Original Research Article

Quality of blockade after dexmedetomidine and bupivacaine combination in interscalene block

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Abstract

Background: Regional anaesthesia in the form of interscalene approach to the brachial plexus is often used to improve analgesia. Dexmedetomidine, an alpha-2 agonist, was first proposed as an adjuvant capable of prolonging duration of sensory and motor block produced by nerve blocks. Bupivacaine can block motor nerves if presenting sufficient concentration. **Aim:** To assess the quality of blockade after Dexmedetomidine and bupivacaine combination in interscalene block. **Material and Methods:** A total of 80 patients of ASA I, and II undergoing elective various upper limb surgeries were included in the study. Patients were divided into 2 groups of 40 each (Group A and Group B). Group A received 30 ml of 0.25% Bupivacaine and Group B received 0.25% Bupivacaine in addition to 1µg/kg dexmedetomidine. Sensory block was evaluated with Hollmen score. Motor blockade was determined according to a Modified Bromage scale for upper extremities on a 3-point scale. **Results:** Onset of sensory and motor blockade was faster in Group B compared to Group A and this difference was statistically highly significant. The duration of motor blockade was longer in Group B (400.3±61.81min) compared to Group A (188.7±20.52 min). Duration of sensory blockade was significantly longer in Group B (440.25±55.21min) compared to Group A (225.5±19.07min) and this difference was both clinically and statistically highly significant. Quality of block was significantly better in Group B compared to Group A. **Conclusion:** Dexmedetomidine added as an adjuvant to 0.25% bupivacaine in Interscalene brachial plexus block in upper limb surgeries is highly effective in prolongation of sensory and motor blockade and provides better postoperative analgesia.

Key Words: Interscalene block, Dexmedetomidine, bupivacaine, sensory blockade, motor blockade, quality

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INTRODUCTION

Upper limb surgeries are common and the brachial plexus block is an established regional anaesthetic technique for these surgeries. Regional anaesthesia in the form of interscalene approach to the brachial plexus is often used to improve analgesia and facilitate mobilization, as an adjunct to general anaesthesia or as the primary anaesthetic.[1] Limiting factors of brachial plexus block are onset of action and duration of analgesia. Increasing volume (dose) of local anaesthetics may prolong duration of analgesia but increases the risk of systemic toxicity. Continuous catheter based nerve blocks provide very good postoperative analgesia but their placement requires additional time, cost and skill. To minimize these drawbacks there has always been a search for an ideal adjuvant.[2] Dexmedetomidine, an alpha-2 agonist, was first proposed as an adjuvant capable of prolonging duration of sensory and motor block produced by nerve blocks.[3] Bupivacaine like other local anaesthetics can block motor nerves if presenting sufficient concentration but has no effect on the neuromuscular junction as such.[4] This study was conducted to assess the quality of blockade after Dexmedetomidine and bupivacaine combination in interscalene block.

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MATERIAL AND METHODS

The study was conducted in tertiary care hospital. It included 80 patients undergoing elective surgeries of the upper limb. Written informed consent was obtained from each participating patient in their own language before enrolling into the study after complete explanation of the study protocol and procedure.

Study design

It was a prospective randomized double blind interventional type of the hospital based controller study.

Sample size

A total of 80 patients of ASA I, and II undergoing elective various upper limb surgeries were included in the study. Patients were divided into 2 groups of 40 each (Group A and Group B).

Group A: Received Interscalene brachial plexus block with 30 ml of 0.25% Bupivacaine + 1ml of normal saline a total of 31 ml.

Group B: Received Interscalene brachial plexus block with 30ml 0f 0.25% Bupivacaine + 1µg/kg dexmedetomidine + normal saline to make total of 31 ml.

Inclusion criteria

- Age: 18- 65 years
- American society of anaesthesiologist (ASA) physical status- I and II
- Elective upper limb surgeries

Exclusion criteria

- Patient refusal for procedure
- Patient with Bleeding disorders or on anticoagulants
- Neurological deficits involving brachial plexus
- Patients with allergy to local anaesthetics
- Local infection at the injection site
- Patients on any sedatives or antipsychotics

These patients were randomly divided into two groups each of 40 patients by lottery method. This was done and the medications were prepared by another person, that way the patient and the person doing the study were unaware of the group a particular patient had been allotted.

Procedure

The Interscalene groove was located by sliding the fingers laterally from under the sternocleidomastoid muscle. The index and middle finger of the left hand remain in the groove, and a small skin wheal is made over the groove and between these fingers. The block needle was then inserted perpendicularly to all planes and slightly caudal. The needle was advanced through the sheath, at which time a fascial "pop" may be felt. As one of the roots of the plexus is neared, the muscles supplied by that root will be stimulated to contract. Usually a current of 1-1.5 mA is adequate to start searching. Once an appropriate muscle contraction is seen, the current is decreased slowly to determine the threshold (the lowest current at which stimulation still occurs). The closer the needle is to a nerve, the lower the threshold will be. Some practitioners generally search for a current of less than 0.5 mA. If the threshold current obtained is higher than desired, the needle is repositioned. Once the desired response is found, the needle is stabilized and 30 mL of local anesthetic is injected. As with all nerve blocks, injection should be slow, in increments and with frequent aspiration. If the threshold current is 0.2 mA or less, if injection pressure is high, or if the patient has a paresthesia during needle placement or injection, the needle is pulled back slightly because of concern of intraneural placement. An acceptable motor response would be one involving the deltoid muscle or any muscle in the arm or hand. If the needle is placed lateral and posterior to the middle scalene, it is possible to stimulate the accessory, dorsal scapular, and long thoracic nerves, which results in stimulation of the trapezius, rhomboids, and serratus anterior muscles, respectively. If the needle is placed between the anterior scalene and the sternocleidomastoid muscle (ie, too anterior), the phrenic nerve is frequently stimulated, causing contraction of the diaphragm (ie, hiccupping). Thus, these undesired twitches can help guide the practitioner in repositioning of the needle.

Assessment of sensory block

Sensory block was assessed with pin prick method assessment of sensory block was done at interval of 1 minute in random sequence in the dermatomal areas corresponding to median nerve, radial nerve, musculocutaneous nerve and ulnar nerve after completion of drug injection and compared with the opposite limb. Sensory block was evaluated with Hollmen score.

Assessment of motor block

It was carried out by the same observer at each minute till complete motor blockade as occurred after drug injection. Onset of motor blockade is considered when there is Grade 1 motor blockade. Complete motor blockade was considered when there is Grade 2 motor blockade. Motor blockade was determined according to a Modified Bromage scale for upper extremities on a 3-point scale.

Statistical analysis

The independent samples t-test procedure compares means for two groups of cases. SPSS for windows (version 21.0, SPSS Inc., Chicago, IL, USA) was employed for data analysis. $P < 0.05$ was considered as significant.

RESULTS

Mean age in Group A was 37.875 years and Group B was 38.025 years. Both groups were comparable in terms of age. Independent two sample T-test was applied. The difference was not statistically significant (P value=0.9663). In group A there were 33 males and 7 females whereas group B included 30 males and 10 females. There was no significant difference between gender distribution in Group A and Group B (P value >0.05). Both groups were comparable in terms of gender distribution. Mean Duration of surgery in Group A was 101.35 minutes and Group B was 102.75 minutes. There was no significant difference between mean duration of surgery (in minutes) in group A and Group B (P value >0.05). Independent two sample T-test was applied. The difference was not statistically significant (P value= 0.593).

Table 1: Type and Distribution of various surgeries in Group A and Group B

Surgery/ Procedure	Group A	Group B	Z-value
Humerus fracture	23	21	0
Supracondylar Humerus fracture	6	14	-2.065
Lateral condyle fracture	2	0	1.43
Medial condyle fracture	3	1	1.026
Olecranon fracture	4	4	-0.84
Radial head excision	2	0	1.43
Total	**40**	**40**	

The two groups were well matched with respect to type of surgical procedures. Two groups were comparable and no statistical significance found (P value >0.05).

Table 2: Comparison of Onset of sensory block (in minutes) in Group A and Group B

	Group A Mean±SD	Group B Mean±SD	P value
Onset of sensory block	15.025±1.52	2.7±0.85	<0.0001
Duration of sensory block	225.5±19.07	440.25±55.21	<0.0001
Onset of motor block	20.075±1.40	5.425±0.95	<0.0001
Duration of motor block	188.7±20.52	400±61.81	<0.0001
Duration of analgesia	275.75±24.27	688.75±33.219	<0.0001

There was significant difference between mean onset of sensory block (in minutes) in group A and Group B. Onset of sensory was faster in Group B (2.7□0.85min) compared to Group A (15.025□1.52min). Independent two sample T-test was applied. The difference was statistically extremely significant (P value=0.0001). There was significant difference between mean time of onset of motor blockade Group A and Group B. Time of onset of motor blockade was faster in Group B (5.425□0.95min) as compared to Group A (20.075□1.40min). Independent two sample T-test was applied. The difference was statistically significant (P value= <0.0001). Duration of motor block was longer in Group B (400□61.81min) and Group A (188.7□20.52min). There was significant difference between Mean Duration of motor block (in minutes) in group A and Group B. Independent two sample T-test was applied. The difference was statistically significant (P value=<0.0001).The duration of sensory Block was longer in Group B (440.25□55.21min) as compared to Group A (225.5□19.07min). There was significant difference between mean duration of sensory block (in minutes) in group A and Group B. Independent two sample T-test was applied. The difference was statistically significant (P value=<0.0001). The duration of analgesia was longer in Group B (688.75□33.219 min) as compared to Group A (275.75□24.27min). Independent two sample T-test was applied. The difference is statistically significant (P value=<0.0001).

Table 3: Comparison of Quality of Block in Group A and Group B

Quality of Block		Groups		Total	Z value
		Group A	Group B		
QOB (grade)	III	26 (65%)	6 (15%)	32	
	IV	14 (35%)	34 (85%)	48	-4.47
Total		**40**	**40**	**80**	

Table 3 shows that Grade 3 block was achieved by 26% in Group A and 6% in Group B. Grade 4 block was achieved by 85% in Group B and by 35% in group A patients. Quality of block was better in Group B as compared to Group A. Z test

was applied The difference was statistically significant. (p value<0.0001). No side effects and complications were seen during the first 24 hrs in the post-operative period in both the groups.

DISCUSSION

With the advancement in the field of regional anaesthesia and better understanding of applied anatomy, peripheral nerve blocks are becoming more and more popular with each day ahead. Brachial plexus blocks are easy and relatively safe procedures and achieve ideal operating conditions by producing complete muscle relaxation, pain relief, maintaining stable intra- operative hemodynamic. The acceptance of regional nerve block technique has been limited by two major factors inherent to local anaesthetic agents available for use namely slow onset of action and short duration of action. In our study, mean onset of sensory block was faster in group B (2.7±0.85 min) as compared to Group A (15.025±1.52min) and mean onset of motor block was also earlier in Group B (5.42±1min) as compared to Group A (20.075±1.403min). These results were similar to the results obtained in studies conducted by Swami SS *et al*[5] and Harshavardhana HS.[6] In the study conducted by Swami SS *et al*[5] and Harshavardhana HS,[6] where dexmedetomidine (1µg/kg) was added to 35ml 0.25% Bupivacaine and Clonidine was added to Ropivacaine (0.5%), respectively in supraclavicular block found onset of sensory block in Dexmedetomidine group (1.77±1.28 min) was faster as compared to Clonidine group (2.33±1.21 min). Another study, Yu-Nan Lin *et al*[7] compared the effect of adding Dexmedetomidine (1µg/kg) and Clonidine (1µg/kg) to 38ml 0.25% bupivacaine in cervical plexus block. They found that onset of sensory block was faster in Dexmedetomidine group (1.70±1.28 min) as compared to clonidine group (2.33±1.21 min). Dose of Dexmedetomidine (1µg/kg) and concentration (0.25%) of Bupivacaine in these studies were exactly the same as used in our study. In study of, Harshavardhana HS[6] compared the effect of adding Dexmedetomidine (1µg/kg) and Clonidine (1µg/kg) to 29ml 0.5% ropivacaine in supraclavicular block. Onset of sensory and motor block was faster in Dexmedetomidine group (2.59±2.2 min and 4.12±1.6 min respectively) as compared to clonidine group (3.26±1.4 min 5.36±3.2 min respectively). Here dose of Dexmedetomidine (1µg/kg) used was same as in our study and local anaesthetic agent used (ropivacaine) is almost as potent as bupivacaine in brachial plexus block. In our study, mean duration of sensory block was longer in Group B (400±61.81min) as compared to Group A (188.7±20.52min) and mean duration of motor block was also longer in Group B (440.25±55.21 min) as compared to Group A (225.5±19.07min). Our result was similar to the studies conducted by Gandhi R *et al*,[8] Swami SS *et al*,[5] and El-Boghdadly K, Brull R.[9] Swami SS *et al*[5] in their study compared the effect of adding Dexmedetomidine (1µg/kg) and Clonidine (1µg/kg) to 35ml 0.25% bupivacaine in supraclavicular block and found that duration of motor and sensory block were longer in Dexmedetomidine group (413.97±87.31min and 472.24±90.06 min respectively) as compared to Clonidine group (227±48. min and 292.67±59.13 respectively). Agrawal S *et al*[10] in their study compared the effect of mixing Dexmedetomidine (100µg) to 30ml of 0.325% bupivacaine in supraclavicular block and found that duration of sensory and motor blockade were longer in Dexmedetomidine group (755.6±126.8 min and 702±111.6 min respectively) as compared to duration of sensory and motor blockade in control group (234.8±47.9 min and 208±22.7 min respectively). El-Boghdadly K, Brull R[9] compared the effect of dexmedetomidine with clonidine as perineural adjuncts to single-injection supraclavicular block. In this study, compared with clonidine, Dexmedetomidine prolonged the duration of sensory and motor block and also prolonged the duration of analgesia. Dexmedetomidine also hastened the onset of sensory block. In our study, mean duration of analgesia was longer in Group B (688.75±33.219min) as compared to Group A (275.75±24.27 min). Our result was similar to the studies conducted by Gandhi R *et al*,[8] Swami SS *et al*,[5] Hussain N[11] and Ammar *et al*.[12] They found that duration of sensory and motor block were longer in Dexmedetomidine group (732.4±48.9min and 660.2±60.4min respectively) as compared to the duration of sensory and motor block in control group (146.5±36.4 min and 100.7±48.3 min respectively). Gandhi R *et al*[8] stated that duration of analgesia in Dexmedetomidine group (732.4±95.1 min) was longer when compared to control group (194.8±60.4min). Swami SS *et al*[5] in their study showed that duration of analgesia in Dexmedetomidine group (456.21±9.7min) was longer than clonidine group (289.67±62.5min). Hussain N *et al*[11] compared the ability of dexmedetomidine to prolong the duration and hasten the onset of motor and sensory blockade when used as an adjuvant to local anesthesia for brachial plexus blockade versus using local anesthesia alone (control). In this study, dexmedtomidine group had significant prolongation of duration of analgesia by 289.31 minutes (95% CI, 185.97-392.64 minutes; I =99%; P <0.00001) than the control group which used local anaesthetic alone. Ammar AS *et al*[12] conducted a study to test the efficacy of adding Dexmedetomidine to bupivacaine during placement of ultrasound guide Infraclavicular brachial plexus blockade. In this study, duration of analgesia was 403 compared to 233 min in the control group. In our study quality of block was better in

Dexmedetomidine group as compared to control (Bupivacaine) group. 85% patients in group B had grade IV quality of block when compared to Group A where only 35% of patients had grade IV quality of block. Swami SS *et al*[5] also reported the better quality of block in Dexmedetomidine group (grade IV quality in 80% patients) compared to clonidine group (grade IV quality in 40% patients). Memis *et al*[3] in their study showed that addition of dexmedetomidine to lignocaine for intravenous regional anaesthesia improves the quality of anaesthesia. This improved quality of block is due to hyperpolarisation, decreased compound action potential and inhibition of voltage gate of sodium pump.

CONCLUSION

In conclusion, Dexmedetomidine at the dose of 1 mcg/kg body weight added as an adjuvant to 0.25% bupivacaine in Interscalene brachial plexus block in upper limb surgeries is highly effective in prolongation of sensory and motor blockade and provides better postoperative analgesia. So, the patient remains comfortable in the post-operative period with considerable therapeutic benefit and without any potential side effects.

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