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ORIGINAL RESEARCH

Comparison of Dexmedetomidine and Clonidine as an Adjuvant to 0.25% Bupivacaine in Peripheral Nerve Stimulator Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgery- A Randomised Single Blind Prospective Study

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ABSTRACT

Background: The supraclavicular approach to brachial plexus block is the most common peripheral nerve block technique used for upper limb surgeries. Aim of the present study was to evaluate and compare the efficacy of clonidine and dexmedetomidine as an adjuvant to 0.25% bupivacaine in peripheral nerve stimulator guided supraclavicular brachial plexus block in upper limb surgery.

Method: Total 80 patients of ASA grade I and II, age between 25-55 years were enrolled in the study and divided into two groups of 40 each. Group C received 39ml bupivacaine 0.25% (2.5mg/ml) + 1ml clonidine (1µg/ml) and group D received 39ml bupivacaine 0.25% (2.5mg/ml) + 1ml dexmedetomidine (1µg/ml). Parameters were observed include hemodynamic stability, onset time and duration of sensory and motor blockade, duration of analgesia and complications.

Results: Onset of sensory (2.32±1.16min) and motor blockade (5.55±1.50min) was earlier in dexmedetomidine group compared to clonidine group (sensory= 6.52±0.71min and motor= 11.65±1.05min), ($p<0.0001$). Duration of sensory blockade was 427.75±19.14 minutes in dexmedetomidine group and 226.0±11.72 minutes with clonidine group. Duration of motor blockade was 486.50±28.96 minutes with dexmedetomidine group and 275.25±17.53 minutes with clonidine group. However, the duration of analgesia was 588.25±28.27 minutes with dexmedetomidine group and 341.00±27.34 minutes with clonidine group. Hemodynamic parameters and side effects were comparable between the two drugs.

Conclusion: Dexmedetomidine shortens the onset, prolongs the duration of sensory and motor block, and also provides longer postoperative analgesia as compared with clonidine when used as an adjuvant to bupivacaine in peripheral nerve stimulator guided supraclavicular brachial plexus block.

Keywords: Supraclavicular brachial plexus block; Peripheral nerve block; Clonidine; Dexmedetomidine; Bupivacaine; Sensory; Motor blockade

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INTRODUCTION

Supraclavicular approach for brachial plexus block is technically easy with little risk of damage to vital structures and widely used for upper limb surgeries either solely or with sedation or combined with general anaesthesia. The classical approach of giving block by paraesthesia technique may be associated with high rate of block failure and nerve injuries. To avoid such complications peripheral nerve stimulator is better alternative option to locate exact location of nerve for block. Peripheral nerve blocks with local anaesthetics provide excellent operating conditions with good muscle relaxation but the duration of analgesia is rarely maintained for more than 4-6 hours even with the longest acting local anaesthetics (Bupivacaine, Ropivacaine and Levobupivacaine) [1].

Bupivacaine is the most commonly administered drug in brachial plexus blocks; however, onset of action and duration of anaesthesia are the limiting factors. Onset times of approximately 14 min for lidocaine and mepivacaine have been reported, versus approximately 23 min for bupivacaine. To minimize these drawbacks many drugs including opioids such as morphine, fentanyl, tramadol, buprenorphine, sufentanil and calcium channel blockers such as verapamil, steroids like dexamethasone and neostigmine were tried [2-5].

Recently there is a renewed interest on α2 agonists like clonidine and dexmedetomidine as an adjunct to local anaesthetics [6]. Clonidine an α2 adrenoreceptor agonists which had been used as antihypertensive initially has sedative, sympatholytic and analgesic properties. It is also known to have anti-nociceptive action and enhances the effect of local anaesthetics when given intrathecally, epidurally and in peripheral nerve blocks [7]. Dexmedetomidine is also α2 adrenoreceptor agonist and its selectivity to α2 adrenoreceptor is 8 times greater than Clonidine [8]. However, the usages of clonidine in brachial plexus block with various local anaesthetics yield conflicting results. Dexmedetomidine has been found to be an effective and safe adjuvant in many studies on neuraxial and peripheral nerve blocks [9]. Hence the present study was undertaken to compare the efficacy of clonidine and dexmedetomidine as an adjunct to 0.25% bupivacaine in supraclavicular brachial plexus block in upper extremity surgery for onset and duration of sensory as well as motor block, duration of analgesia, hemodynamic stability, and complications / side effects if any.

MATERIALS AND METHODS

After obtaining Institutional Ethical Committee approval and written informed consent from all the patients, this prospective, randomized, hospital based, single blind study was conducted in the Department of Anaesthesiology at tertiary care hospital during a period of 24 months starting from the date of ethics committee approval. Eighty patients of age between 25 to 55 years, ASA grade I and II undergoing elective upper limb surgeries were included in the study. Patients with known allergy to local anaesthetics, infection at local site, patient with ASA grade III, IV or V, history of cardiovascular disorders, respiratory compromise, hepatic failure, renal failure, bleeding disorders or patient on anticoagulant therapy and patient's refusal were excluded from the study. Selected patients were randomly allocated to one of the two groups of 40 patients each by block randomization using random number table. Group C i.e., clonidine group received 39 ml Bupivacaine 0.25% (2.5 mg/ml) + 1ml Clonidine (1μg/kg) and group D i.e., dexmedetomidine group received 39 ml Bupivacaine 0.25% (2.5 mg/ml) +1ml Dexmedetomidine (1μg/kg).

All the patients underwent thorough preanesthetic evaluation on the day prior to surgery. Thorough general and systemic examination was done including airway and the surface anatomy where the block was to be given. All the patients were kept nil per oral 6 hours prior to surgery. All of them received Tab. Diazepam 10 mg at night before the

surgery. Blood investigations (Hb%, TLC, DLC, BT, CT, serum urea, serum creatinine serum bilirubin, blood sugar level and blood group), routine and microscopic urine analysis, ECG and Chest x-ray PA view were done.

Intravenous access obtained in the limb opposite to that undergoing surgery with a large bore iv cannula. Standard multipara monitors (ECG, Pulse oximeter, Non-invasive blood pressure) were connected and monitored in all the patients and recorded at interval of 5 minute in the first 30 minutes and every 30 minutes thereafter. Patient was placed in supine position with head turned 30^0 to the opposite side to be injected. The arms were placed at the patient's side with hands pointing towards the knee. A rolled towel was placed lengthwise between the shoulders along spine to give the best exposure of area. The interscalene groove and subclavian pulsations were marked. An intradermal wheal raises about 1.5-2.0 cm above the midclavicular point. The pulsation of subclavian artery against the palpating finger was used as a guide and the stimulating needle was inserted just above the palpating finger (i.e., the inferior most point of interscalene groove) and advanced in a direction which was directly caudal running parallel to sagittal axis. The needle was advanced behind the palpating finger until EMR of elbow or hand was obtained. If contraction was observed with a stimulated voltage reduced to 0.5 mA, 0.5 ml/ kg of LA mixture containing 0.25 % bupivacaine and inj. Dexmedetomidine (1μg/kg) 1ml or inj. Clonidine (1μg/kg) 1ml was injected (not exceeding 40 ml) after a negative aspiration for blood. Goal is to achieve hand twitch (preferably flexion of finger and thumb) using a current of 0.2-0.3mA. Care was taken so that the toxic dose of the local anaesthetics was not exceeded according to the weight of the patients.

Sensory block was assessed by pin prick with 23G hypodermic needle by pin prick method in skin dermatomes C4-T2 once in every minute for initial 30 minutes and then after every 30 minutes till patient regained normal sensations and graded according to Visual analogue scale (VAS). Quality of motor block was assessed at the same intervals (i.e., in skin dermatomes C4-T2 once in every minute for initial 30 minutes and then after every 30 minutes till patient regained normal motor power) and graded according to Modified Lovett's Scoring. Onset time of sensory and motor blockade, duration of sensory and motor block, duration of analgesia was noted. Patients were observed for bradycardia, hypotension convulsions, restlessness, disorientation, drowsiness, nausea, vomiting and any other complications.

Statistical Analysis

Statistical analysis was done by applying unpaired t- test and chi square test and p value was determined. If 2 tail p value was: $P > 0.05$, it was not significant while $P < 0.05$, it was significant.

OBSERVATIONS AND RESULTS

A total 80 patients of ASA grade I and II, age between 25-55 years undergoing elective upper limb surgeries were enrolled in the study and divided into two groups of 40 each. Both the groups were comparable and found no significant difference in regard to demographic profile of the patients and duration of surgery, ($p>0.05$) as shown in table 1.

Table 1: Demographic profile of the patients and duration of surgery

Demographic data		**Group D**	**Group C**	**P value**
Age groups (years)	25-30	13 (32.5%)	07 (17.5%)	0.26
	31-35	08 (20%)	05 (12.55)	
	36-60	06 (15%)	04 (10%)	
	41-45	03 (7.5%)	02 (05%)	
	46-50	04 (10%)	11 (27.5%)	

	51-55	06 (15%)	11 (27.5%)	
Gender	Male	33 (82.5%)	30 (75%)	>0.05
	Female	07 (17.5%)	10 (25%)	
Height (cm)	140-150	15 (37.5%)	13 (32.5%)	>0.05
	151-160	19 (47.5%)	20 (50%)	
	161-170	06 (15%)	07 (17.5%)	
Weight (Kg)	40-50	08 (20%)	09 (22.5%)	0.78
	51-60	10 (25%)	07 (17.5%)	
	61-70	17 (42.5%)	11 (27.5%)	
	71-80	05 (12.5%)	13 (32.5%)	
Mean duration of surgery		85.5±25.0 min	80.6±24.8 min	0.385

The preoperative hemodynamic parameters were comparable in both the groups. Significantly lower heart/pulse rate was observed at 60 min and 120 min in dexmedetomidine group as compared with clonidine group, but not less than 60 beats/min, which was statistically significant, (p 0.001). No treatment was required in any patients. Systolic and diastolic blood pressure remains significantly lower at 60 min to 120 min and 90 min to 120 min respectively in group D as compared to group C which was statistically significant. All patients remained hemodynamically stable throughout the surgery and anaesthesia, (Figure 1).

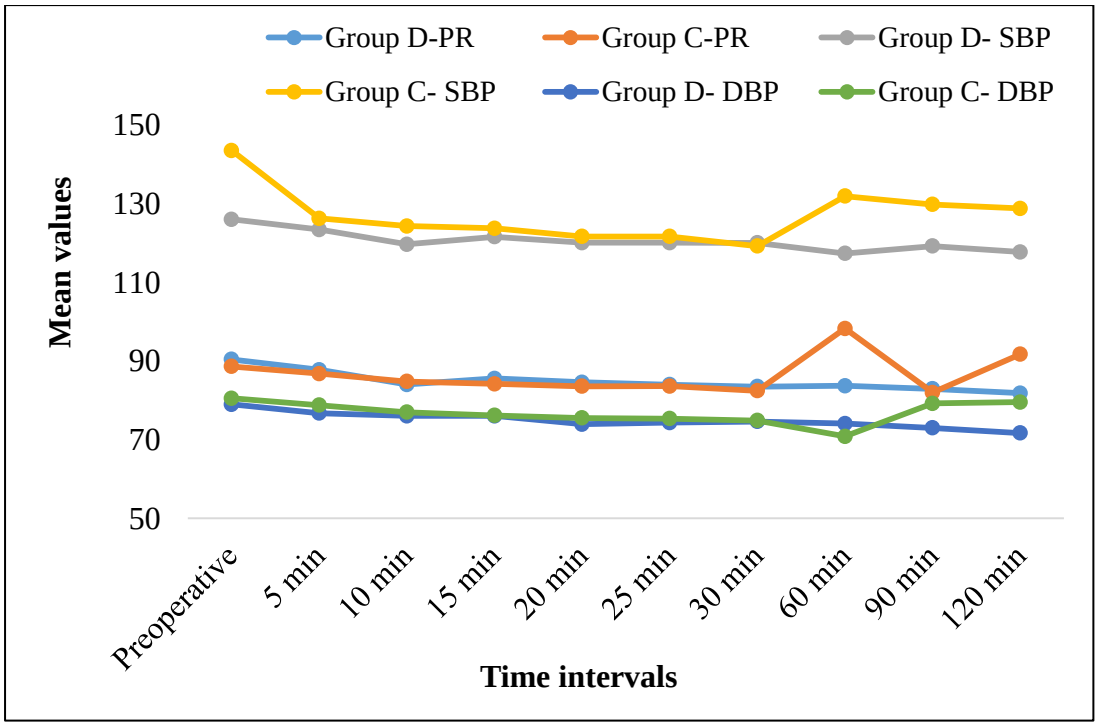

Figure 1: Comparison of haemodynamic parameters between two groups

Onset of sensory and motor blockade was earlier, and the duration of sensory and motor blockade was prolonged in dexmedetomidine group compared to clonidine group that was statistically significant (p<0.0001). Also, the duration of analgesia was longer in dexmedetomidine group compared with clonidine group, which was statistically significant

(p<0.0001) as shown in table 2. There was no side effects or complications observed in this study.

Table 2: Comparison of anaesthetic characteristics in both groups

Characteristics	Group D	Group C	P value
Onset of Sensory Blockade	2.32 ± 1.16	6.52 ± 0.71	0.0001
Onset of Motor Blockade	5.55 ± 1.50	11.65 ± 1.05	0.0001
Duration of Sensory Blockade	427.75 ± 19.14	226.00 ± 11.72	0.0001
Duration of Motor Blockade	486.50 ± 28.96	275.25 ± 17.53	0.0001
Duration of Analgesia	588.25 + 28.27	341.00 + 27.34	0.0001

DISCUSSION

Brachial plexus block provides post-operative analgesia of short duration even when a long-acting local anaesthetic like bupivacaine is used alone. Various studies have shown that addition of adjuncts like clonidine and dexmedetomidine in local anaesthetic solution in peripheral nerve blocks prolonged the duration of anaesthesia and analgesia [1].

The α2 agonists dose dependently enhances local anaesthetic potency and prolongs its duration by combining at the α2 receptors at the peripheral level. The other possible mechanisms by which the α2 agonists improve local anaesthetic action include vasoconstriction around the site of injection, thus the absorption of local anaesthetic drug will be delayed, resulting in a prolongation of the local anaesthetic effect. Other mechanisms include release of local enkephalin like substances, decrease in the release of local inflammatory mediators and increase in the release of anti-inflammatory cytokines [10].

Here an attempt has been made to compare the efficacy of dexmeditomidine and clonidine as an adjuvant to bupivacaine 0.25% in brachial plexus block (supraclavicular approach) in terms of onset time, duration of anaesthesia and analgesia, hemodynamic stability and side effects. The two groups were comparable and found no significant difference with respect to age, sex distribution, height, weight, ASA status and duration of surgery. The type of surgeries done, were almost similar in both the groups. These findings are comparable with the study conducted by Kalyanam P et al [1], Kirubahar R et al [10].

The preoperative and intraoperative hemodynamic parameters were comparable in both groups. All the patients remained hemodynamically stable throughout the surgery and anaesthesia. Postoperatively patient's hemodynamical parameters observed for 12 hours but this was not clinically significant and none of them required treatment. These observations are consistent with the study carried out by Tripathi A et al [11] and Shastri Y et al [12].

The onset time of the sensory and motor blockade was earlier in dexmedetomidine group in comparison with clonidine group, which was statistically significant (p value <0.0001). These findings are comparable with the study done by Shastri Y et al [12], Sreeja R et al [13] and Singh H et al [14]. However, the duration of sensory and motor blockade was longer in dexmedetomidine group as compared to clonidine group, this was statistically significant (p value <0.0001) which is in accordance with the earlier studies [11-13, 15, 16].

The duration of analgesia was 588.25±28.27 minutes with dexmedetomidine group (Group D) and 341.0±27.34 minutes with clonidine group (Group C). Thus, the duration of analgesia was longer in dexmedetomidine group as compared with clonidine group, which was statistically significant (p value <0.001). Similar findings are reported in other studies done by Tripathi A et al [11], Shastri Y et al [12], Shekhawat KK et al [15], More P et al [17] and Swami SS [18].

In the present study, we didn't find any serious complications. None of the patients experienced an episode of hypotension, bradycardia, or hypoxemia that required treatment during either intraoperative or postoperative period. Side effects such as drowsiness, nausea, and vomiting were not seen in any patient in the two groups. These observations are consistent with the previous studies [12,14,15,18,19].

CONCLUSION

After the use of α2 agonists, dexmedetomidine (1 μg/kg) and clonidine (1 μg/kg) as adjuvants to local anaesthetic solution (0.25% bupivacaine) in peripheral nerve stimulator guided supraclavicular brachial plexus block for upper limb surgeries, we conclude that faster onset of sensory and motor block was seen with dexmedetomidine as compared to clonidine. However, the duration of sensory and motor block as well as duration of postoperative analgesia was significantly prolonged with dexmedetomidine as compared to clonidine. Both the drugs maintain stable hemodynamic and no significant side effects/complications occurs during both perioperative and postoperative period.

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