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RESEARCH ARTICLE

A COMPARATIVE STUDY OF ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING BUPIVACAINE – LIGNOCAINE WITH ADRENALINE AND DEXMEDETOMIDINE ADDED TO BUPIVACAINE – LIGNOCAINE WITH ADRENALINE

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ABSTRACT

Background and Objectives: The ultrasonographic visualization of the nerves to be blocked is a relatively new technique that holds promise for the future. The last few years have witnessed a tremendous increase in the use of ultrasound guidance for regional nerve blocks. Our study was conducted to study the effect of Dexmedetomidine added to the local an aesthetics for ultrasound guided supraclavicular block in respect to onset, duration of sensory and motor block along with duration of analgesia.

Materials and Methods: After informed consent, 60 ASA I and II patients undergoing elective upperlimb surgery under ultrasound guided Supraclavicularbrachial plexus block in were divided into two equal groups in a randomized double blind fashion. Group I patients received 0.5% bupivacaine(15ml) + 2%lignocaine with adrenaline (15ml) + normal saline(0.5ml) and Group II patients received 0.5% bupivacaine(15ml) + 2% lignocaine with adrenaline (15ml) + dexmedetomidine (0.5ml-50mcg).Onset and duration of Motor and sensory block block were recorded.

Results: Though with similar demographicprofile in both groups, sensory and motor block onset times was earlier in group II as compared to group I ($p<0.001$). Sensory and motor blockade duration were longer in group II than in group I ($p<0.001$).Intra-operative hemodynamicswere significantly lower in group II ($P < 0.05$) without any appreciable side-effects.

Conclusion: We conclude that dexmedetomidine added to bupivacaine- lignocaine with adrenaline in supraclavicular brachial plexus block isextremely effective in reducing the time of onset and prolonging the duration of both sensory & motor blockade.

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INTRODUCTION

Brachial plexus blockade is a time tested, popular and widely employed regional nerve block of upper extremity. Among the various approaches of brachial plexus block, supraclavicular approach is considered easiest and most effective.The first supraclavicular brachial plexus block was performed by Kulenkampff in 1912 (Alfred Lee *et al.,* 1987).

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The use of ultrasound for regional anesthesia is relatively new; however interest in this application is growing exponentially. Conventional peripheral nerve block techniques that are performed without visual guidance are highly dependent on surface anatomical landmarks for localization of the target nerve. It is therefore not surprising that regional anesthetic techniques are associated with a reported failure rate of up to 20% presumably because of incorrect needle and/or local anesthetic spread. ultrasound is the most practical imaging tool for regional anesthesia as it is portable, relatively easy to learn, moderately priced, and does not pose any radiation risk. Ultrasound provides real time imaging guidance during a nerve block procedure.

Alpha-2 agonists provide sedation, analgesia, muscle relaxation & anxiolysis (Halaszynski *et al*., 2012). Dexmedetomidine, an imidazole compound is the pharmacologically active s-enantiomer of medetomidine. The specificity of Dexmedetomidine for the alpha-2 receptor is 8 times that of clonidine, with an α-2 / α-1 binding affinity ratio of 1620:1 andhence, considered as the full agonist at alpha-2 receptors (Reves *et al*., 2010 and Kaur, 2011). Variousstudies have shown that Dexmedetomidine prolongsthe duration of sensory and motor block and provide avery good analgesia when used as an adjuvant to localanesthetics for nerve blocks (Brummett *et al*., 2008; Kanazi *et al*., 2006; Kanazi *et al*., 2004 and Esmaoglu, 2010). Our study was conducted to evaluate the efficacy of Dexmedetomidine as adjuvant to when added to 0.5% bupivacaine and 2% lignocaine with adrenaline.

MATERIALS AND METHODS

After obtaining permission from institutional ethics committee, written informed consent was taken.60 patients ofAmerican Society of Anesthesiologists (ASA) physical status I and II, aged between 18 - 60 years ofboth sexes undergoing elective orthopedic surgeries ofelbow, forearm and hand under ultrasound guided supraclavicular brachialplexus block were enrolled in the study.

Group I: Patients received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline(15ml) + normal saline(0.5ml).

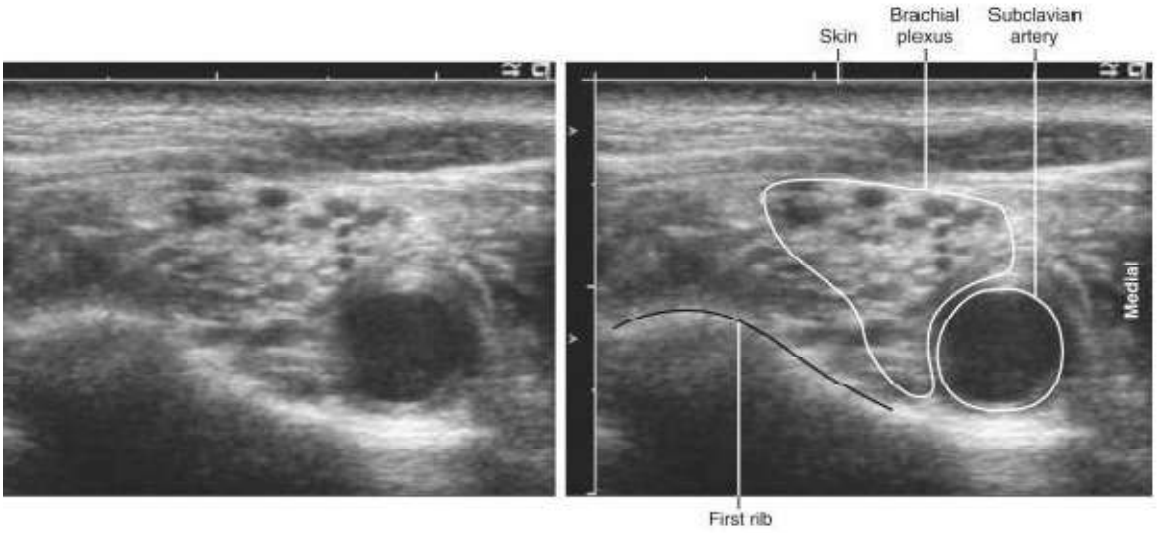
Group II:Patients received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + Dexmedetomidine(0.5ml).

Exclusion criteria: Patient refusal, known hypersensitivity to local anaesthetics, dexmedetomidine, pregnancy, lactating mothers, hepatic, renal or cardiopulmonary abnormality, alcoholism, diabetes, bleeding diathesis, local skin site infections were excluded from the study. Patients having a history of significant neurological, psychiatric, or neuromuscular disorders were also excluded.

Preoperative assessment: All the patients underwent thorough pre anesthetic evaluation on the day prior to surgery. All the patients were kept nil per oral as per the fasting guidelines. All patients were clinically examined in the pre-operative period and whole procedure was explained. All patients are investigated for Hb%, Total leukocyte count, different ialleukocyte count, erythrocyte sedimentation rate, platelet count, blood sugar, blood urea, serum creatinine and liver function tests. A 12 lead electrocardiography (ECG) and chest X-ray were also taken. In the operation theatre standard intra-operative monitors likeECG, pulse oximeter, non-invasive blood pressure were attached and baseline parameter were recorded. Intravenous (i.v) infusion of Ringers' lactate started and oxygen given at 3 L/min through a face mask. All patients received injection midazolam 0.04 mg/kg before procedure.

Landmarks: A point 1cm above the midpoint of clavicle and pulsations of the subclavian artery. Parts were prepared with povidone iodine solution. Local infiltration of 2ml of 1% lignocaine was given at the puncture site. This procedure was done by using sonosite ultrasound machine with 13-6 MHz transducer by in-plane approach using 22G, 100mm needle. Ultrasound machine & probe were prepared for the procedure under all aseptic precautions.

Block was performed after real time visualization of the vessels, nerve & bone. The brachial plexus and its spatial relationship to surrounding structures were scanned after the patients received IV access and routine anesthesia monitoring. With the patient lying supine and the head turned 45° to the contralateral side, the ultrasoundprobe was placed in the coronal oblique plane in the supraclavicular fossa to visualize thesubclavian artery and brachial plexus in the transverse sectional view (i.e., at approximately 90°). The brachial plexus, a cluster of hypoechoic nodules, was often found lateral to the round pulsating hypoechoicsubclavian artery lying on top of thehyperechoic first rib (Fig.1). Once brachial plexus is located.



Group I received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + normal saline(0.5ml).

Group II received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + Dexmedetomidine(0.5ml) over 2-3 minutes using inplane approach. During the procedure & thereafter, the patient was observed vigilantly for any complications of the block & for the toxicity of the drugs injected.

Sensory and motor blockade were assessed every 3 minutes till loss of sensation and movements and thereafter every half an hour till the regain of sensation and movements. Heart rate, mean arterial blood pressure and oxygen saturation were also recorded during this period. The duration of sensory block was defined as the time interval between the onset of sensory block and the first post-operative pain. The duration of motor block was defined as the time interval between the onset of motor block and complete recovery of motor functions. Onset of sensory block was assessed by spirit swab method.

Assessment of motor block was done using the Bromage three point score

0 normal motor function with full flexion and extension of elbow, wrist and fingers,
1 decreased motor strength with ability to move fingers and/or wrist only
2 complete motor blockade with inability to move fingers**]**. It was done by the same observer each .time till complete motor blockade after the drug injection

Sedation Assessed by the Ramsay sedation score (Ramsay, 1974). Sedation was assessed using the Ramsay sedation score (RSS);

Level 1 Anxious and agitated,or restless or both
Level 2 Co-operative, oriented and tranquil
Level 3 Responds to commands only
Level 4 Brisk response to painful stimulus
Level 5 Sluggish response to painful stimulus
Level 6 No Response to painful stimulus

Heart rate, blood pressure & oxygen saturation were recorded every 5min intraoperatively& then at an interval of every 30mins postoperatively.

Statistical Analysis

All recorded data were entered using MS Excel software and analyzed using SPSS 20 version software for determining the statistical significance. Results were expressed as mean ± standard deviation. Proportions were compared using Chi-square test. The student 't' test was used to determine whether there was a statistical difference between the study groups."P" value of >0.05 was considered not to be statistically significant, <0.05 was considered to be statistically significant, a value of <0.01 was highly statistically significant & a "P" value of <0.001 was considered as extremely statistically significant. The groups were comparable with respect to their age, sex & weight because there was no statistical significant difference among the groups (p > 0.05), (Table 1).

Demographic Data

Table 1. Comparison of demographic data among the groups

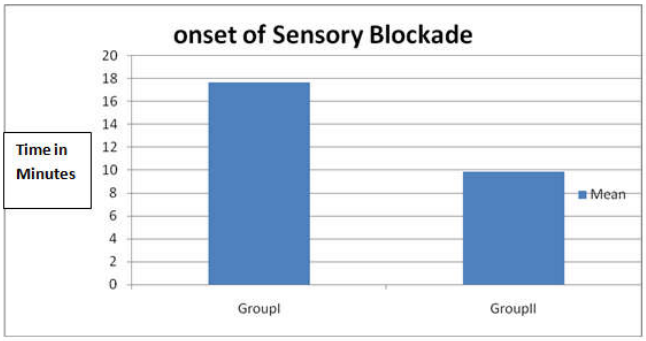
		Group I	Group II	P Value
Age		33.7±13.57	31.5± 13.76	0.53
Sex	Males	24	25	0.73
	Females	6	5	
Weight		65.9±8.	64±7.1	0.33

The mean onset time of sensory blockade was faster in group II (9.9±2.34) compared to that in group I (17.7±2.35). This difference was statistically highly significant (P<0.001), (Table 2) (Graph 1)

Onset Time of Sensory Block

Table 2. Onset time of sensory block

Onset time (Min)	Group I	Group II	t value	P value
Mean	17.7	9.9	12.88	<0.001
SD	2.35	2.34		



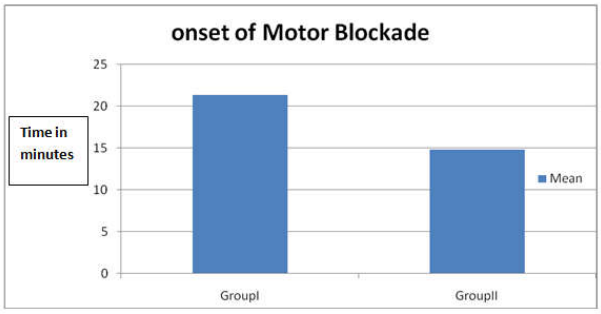
Graph 1. Onset time of sensory block

The mean onset time of motor blockade was faster in group II (14.8±2.48) compared to that in group I (21.4±3.22). This difference was statistically highly significant (P<0.001), (Table 3), (Graph 2)

Onset time of motor block

Table 3. Onset time of motor block

Onset time (Min)	Group I	Group II	t value	P value
Mean	21.4	14.8	8.89	<0.001
SD	3.22	2.48		



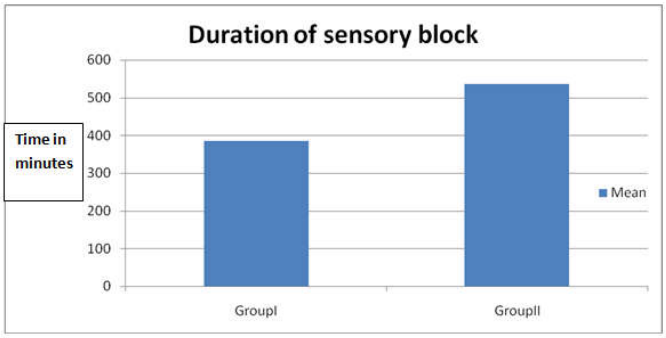
Graph 2. Onset time of motor block

The mean duration of sensory blockade was more in group II (535.67±38.92) compared to that in group I (386±42.23). This difference was statistically highly significant (P<0.001), (Table 4), (Graph 3).

Duration of sensory block

Table 4. Duration of sensory block

Duration time (Min)	Group I	Group II	t value	P value
Mean	386	535.67	14.36	<0.001
SD	42.23	38.92		



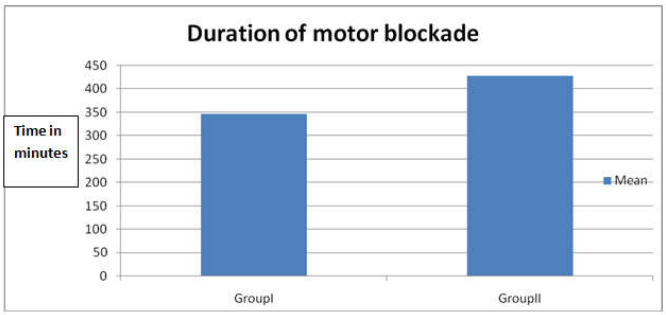
Graph 3. Duration of sensory block

The mean duration of motor blockade was more in group II (428±38.54) compared to that in group I (347±37.52). This difference was statistically highly significant (P<0.001), (Table 5), (Graph 4).

Duration of motor block

Table 5. Duration of motor block

Duration time (Min)	Group I	Group II	t value	P value
Mean	347	28	8.24	<0.001
SD	37.52	38.54		



Graph 4. Duration of motor block

There was statistically significant difference in heart rate between the groups at 27,30, 60, 90, 120, 150, 180, 210, 240, 270& 300 min (p.<0.05).There was statistically significant difference in mean arterial pressure between the groups at 15,18,21,24, 27,30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360 & 420 min (p.<0.05). The sedation score was better in group II compared to group I & this difference is statistically highly significant (p<0.001).

Table 6. Variation of sedation score among the groups

RSS	Group I	Group II	p value
1	30	05	< 0.001
2	00	25	
Total cases	30	30	

DISCUSSION

Use of ultrasound in Anaesthesia practise is increasing over the years. Ultrasound guided nerve blocks provides real time visualisation of deposition of the drugs around the nerve plexus reducing the margin of error for failures. Supraclavicular brachial plexus block is the most commonly performed block for upperlimb surgeries as almost the entire sensory, motor and sympathetic innervations of the upper extremity are carried in just three nerve structures (trunks), confined to a very small surface area. Consequently, typical features of this block include rapid onset, predictable and dense anesthesiaalong with its high success rate (Singh *et al*., 2010). Local anesthetics alone forsupraclavicular brachial plexus block provide good operative conditions but have a shorter duration of postoperativeanalgesia. Hence various drugs such as opioids (Schoeffler *et al*., 1997), clonidine (Kohli, 2013), neostigmine, dexamethasone (Yadav, 2008), midazolam (Jarbo, 2005), magnesium (Dogru, 2012) etc., were used as adjuvants to local anesthetics in brachialplexus block to achieve quick, dense and prolonged block.

In our study, we demonstrated that in patientsundergoing ultrasound guided Supraclavicular brachial plexus block forupper arm surgery, addition of Dexmedetomidine which is a potentα2 selective agonist to 0.5% bupivacaine and 2% lignocaine with adrenaline shorten the sensoryand motor block onset time and prolongs the durationof sensory and motor block time. Rachana Gandhi, Alka Shah and Ila Patel[16]conducted a prospective double blind study to compare the postoperative analgesic efficacy and safety of dexmedetomidine (30µg) for brachial plexus blockade along with bupivacaine (0.25%). It was observed that in control group onset of motor and sensory blockade was faster, whereas, dexmedetomidine group have better hemodynamic stability and greater postoperative analgesia. Amany S. Ammar and Khaled M. Mahmoud (Amany, 2012), conducted a prospective randomized controlled trial of ultrasound-guided infraclavicular brachial plexus block using 0.33% (30cc) bupivacaine alone or combined with 0.75µg/kg of dexmedetomidine, to study the efficacy of dexmedetomidine. They concluded that adding dexmedetomidine to bupivacaine provides enhancement of onset of sensory and motor blockade, prolonged duration of analgesia, increases duration of sensory and motor blockade, yields lower VAS pain scores and reduces supplemental opioid requirement. Our study concluded that the mean onset time of sensory blockade was faster in group II (9.9±2.34) compared to that in group I (17.7±2.35).(p<0.001). The mean onset time of motor blockade was faster in group II (14.8±2.48) compared to that in group I (21.4±3.22). This difference was statistically highly significant (P<0.001). The mean duration of sensory blockade was more in group II (535.67±38.92) compared to that in group I (386±42.23). This difference was statistically highly significant (P<0.001). The mean duration of motor blockade was more in group II

(428±38.54) compared to that in group I (347±37.52). This difference was statistically highly significant (P<0.001).

Conclusion

We conclude that addition of 50µg of Dexmedetomidine to local anaesthetics for ultrasound guided supraclavicular block hastens the onset of sensory and motor block and also prolongs the duration of sensory and motor block significantly without significant side effects.

Conflicts of Interest: None.

Source of support: Nil.

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