Axillary block minimises the risk of vascular damage while also improving the precision and success of the procedure. It allows for direct visualisation of tissues and movement of the needle during the nerve blocks, improving accuracy, increasing success rates, reducing multiple needle insertions, and reducing complications.[4] Ropivacaine is an Amide local anaesthetic with a prolonged duration of

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action. It belongs to the pipecoloxylidides group of local anesthetics which are chiral molecules with asymmetric carbon atoms. Ropivaca has a propyl group on the piperidine nitrogen atom of the molecule, whereas bupivacaine and mepivacaine have butyl and methyl groups respectively.[5]

Dexmedetomidine is a novel sympatholytic drug with sedative and analgesic properties. Dexmedetomidine possesses various properties of an ideal anesthetic agent. Dexmedetomidine is a highly selective alpha 2 receptor agonist with a short half-life. Dexmedetomidine has sedative and hypnotic action on the central nervous system. Dexmedetomidine produces natural sleep-like patterns during the sedation by decreasing the activity in the projections between locus coeruleus and ventrolateral preoptic nucleus, which ultimately results in decreased histamine release in cortical and subcortical regions. Patients will be easy to wake up during the sedation by Dexmedetomidine which allows 'daily wake up' tests to be easily done in ICU patients.

Dexmedetomidine can be used for sedation during radiological procedures. It has shown a superior profile in sedation for children 45 of age 1 - 7 years of age during MRI scans when compared with midazolam and propofol. Dexmedetomidine has excellent analgesic properties with sparing respiratory depression, which is beneficial in some patients. Several studies have shown the synergistic effect of peripheral regional nerve blocks to prolong the duration of analgesia with an opioid-sparing effect. Intravenous Dexmedetomidine at doses of 0.33 to 0.67 mics/kg body weight, 15 minutes before surgery can be used for premedication with minimal cardiovascular complications.[6,7,8]

AIM

To compare the efficacy of Dexmedetomidine when administered as an adjuvant to 0.5% Ropivacaine in ultrasound-guided Axillary brachial plexus block for hand and forearm surgeries.

MATERIALS AND METHODS

The Randomized Interventional Double-blinded study was conducted in 60 patients were admitted for the forearm, and hand surgeries after taking informed written consent.

Patients were randomly divided into two groups of 30 each: Group R: Patients in group R received (30ml) 0.5% Ropivacaine. Group D: Patients in group D received 30ml of 0.5% Ropivacaine + Dexmedetomidine (1mic/kg).

Inclusion Criteria

Patients aged between 18 years to 60 years. ASA I and II grade patients, and patients undergoing forearm and hand surgeries.

Exclusion Criteria

Patient's refusal for participation, ASA grade of III and IV, patient's age less than 18 years and more than 60 years. co-existing severe cardiovascular, respiratory, or neurological disorders. any known history of coagulation disorders, inflammatory / Infective skin lesions at the site of block, pre-existing neuropathies, allergy to local anesthetics, and pregnant women and lactating mothers.

The pre-anesthetic evaluation was done a day before surgery including the general condition of the patient according to ASA status, a general physical examination including the height, and weight, a detailed airway examination, and a detailed systemic examination of the cardiovascular and respiratory system. Investigations were done in patients as complete Haemogram, blood grouping, and typing, HbsAg, HCV, HIV screening, Coagulation profile, renal function tests, blood sugars: FBS/PPBS, standard 12 lead ECG, and screening chest x-ray.

Preoperatively patients were kept nil per oral for 6 hours for solids before the surgery and we allowed water orally up to 2hrs before surgery. Preoperatively patients were given premedication with Tab. Alprazolam 0.25mg, and Tab. Ranitidine 150mg PO night before surgery. After the patient arrived at the operation theatre, the patient was connected to the multiparameter monitor with all standard ASA monitors such as pulse oximeter, ECG, and non-invasive blood pressure monitor, and the baseline parameters were recorded. After securing a wide-bore intravenous cannula, the ringer's lactate infusion was started, and oxygen will be given at 5L/min via a poly mask.

Heart rate, blood pressure & SPo2 were recorded every 5 minutes intraoperatively and then at intervals of every 15 minutes postoperatively. The Sensory and motor blockade onset was assessed every 1 minute until loss of sensory and motor sensations was obtained, and from then on every 30 minutes until the regain of sensations and motor power.

Numbers and percentages are used to represent categorical variable data values. A Chi-square test was employed to examine the relationship between the groups. Means and standard deviations are used to depict continuous variable data. To compare the outcomes of the study groups, the Student's T test was used.

RESULTS

Of 60 patients, the male was 47, and the females was 13. There is no significant difference in gender between groups (p=0.754). The youngest patient was 19 years old, and the oldest was 56. The majority of patients are between the ages of 31 and 40. There is no significant difference in the age between groups (p=0.668) [Table 1].

There is no significant difference in weight between groups (p=0.601). There is a significant difference

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in the onset of sensory block (p=<0.0001), the onset of motor block (p=<0.0001), the duration of sensory block (p=<0.0001), the duration of motor block (p=<0.0001), and duration of analgesia (p=<0.0001) between groups [Table 2].

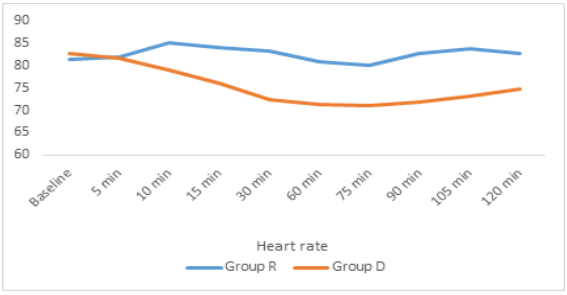

Figure 1: Heart rate between groups

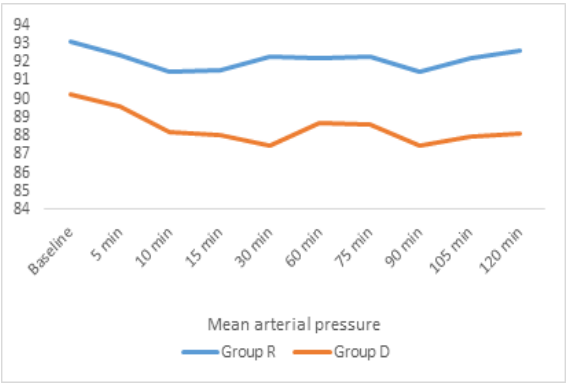

Figure 2: Mean arterial pressure between groups

Table 1: Distribution of patient's characteristics

		Group R	Group D	P-value
Gender	Male	23 (76.67%)	24 (80%)	0.754
	Female	7 (23.33%)	6 (20%)	
Age	<20	1 (3.33%)	1 (3.33%)	0.668
	21-30	7 (23.33%)	8 (26.67%)	
	31-40	14 (46.67%)	14 (46.67%)	
	41-50	6 (20%)	5 (16.67%)	
	51-60	2 (6.66%)	2 (6.66%)	

Table 2: Demographic data of the study

	Group R	Group D	P-value
Weight	66.4 ± 8.8924	65.1 ± 10.2262	0.6013
The onset of sensory block	13.9 ± 1.2689	10.4 ± 1.3025	<0.0001
The onset of motor block	16.6 ± 1.2205	13.2 ± 1.3746	<0.0001
Duration of sensory block	422.5 ± 5.5320	543 ± 6.6436	<0.0001
Duration of motor block	354 ± 8.1367	363 ± 7.3812	<0.0001
Duration of analgesia	477 ± 4.4721	578.5 ± 4.5769	<0.0001

The difference in mean heart rate (more than 10 minutes after the block) between the two study groups was significant statistically, with group D showing a lower tachycardic stress response [Figure 1].

From 15 minutes after the block, the difference in MAP between the two study groups was significant statistically. The two study groups with a decreased hypertensive stress response to surgery in the D group than the R group [Figure 2]. There is no significant difference in oxygen saturation between groups.

During the intraoperative and postoperative periods, neither group experienced nausea, vomiting, hypotension, hypoxemia, or respiratory depression. No complications such as hematoma formation, or accidental intraarterial injection were noted.

DISCUSSION

Koraki et al,[9] conducted a study, of 37 patients divided into two groups - Group R who received 15ml of 0.5% Ropivacaine + 1ml of normal saline, and 4 Group RD who received 15ml of 0.5% Ropivacaine + 100mics dexmedetomidine in ultrasound-guided brachial plexus block by the axillary approach. RD group had an earlier onset of sensory block, which is significant (p=<0.001), but there was no significant difference in the onset of the motor block between the groups (p=0.096). In their study duration of motor and sensory block and the duration of analgesia is prolonged. Early sensory block onset was seen with no change in the onset of motor block.

But our study results showed onset of motor block was significantly earlier in patients who were given dexmedetomidine as an adjuvant.

Bangera et al,[7] in their study 80 patients were divided into two groups. Group R received 39ml of 0.375% Ropivacaine + 1ml normal saline, whereas Group RD received 39ml of 0.375% Ropivacaine + 1ml normal saline + Dexmedetomidine (1mic/kg). The onset of Sensory and motor block was earlier in patients who were given dexmedetomidine as an adjuvant when compared to patients who received plain Ropivacaine which is significant. They concluded that adding Dexmedetomidine as an adjuvant to Ropivacaine in brachial plexus block by axillary approach decreases the time for onset of anesthesia and prolongs the duration of analgesia.

The onset of sensory and motor block was significantly earlier in our study Group D who received Dexmedetomidine (1mic/kg) as an adjuvant.

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Arun et al,[10] studied 60 patients who were posted for forearm and hand surgeries of ASA grade I and II and were included in the study and were allocated into two groups: Group R (25ml 0.75% Ropivacaine + 1ml normal saline) and Group D (25ml 0.75% Ropivacaine + 1ml 50mics Dexmedetomidine). They demonstrated that using dexmedetomidine with ropivacaine in brachial plexus block by axillary approach results in earlier onset of sensory and motor blockade. Prolonged duration of sensory blockade with prolonged duration of analgesia was seen in group D when compared to Group R, no significance is seen in the motor blockade duration between the two groups.

Our study also showed similar results, that correlate with their study as the onset of sensory-block was 13.9 min in group R and 10.4 min in group D which is statistically significantly earlier in group D with a P-value of <0.0001. The onset of motor block was significantly earlier in the D group (13.2 min) when compared to the R group (16.6 min).

Zhang et al,[11] conducted a study of 45 ASA grade I and II patients of age between 25 to 60 years into three groups: Group R patients received 0.33% Ropivacaine 40ml + 1ml normal saline, Group DR1 patients received 0.33% Ropivacaine 40ml + 50mics Dexmedetomidine, and Group DR2 patients received 40ml of 0.33% Ropivacaine + 100mics Dexmedetomidine. They showed no significant difference in motor and sensory block onset in all three groups, but prolonged motor and sensory blockade was seen in Group DR 2 who received 100mics Dexmedetomidine. In Group RD1 who received 50mics Dexmedetomidine, prolongation of motor block was seen without any prolongation in the sensory blockade.

Results from our study differ from their study, as we obtained a statistically significant difference in the onset of sensory and motor block which may be because of the use of the ultrasound-guided technique in our study which is superior to Peripheral nerve stimulator-guided axillary block. When compared to a peripheral nerve stimulator, ultrasound guidance aids in the accurate local anesthetic deposition around the target nerves.

In a study by Murthy et al,[12] 84 patients who were planned and posted for upper limb surgeries were divided into two groups: Group A (15ml 0.5% Ropivacaine + 100mics Dexmedetomidine) and Group B (15ml 0.5% Ropivacaine + 1ml normal saline). The study showed earlier onset of sensory and motor block in Group A and prolongation of sensory and motor block was also seen in group A. Patients who were given dexmedetomidine along with Ropivacaine showed a significant prolongation of the duration of analgesia.

Chinnappa et al,[13] conducted a study on 60 patients who were divided into two groups: Group A (30ml 0.5% Ropivacaine) and Group B (30ml 0.5% Ropivacaine + Dexmedetomidine 1mic/kg). In their study early onset of sensory and motor block was seen in Group B. Prolongation of the duration of block and duration of analgesia was also seen in the group who received Dexmedetomidine.

Rashmi et al,[14] conducted a study on 60 patients of ASA class I and II, who were posted for upper limb surgeries and were divided into two groups of 30 patients each: Group R (30ml 0.75% Ropivacaine + 0.5ml normal saline) and Group RD (30ml 0.75% Ropivacaine + 50mics Dexmedetomidine). They concluded that using Dexmedetomidine as an adjuvant to Ropivacaine in Interscalene block showed a significantly earlier onset of sensory and motor block with prolongation of the duration of sensory and motor block. The duration of analgesia was prolonged in the Dexmedetomidine group.

In a study by Kathuria et al,[15] 60 patients of ASA class I and II were divided into three groups: Group C (30ml of 0.5% Ropivacaine), Group D (30ml 0.5% Ropivacaine + 50mics Dexmedetomidine) and Group D-IV (30ml 0.5% Ropivacaine + intravenous Dexmedetomidine 50mics). The results of their study showed that the onset of sensory and motor block was early in Group D than in Group and Group D-IV. Duration of the Block was prolonged in Group D than in Group C and Group D-IV. Duration of analgesia is more in both the groups who received perineural and Intravenous Dexmedetomidine when compared to Group C who received plain Ropivacaine.

Maya Keplinger et al,[16] reported 24 volunteer patients were divided into 4 groups and they received 3ml Ropivacaine with adjuvants: Group R (no adjuvants), Group RD 50 (50mics Dexmedetomidine), Group RD 100 (100mics Dexmedetomidine), Group RD 150 (150mics Dexmedetomidine). The study showed that Dose-dependent prolongation of sensory block. Dose-dependent sedation is also seen in patients who received Dexmedetomidine.

Das et al,[17] conducted a study on 84 patients posted for forearm, elbow, and hand surgeries and were assigned into two groups: Group R (30ml 0.5% Ropivacaine + 1ml normal saline) and Group RD (30ml 0.5% Ropivacaine + 100mics Dexmedetomidine). They concluded that significant prolongation of sensory and motor block with prolonged duration of analgesia was seen in the RD group. Earlier onset of sensory and motor block was seen in group RD when compared to the R group which is not significant.

In our study, Side effects such as Hypotension, bradycardia, Hypoxemia, and respiratory depression were not reported. No complications such as hematoma formation, or accidental intraarterial injection were noted. The use of USG guidance for the axillary approach of the brachial plexus block reduces the risk of complications during the procedure.

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CONCLUSION

Based on our findings, we conclude that the addition of Dexmedetomidine (1mic/kg) as an adjuvant to Ropivacaine (0.5 percent) in Axillary brachial plexus block resulted in a faster onset of sensory and motor block and a longer duration of sensory and motor block, as well as significant prolongation of postoperative analgesia.

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