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COMPARISON OF TWO DOSES OF DEXMEDETOMIDINE GIVEN AS ADJUVANT TO 0.5% ROPIVACAINE IN ULTRASOUND GUIDED BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES

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ABSTRACT

BACKGROUND: The ultrasound guided brachial plexus block is a precise technique of providing anaesthesia & post op analgesia in surgical procedures involving upper limb. This study was conducted to compare two doses of dexmedetomidine given as adjuvant to 0.5% ropivacaine in ultrasound guided brachial plexus block in upper limb surgeries.

METHODS : This was a randomised control trial carried out in 60 patients , 18-60 years of age of both sexes posted for upper limb surgeries . Patients were randomly divided into two groups of 30 patients each. Group A received 0.5% Ropivacaine 25 mL plus 30 micrograms dexmedetomedine (0.3 mL) plus 4.7 mL distilled water and Group B received 0.5% Ropivacaine 25 mL plus 50 micrograms (0.5 mL) dexmedetomedine plus 4.5 mL distilled water. Patients were assesed for onset and duration of sensory and motor block , time of rescue analgesia , hemodynamic responses and complications or any side effects.

RESULT : Onset of sensory and motor block in Group A was 10.07 ± 0.69 mins and 14.23 ± 0.77 mins respectively while in Group B was 7.47 ± 0.63 mins and 10.0 ± 0.83 mins respectively. Mean duration of sensory block in Group A was 654.40 ± 28.42 mins and in Group B was 942.0 ± 54.32 mins while mean duration of motor block in Group A was 537.03 ± 27.07 mins and Group B was 798.67 ± 67.84 mins.

CONCLUSION : We concluded that , 50 micrograms of dexmedetomedine when compared with 30 micrograms of dexmedetomedine with 0.5% ropivacaine produced early onset of both sensory and motor block, longer duration of sensory and motor block and longer post-operative pain relief.

KEYWORDS: Ropivacaine , Dexmedetomedine , Brachial Plexus Block.

INTRODUCTION

As an alternative to general anesthesia for upper limb procedures, brachial plexus block has become a crucial component of everyday conventional anesthesiology practice in the modern world. Because this anesthetic method is applied in conjunction with ultrasound-guided live imaging, it is also regarded as safe. Additionally, it helps patients by minimizing hospital stays and providing post-operative analgesia, both of which are financially beneficial.[1]

In contemporary regional anesthesia, peripheral nerve block is a crucial anesthetic technique. When employing peripheral regional anesthesia in routine clinical practice, the two most important requirements are safety and success rate. Outpatient treatments are commonly used for upper limb surgeries, especially those involving the hands. Peripheral nerve blocks provide both intraoperative and postoperative analgesia without causing significant systemic adverse effects. They do this by reducing stress reactivity and using less anesthetic medicine. Ultrasound increases block success and improves drug deposition at the right location.[2]

A local anesthetic is used in regional anesthesia to block the brachial plexus. As a long-acting amino amide, ropivacaine is one of the main medications used to block the brachial plexus. Since ropivacaine is less lipid soluble than bupivacaine and levobupivacaine, it provides a longer period of sensory and motor blockage and a quicker return of motor function. When contrasted against other local anesthetics such as bupivacaine and levobupivacaine, ropivacaine is less harmful to the heart and central nervous system.[3]

As an adjuvant to local anesthetic, dexmedetomidine, an alpha 2 receptor blocking agonist, can extend the duration of post-operative analgesia and shorten its onset time.Dexmedetomidine provides multimodal benefits such as analgesic, sedative, antihypertensive, and anesthetic sparing effects. When used as an adjuvant, dexmedetomidine, an alpha 2 agonist, has remarkableselectivity.[4]Increases in the hyperpolarization-activated cation current, which maintain the nerve hyperpolarized and stop it from firing again, are what cause peripheralperineural dexmedetomidine's analgesic action.[4]

MATERIAL AND METHODS

Institutional Ethics Committee approval was taken prior to conducting this study & registration of this study with clinical trial registry of India (CTRI/2022/11/047461). Patient's informed and written consent was taken prior to procedure.

After a comprehensive pre-anesthesia examination the day before the procedure and after obtaining informed written consent, patients were distributed at random among two groups. Every patient received guidance on the numeric rating scale[7]. Patients were kept Nil Per Oral for six hours before surgery. A 150 mg ranitidine tablet and a 0.25 mg alprazolam tablet were administered orally the night before the surgery.

Vital signs monitors were attached, and IV access was established on the day of the procedure. In the operating room, the patients were placed supine with their head tilted 45 degrees to the other side and their arms adducted in order to offer the best transverse image . A brachial plexus block was performed using an ultrasonic system (sonosite) equipped with a high-frequency linear transducer that operated between 8 and 13 MHz ..

Once the artery, rib, pleura, and plexus were all visible, a 22 gauge needle was entered from the lateral side of the probe and drug was injected above the plexus using a "in plane" approach.

Following negative aspiration, patients in Group A received (25 ml) of ropivacaine + 30 micrograms dexmedetomidine (0.3 mL) in 4.7 mL of distilled water, while patients in Group B received (25 ml) of ropivacaine + 50 micrograms dexmedetomidine (0.5 mL) in 4.5 mL of distilledwater.Drug was deposited between the subclavian artery medially, the first rib inferiorly, and the nerves superiorly and laterally in the corner pocket. The propagation of local anesthesia was suggested by the brachial plexus sheath distension. The needle was moved to distribute the fluid throughout the plexus sheath, encompassing all nerve trunks and divisions, . After removing the needle, sterile swabs were used to clean and seal the region.

A blinded observer independently assessed each patient in each of the two groups for the following outcomes:A. The ECG II lead, heart rate, systolic and diastolic blood pressure, mean arterial pressure, and oxygen saturation will be measured 2,4,6,8,10,12,14,16,18,20,30,40,50,60, 90, 120,180,240,360,480,720 minutes following the block.
B. Every minute starting from the injection point until total blockage was attained, the onset of sensory and motor block was monitored. A blunt 23 G hypodermic needle was used to assess sensory block on a three-point scale. The results were compared to the contralateral arm's response to the same stimulation.

RESULTS

The study comprised 60 patients in total, whose ages and genders were known. The patients were randomly divided into groups of 30 with each group representing an ASA grade I or II.

The study groups were comparable in demographic data such as age , sex, ASA grade . there was no significant difference among the groups in hemodynamic (HR , SBP , DBP and MAP) and respiratory parameters (SpO_2) .

Onset of sensory and motor block in Group A was 10.07 ± 0.69 mins and 14.23 ± 0.77 mins respectively while in Group B was 7.47 ± 0.63 mins and 10.0 ± 0.83 mins respectively. Mean duration of sensory block in Group A was 654.40 ± 28.42 mins and in Group B was 942.0 ± 54.32 mins while mean duration of motor block in Group A was 537.03 ± 27.07 mins and Group B was 798.67 ± 67.84 mins.

TABLE 1: DEMOGRAPHIC CHARACTERSTIC OF PATIENTS.

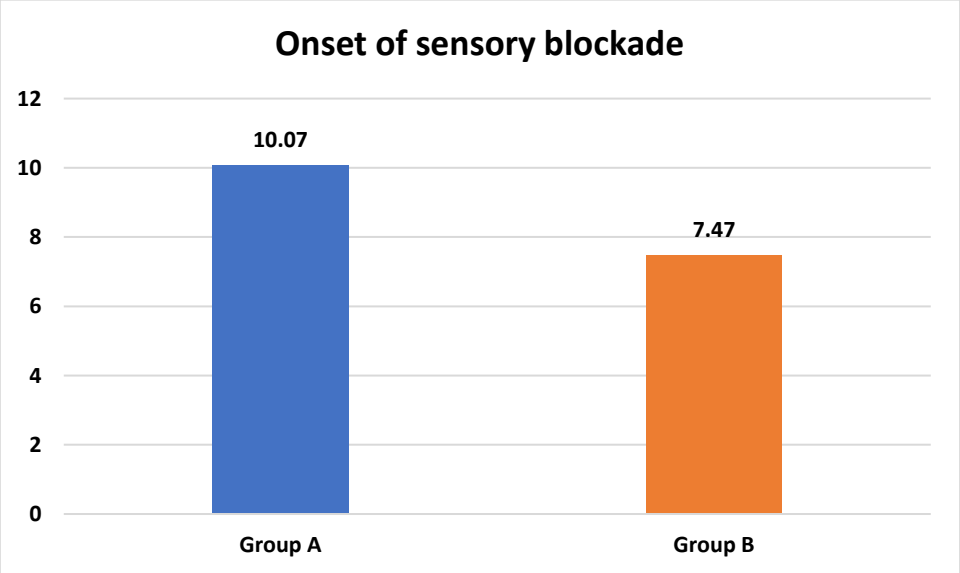
PARAMETER	GROUP A	GROUP B	P VALUE
	MEAN SD	MEAN SD	
AGE (in years)	38.96 ±12.39	40.76 ± 11.34	0.128#
SEX (Male/Female)	16/14	11/19	0.194#
ASA GRADE (I/II)	28/2	26/4	0.158#

#p>0.05 statistically not significant.

TABLE 2 ONSET OF SENSORY AND MOTOR BLOCK

PARAMETER	GROUP A	GROUP B	P value
	Mean SD	Mean SD	
ONSET OF SENSORY BLOCK	10.07 ± 0.69 mins	7.47 ± 0.63 mins	<0.001*
ONSET OF MOTOR BLOCK	14.23 ± 0.77 mins	10.0 ± 0.83 mins	<0.001*

#p<0.05 statistically significant



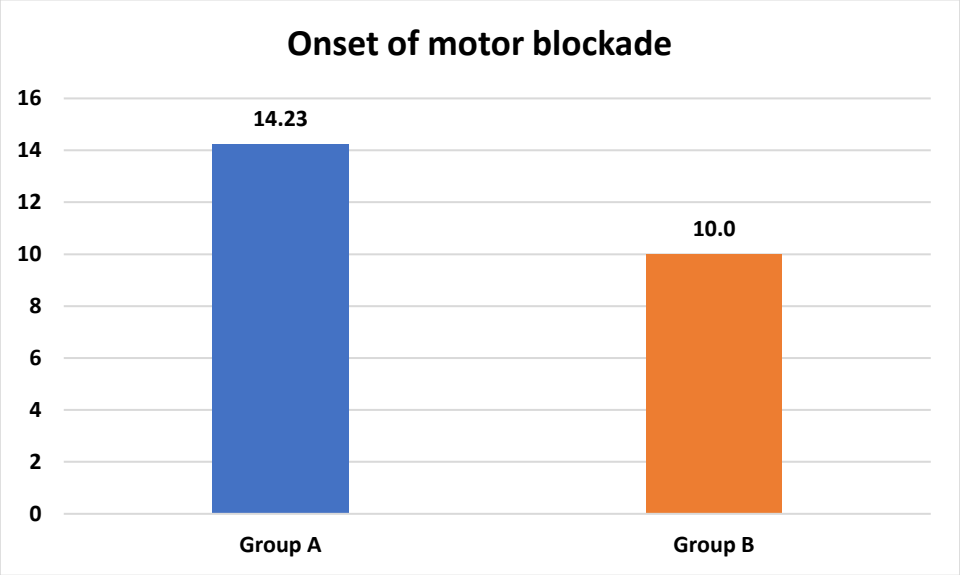
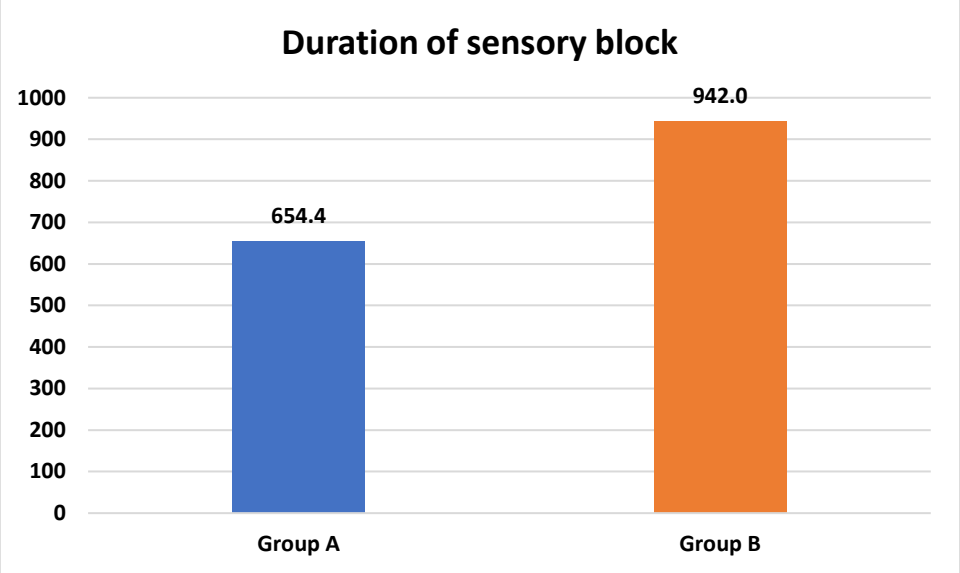
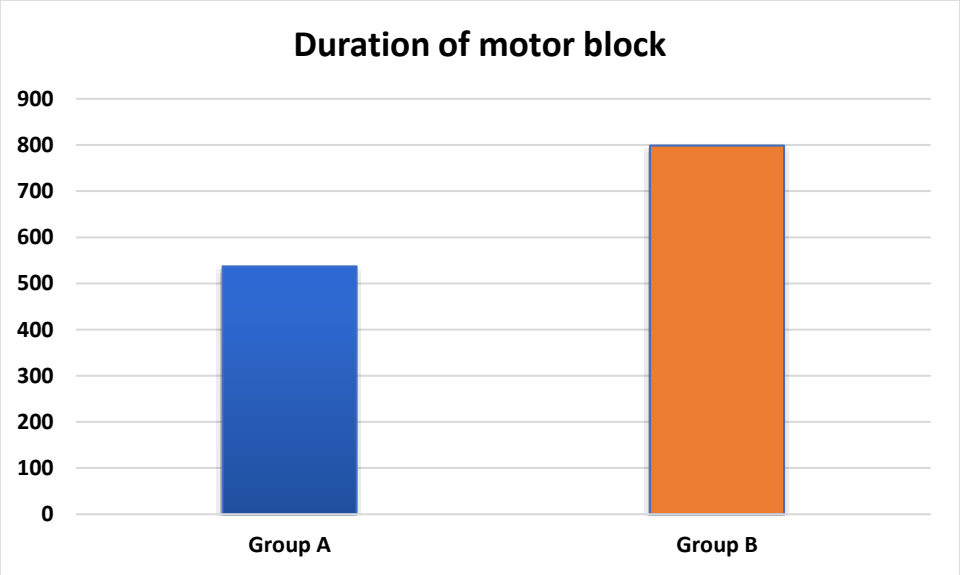


TABLE 3 DURATION OF SENSORY AND MOTOR BLOCK

PARAMETER	GROUP A	GROUP B	P VALUE
	MEAN SD	MEAN SD	
DURATION OF SENSORY BLOCK	654.40 ± 28.42 mins	942.0 ± 54.32 mins	<0.001*
DURATION OF MOTOR BLOCK	537.03 ± 27.07 mins	798.67 ± 67.84 mins	<0.001*





DISCUSSION

It is widely acknowledged that regional anesthesia provides benefits over general anesthesia, especially with regard to reduced exposure to the anesthetic, reduced requirement for systemic analgesics, and quicker discharge.[5]

Uneven nerve block, early wear-off, toxicity from local anesthetics, anxiety, and the requirement for intraoperative sedation are some of the disadvantages of regional anesthesia. If these problems can be fixed, most patients will find that regional anesthetic is safe and comfortable. Intravenous benzodiazepines, barbiturates, or opioids seemed to be the most obvious answer; nonetheless, it was crucial to take into account the haemodynamic effects of these drugs. Together with local anesthetics, these goals gave rise to the concept of additives

in regional anesthesia. The objective was to provide a fast, dense, and long-lasting block while also reducing the requirement for systemic analgesics and anxiolytics.[5]

Peripheral nerve blocks guided by ultrasound (USG) are among the safest, most accurate methods utilized today. Intraneural and intravascular injection side effects can be avoided with USG-guided regional nerve blocks.[2]

Since ropivacaine is a less lipophilic amide-linked local anesthetic with a S(−) enantiomer than bupivacaine, it has a lower potential for cardiotoxicity and central nervous system (CNS) toxicity. It penetrates large myelinated nerve fibers less because it is less lipophilic, which results in a higher degree of motor sensory differentiation.[2]

Dexmedetomedine , an α2 agonist with central activity, uses peripheral α2 adrenoceptors to induce antinociception. Clonidine is another somewhat less selective centrally acting α2 agonist that has been added to local anesthesia. The most plausible mechanisms of action of dexmedetomidine are the reduction of calcium conductance and the activation of inwardly rectifying G1 protein-gated potassium channels, which results in membrane hyperpolarization and a decrease in the excitability of CNS cells.[2]

In our study Onset of sensory and motor block in Group A (30 mcg dexmedetomedine) was 10.07 ± 0.69 mins and 14.23 ± 0.77 mins respectively while in Group B (50 mcg dexmedetomedine) was 7.47 ± 0.63 mins and 10.0 ± 0.83 mins respectively. Mean durationof sensory block in Group A (30 mcg dexmedetomedine) was 654.40 ± 28.42 mins and in Group B (50 mcg dexmedetomedine) was 942.0 ± 54.32 mins while mean duration of motor block in Group A was 537.03 ± 27.07 mins and Group B was 798.67 ± 67.84 mins.

As in study done by Anjan das *et al* In a randomized, double-blind manner, 84 patients (20–50 years old) who had been posted for elective forearm and hand surgery under supraclavicular brachial plexus block were split into two equal groups (Group R and RD). Subclavicular block was used to administer 30 ml of 0.5% ropivacaine plus 1 ml (100 μg) of dexmedetomidine to group RD (n = 42) and 30 ml of 0.5% ropivacaine plus 1 ml of normal saline to group R (n = 42). Every patient had their postoperative visual analog scale (VAS), hemodynamics, side effects, time to first analgesic use, total analgesic need, and sensory and motor block onset and durations recorded.Group RD developed sensory and motor block earlier than group R ($P < 0.05$), while having similar demographic features. In comparison to group R, group RD had a considerably longer period of sensory and motor block, a longer wait to take analgesics for the first time, and a reduced total demand for rescue analgesics ($P < 0.05$).[6]

In terms of oxygen saturation, mean arterial blood pressure, and pulse rate, both groups were similar. $P > 0.05$ indicated that there was no statistically significant difference in our study.

Our study found no negative effects, such as bradycardia, hypotension, etc.

Our study clearly shows faster onset of sensory and motor block along with longer duration of sensory and motor block with use of 50 micrograms of dexmedetomedine with ropivacaine in USG guided brachial plexus block.

The limitation of our study is that USG machine is not available at all centres and is subject of availability at a particular centre .also the possibility of systemic changes caused by studied drug could not be ruled out because we did not check plasma levels of dexmedetomedine.

CONCLUSION

We came to conclusion that adding a higher dose of dexmedetomedine as an adjuvant to ropivacaine for brachial plexus blocks significantly fastened onset of sensory and motor block and prolonged duration of sensory and motor block without causing any significant side effects.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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