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The Comparison of Dexmedetomidine Vs Dexamethasone as Adjuvants in Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgeries

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ABSTRACT

The clinical utility of local anaesthesia with adjuvant provides excellent nerve block with prolonged duration and faster action onset. There are various approaches for giving brachial plexus block among which supraclavicular plexus block is commonly used for upper limb surgeries. This study focuses on comparing the effects of dexmedetomidine and dexamethasone as adjuvants in ultrasound guided supraclavicular brachial plexus block. A total of 150 ASA (American society of anaesthesiologist) grade 1 and 2 patients aged 18-60 undergoing upper limb surgery were divided into two groups according to randomised double blind study - Group A given 20 mL of 0.5% Bupivacaine with 50 mcg (0.5ml) of dexmedetomidine and Group B given 20 mL of 0.5% Bupivacaine with dexamethasone 8mg (2ml). In both groups, 0.9% normal saline was added to make a total volume of 25 mL. Onset and duration of sensory and motor blocks, along with intraoperative analgesia quality were evaluated. The onset of sensory blocks was faster in patients in group A as compared to group B patients. In terms of duration of block, sensory and motor block and in terms of duration for post op analgesia were maintained for longer duration in Group A patient compared to group B patient.

Keywords: *Brachial plexus block, Supraclavicular brachial plexus block, Ultrasound guided, Bupivacaine, Dexmedetomidine, Dexamethasone*.

INTRODUCTION

The brachial plexus block has become a widely preferred anaesthetic technique for upper limb surgeries. It offers several benefits, including reduced intraoperative stress response, lower anaesthetic requirement, better intraoperative analgesia and prolonged postoperative pain relief. There are various approaches for administering brachial plexus block including Interscalene, Supraclavicular, Infraclavicular and Axillary approach. Due to the dense innervation of upper limb, the Supraclavicular brachial plexus block is particularly effective. It provides

quick onset and dense anaesthesia. Ultrasound facilitates the deposition of drug at apt place and augments block success. The brachial plexus at supraclavicular region is compact and shallow (20-30 mm deep) and the nerve visibility is also remarkable. To improve the efficacy and duration of nerve blocks, various adjuvants are often combined with LA such as clonidine, dexmedetomidine, dexamethasone, hyaluronidase, bicarbonate and neostigmine. The addition of these adjuvants have helped to reduce the total dose of local anaesthetics required thereby minimising the risk of toxicity and also extending postoperative analgesia.

Dexmedetomidine is an alpha-2 adrenergic agonist, when used with Bupivacaine is known to increase the onset of action and prolong the duration of blockade with enhancing postoperative pain control.

Similarly Dexamethasone is a potent long acting glucocorticoid which can provide analgesia upto 48 hours. It's mechanism include vasoconstriction which slows the systemic absorption of local anaesthetics and inhibition of potassium channels in nociceptive C fibers. Additionally dexamethasone helps suppress the release of inflammatory mediators contributing to it's Analgesic effect. In this randomized, double blind prospective study, the primary objective was to assess the block characteristics after adding dexmedetomidine vs dexamethasone as adjuvants in supraclavicular brachial plexus block. The secondary objective was to evaluate the onset, duration of sensory and motor blockade and postoperative analgesia within 24 hours.

MATERIALS AND METHODS

A total of 150 adult patients, aged between 18 and 60 years and classified as ASA grade I or II, scheduled for elective upper limb surgeries, were enrolled in this study. Exclusion criteria included patients with peripheral neuropathy, motor weakness, local infection at the intended injection site, a history of pneumothorax or diaphragmatic palsy, known hypersensitivity to any of the study drugs, bleeding disorders, uncooperative behavior, or inability to comprehend the Visual Analog Scale (VAS).

A comprehensive preanaesthetic evaluation, including medical history and systemic examination, was carried out a day before surgery. Participants and their family members were thoroughly briefed about the study protocol, the brachial plexus block (BPB) procedure, and the use of the VAS (scale 0–10). Written informed consent was obtained. All patients received a tablet Alprazolam 0.5 mg the night before surgery and were kept NMB for at least 8 hours prior to the surgery. On the day of surgery, patients were reassessed in the preoperative area and randomly assigned into two groups using a computer-generated randomization method each group containing 75 patients.

The test solutions were prepared by an anesthesist who was not involved in either patient care or data analysis. The brachial plexus block was administered by an experienced anesthesiologist under ultrasound guidance. Participants were fully informed in writing about the objectives of the study, potential benefits, complications, alternative methods, and possible side effects of the drugs involved. Patients were taken in opearting room and were attached with monitoring system. Pre induction Vitals (H.R, B.P., Spo2, Pulse) were noted. Patients were placed in a propped-up supine position with the operative arm adducted. Under all aseptic condition, The supraclavicular area was cleansed using a Betadine and then with spirit-soaked swab. Draping was also done. Using an in-plane ultrasound-guided technique, the needle was advanced from a lateral to medial direction to perform the block.

Patients in Group A received 20 mL of 0.5% bupivacaine combined with 50 mcg of dexmedetomidine and 4.5 mL of normal saline (total 25 mL), while those in Group B were given 20 mL of 0.5% bupivacaine with 8 mg dexamethasone and 3 mL of normal saline (total volume 25 mL).

Sensory block was evaluated every 2 minutes for up to 20 minutes using a 4-point scale across the distributions of the radial, ulnar, median, and musculocutaneous nerves:

- Grade 1: Normal sharp sensation (same as control area)
- Grade 2: Decreased sharpness
- Grade 3: Perception of light touch only
- Grade 4: Complete loss of sensation

An acceptable sensory block was defined as a grade of 3 or above in all patients , and the time taken to achieve this was recorded as the onset of sensory blockade.

Motor function was assessed using a 3-point scale:

- Grade 0: Normal motor activity
- Grade 1: Partial motor weakness with ability to move fingers
- Grade 2: Complete motor block (no movement at elbow, wrist, or fingers)

The time to achieve Grade 2 motor block was noted as the onset of motor blockade. If a patient could still move the limb or feel pinprick stimuli 30 minutes after the injection, the block was deemed insufficient. Single nerve sparing was treated with local infiltration of peripheral nerve block.

Postoperative pain was assessed using the VAS every 4 hours for the first 24 hours following surgery. Rescue analgesia, in the form of intravenous injection diclofenac 75 mg, was administered upon patient request. The duration of analgesia was defined as the interval between the time of block administration and the patient's first request for rescue analgesia.

STATISTICAL ANALYSIS

Statistical analysis was performed using mean and standard deviation to represent the average and typical spread of values. The precision of estimates was shown as 95% confidence limits. Categorical data were expressed as frequency (%). Chi square test was used for nonparametric data and ANOVA was used for parametric data.

RESULTS

GROUP A - Adjuvant as Dexmedetomidine GROUP B - Adjuvant as Dexamethasone n = 75 per group

TABLE 1 - Demographic characteristic of patients (ASA- American society of anaesthesiologist

Parameter	Group A (n=75)	Group B (n=75)	p-value
Age	37.99 ± 12.13	40.01 ± 12.98	0.3248
Height (cm)	164.45 ± 11.13	165.85 ± 11.85	0.4563
Weight (kg)	68.22 ± 15.13	70.06 ± 16.69	0.4810
Duration of Surgery (min)	88.7 ± 10.07	100.11 ± 10.02	< 0.0001
Gender: Male	33 patients (44%)	37 patients (49%)	—
Gender: Female	42 patients (56%)	38 patients (51%)	—
ASA Grade: 1	44 patients (58.6%)	35 patients (46.6%)	—
ASA Grade: 2	31 patients (41.3%)	40 patients (53.33%)	—

TABLE 2 - Effect of study drugs on block characteristics

Block parameters	GROUP A (Mean ± SD)	GROUP B (Mean ± SD)	p-value
Onset of sensory block (min)	7.99 ± 1.55	9.13 ± 1.64	<0.0001
Onset of motor block (min)	11.92 ± 1.39	12.97 ± 1.73	<0.0001
Duration of sensory block (min)	901.68 ± 103.39	751.24 ± 86.69	<0.0001
Duration of motor block (min)	850.55 ± 127.57	707.01 ± 87.52	<0.0001

TABLE 3- Effect of study drugs on analgesia for first 24 hours of postoperative period according to Visual Analog Score (VAS)

TIME (HOURS)	GROUP A (MEAN ± SD)	GROUP B (MEAN ± SD)	p-value
0	0.0 ± 0.0	0.0 ± 0.0	—
4	0.80 ± 0.35	1.10 ± 0.30	0.018
8	2.10 ± 0.50	2.60 ± 0.55	0.004

12	3.40 ± 0.70	4.00 ± 0.65	<0.001
16	4.20 ± 0.75	4.50 ± 0.70	0.045
20	4.60 ± 0.70	4.70 ± 0.65	0.378
24	5.00 ± 0.75	5.10 ± 0.70	0.622

VAS scores were significantly lower in the dexmedetomidine group (group A) compared to dexamethasone group (Group B) indicating better pain control with dexmedetomidine than dexamethasone.

CONCLUSION

The addition of dexmedetomidine or dexamethasone as an adjuvant to Bupivacaine effectively decreased the time of onset for sensory and motor blockade, the mean VAS score and other analgesic consumptions and also improves the quality of postoperative analgesia. However among the two study drugs, Dexmedetomidine proved superior to Dexamethasone in terms of block characteristics (duration of sensory and motor blockade and duration of analgesia)

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