Dexmedetomidine as an adjuvant to bupivacaine in interscalene block for postoperative pain management

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Abstract

Background: Dexmedetomidine is a highly selective alpha-2 adrenergic agonist, sedative, analgesic effects with reduced analgesic requirements. Bupivacaine is a long acting local anaesthetic. Both are used in combination for better postoperative pain management in regional block. **Aim:** To evaluate dexmedetomidine as an adjuvant to bupivacaine in interscalene block for postoperative pain management. **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 received 0.25% Bupivacaine and Group B received 0.25% Bupivacaine + 1 µg/kg dexmedetomidine. Visual analogue score was used to grade severity of pain. **Results:** Even after ten hours post op (600 min) half of the patient (16) in Group B did not required analgesics, whereas all the patients required analgesics in Group A. This shows that Group B had better analgesia post operatively as compared to Group A. **Conclusion:** Addition of dexmedetomidine to bupivacaine as an adjuvant is a promising option to enhance their effectiveness. So, the patient remains comfortable in the postoperative period with considerable therapeutic benefit and without any potential side effects.

Key Words: Interscalene block, Dexmedetomidine, bupivacaine, visual analogue score

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INTRODUCTION

Pain is an unpleasant, sensory and emotional experience associated with actual or potential tissue damage. Pain after orthopaedic surgery can be intense.¹ In particular, managing pain after shoulder procedures poses a challenge to both anaesthesiologists and orthopaedic surgeons. In an effort to improve analgesia and facilitate mobilization, regional anaesthesia in the form of an interscalene

approach to the brachial plexus is often used either as an adjunct to general anaesthesia or as the primary anaesthetic. Peripheral nerve blockade is now a well-accepted component of comprehensive anaesthetic care. Its role has expanded from the operating suite into area of postoperative and chronic pain management.² Dexmedetomidine is a highly selective alpha-2 adrenergic agonist. Alpha-2 adrenergic agonists have been the focus of interest for their sedative, analgesic, perioperative sympatholytic and cardiovascular stabilizing effects with reduced analgesic requirements. Dexmedetomidine is being used in intravenous regional anaesthesia, intravenous sedation and analgesia for intubated and mechanically ventilated patients in intensive care units, and non-intubated patients for surgical and other procedures. It has been reported to improve the quality of intrathecal and epidural anaesthesia. Its use in peripheral nerve blocks has recently been described.^{2,3} Bupivacaine is a long acting local anaesthetic. Due to its long duration of

action and combined with its high quality sensory anaesthesia relative to motor blockade it has been the most commonly used local anaesthetic for peripheral nerve blocks. The present study was conducted to evaluate dexmedetomidine as an adjuvant to bupivacaine in interscalene block for postoperative pain management.

MATERIAL AND METHODS

The study included 80 patients undergoing elective surgeries of the upper limb.

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 + 1 ml of normal saline a total of 31 ml.

Group B: Received Interscalene brachial plexus block with 30ml Of 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 [SEP]

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 [SEP]

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

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. 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.

Visual analogue score

This scale is used for grading severity of pain. It is graded on a scale of 0-10. 0: being no pain at all [SEP] 10: being the worst pain imaginable. Time between onset of complete block to time of first request for analgesia i.e. VAS >4. 0-1: good analgesia. [SEP] 1-4: moderate analgesia. 4-7: mild analgesia. 7-10: no analgesia. Rescue analgesics was given in the form of injection diclofenac (1.5mg/kg) intravenously when VAS score is > 4 on patients request and the time of administration was noted.

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.

Ethical Approval was taken from Institutional Ethical committee.

RESULTS

The mean age in Group A was 37.875 years and Group B was 38.025 years. In group A there were 33 males and 7 females whereas group B included 30 males and 10 females. Both groups were comparable in terms of age and sex. Independent two sample T-test was applied. The difference was not statistically significant (P value=0.9663).

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). 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 2: Comparison of median VAS in Group A and Group B

	Median VAS		P value
	Group A	Group B	
30 min	0	0	NA
60 min	0	0	NA
90 min	1	0	0.03
120 min	2	0	<0.0001
180 min	3	0	<0.0001
240min	4	1	<0.0001
300min	4	1	<0.0001
360min	5	1	<0.0001
420min	5	2	<0.0001
480 min	6	3	<0.0001
540 min	6	3	<0.0001
600 min	6	3	<0.0001

Table 2 shows that there is significant difference between median VAS score in Group A and Group B. Group B has significantly less VAS score compared to Group A ($p < 0.0001$). Mann Whitney U test was applied; The difference is statistically highly significant from post op 30th to 600th min ($p < 0.0001$). P value of <0.001 was considered as highly significant.

Table 3: Comparison of visual analogue scale (VAS) score in both groups (in time trends)

Post op in min		Visual analogue score								Total
		0	1	2	3	4	5	6	7	
30 min	Group A	40	0	0	0	0	0	0	0	40
	Group B	40	0	0	0	0	0	0	0	40
60 min	Group A	40	0	0	0	0	0	0	0	40
	Group B	40	0	0	0	0	0	0	0	40
90 min	Group A	3	28	9	0	0	0	0	0	40
	Group B	40	0	0	0	0	0	0	0	40
120 min	Group A	0	4	30	6	0	0	0	0	40
	Group B	40	0	0	0	0	0	0	0	40
180 min	Group A	0	1	3	26	10	0	0	0	40
	Group B	40	0	0	0	0	0	0	0	40
240 min	Group A	0	0	0	3	37	0	0	0	40
	Group B	4	36	0	0	0	0	0	0	40
300 min	Group A	0	0	0	0	40	0	0	0	40

360 min	Group B	1	33	6	0	0	0	0	0	40
	Group A	0	0	0	0	0	40	0	0	40
420 min	Group B	0	32	7	1	0	0	0	0	40
	Group A	0	0	0	0	0	27	13	0	40
480 min	Group B	0	0	37	3	0	0	0	0	40
	Group A	0	0	0	0	0	16	24	0	40
540 min	Group B	0	0	14	26	0	0	0	0	40
	Group A	0	0	0	0	0	1	31	8	40
600 min	Group B	0	0	8	32	1	0	0	0	40
	Group A	0	0	0	0	0	0	6	34	40
	Group B	0	0	2	33	1	0	0	0	40

Post op 30 and 60 min median VAS in Group A and Group B was 0. All 40 patients VAS was 0 at 30 and 60 min in both groups. At 90th min median VAS in Group A was 3 and 0 in Group B. In Group A 28 patients had VAS 1 and 9 patients had VAS 2, in Group B all 40 patients had VAS 0. In Group B up to 3 hours post op (i.e. at 180 min) none of the patients complained of pain i.e. all the patients were pain free (VAS 0), whereas in Group A pain had started appearing in almost all the patients they were towards analgesic requirement. Up to 6 hrs postop (360min) no patient in Group B required analgesics whereas in Group A more than half of the patients (65%) required analgesic. Even after ten hours post op (600 min) half of the patient (16) in Group B did not required analgesics, whereas all the patients required analgesics in Group A. This shows that Group B had better analgesia post operatively as compared to Group A.

DISCUSSION

There are different approaches of the brachial plexus block. Interscalene approach is widely used method for anaesthesia because, plexus is superficial, easily accessible, and there is less chance of pneumothorax. Interscalene approach is used for anaesthesia and perioperative pain management in surgery of shoulder joint. 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). Gandhi R *et al.*⁴ 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.*⁶ 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, dexmedetomidine 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.*⁷ 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 present study, there was significant difference between median VAS score in Group A and Group B. Group B has significantly less VAS score compared to Group A (p<0.0001) Group B patients required less rescue analgesics as compared to Group A patients during first 24 hour postoperatively. An initial intravenous dose of 1.0 µg/kg dexmedetomidine for 10 min, followed by a continuous infusion of 0.7 µg/kg/h approximately 15 min before the induction of general anesthesia, may be a novel and effective treatment option for preventing or attenuating opioid-induced hyperalgesia.⁸ One study reported that dexmedetomidine led to a decreased requirement for opioid analgesics and inhaled anesthetics, and lessened the incidence of severe changes of circulation during traumatic phases of surgeries.⁹ Adding 1 µg/kg dexmedetomidine to 0.75% ropivacaine in 35 patients undergoing arthroscopic shoulder surgery with ultrasound-guided single-dose interscalene block prolonged the interscalene block, and provided better postoperative pain control during the first 24 h, compared to that produced by clonidine.¹⁰ The addition of 2 mL of 0.5 µg/kg dexmedetomidine to 20 mL of 0.3% ropivacaine for ultrasound-guided bilateral transversus abdominis plane block for postoperative analgesia after abdominal hysterectomy surgery potentiated the analgesic properties of ropivacaine, reduced sufentanil consumption, and provided better pain control.¹¹

CONCLUSION

Addition of dexmedetomidine to bupivacaine as an adjuvant is a promising option to enhance their effectiveness. So, the patient remains comfortable in the postoperative period with considerable therapeutic benefit and without any potential side effects.

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