

Comparison of Effectiveness of dexamethasone and dexmedetomidine as an adjuvant in Plexus Block by Supraclavicular Approach

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Received: 17-11-2021 / Revised: 23-12-2021 / Accepted: 09-01-2022

Abstract

Background- Supraclavicular brachial plexus block is a commonly employed regional nerve block technique for upper extremity surgery. Various adjuvants were added to local anaesthetics in brachial plexus block to achieve rapid onset and prolonged block. **Objectives-** To compare dexamethasone and dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block and duration of blockade. **Methods-**Forty ASA I and II patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block were divided into two equal groups in a double- blinded fashion. Group one was given 0.25% Bupivacaine 2 milligram/kg as local anaesthetic and Dexmedetomidine 1microgram/kg as adjuvant. Group two was given 0.25% Bupivacaine 2 milligram/kg and Dexamethasone 100microgram/kg as adjuvant. Onset and duration of sensory and motor blockade and hemodynamic stability were recorded. All patients were observed for any side effects and complications. All data were recorded and statistical analysis was done. **Results-** Sensory block and motor block onset was earlier in dexmedetomidine group. The duration of blockade was also prolonged in dexmedetomidine group when compared with dexamethasone group and is not associated with any major side-effect. **Conclusion-** Dexmedetomidine is a better adjuvant than dexamethasone in supraclavicular brachial plexus block.

Key words- Dexmedetomidine, dexamethasone, bupivacaine, supraclavicular brachial plexus block.

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Introduction

Brachial plexus block is a popular and widely employed regional nerve block technique for perioperative anesthesia and analgesia for surgery of the upper extremity. Various approaches have been described such as supraclavicular, interscalene, transscapular, infraclavicular and axillary. Supraclavicular approach is the easiest and most consistent method for surgery below the shoulder joint. Regional nerve block minimizes the stress response and using minimal anesthetic drugs is always beneficial for the patients with various cardio-respiratory comorbidities [1]. Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have shorter duration of postoperative analgesia. Bupivacaine is used frequently for supraclavicular nerve block as it has long duration of action from 3 to 6h. So various adjuvant like opioids, clonidine, neostigmine, midazolam, dexamethasone etc. were added to local anesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with side effects [2]. There has always been a search for adjuvants to the regional nerve block with drugs that prolong the duration of analgesia but with lesser adverse effects. Increasing attention has been focused on the clinical application of α -2 adrenoceptor agonists for anesthetic management in anticipation of sympatholytic, sedative, analgesic, and anesthetic-sparing effects [3,4,5]. Dexmedetomidine when added to bupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs their duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesic [6]. The current study was designed to test the hypothesis that dexmedetomidine when added as an adjuvant to local anesthetic in supraclavicular brachial plexus block enhanced the

duration of sensory and motor block, duration of analgesia and quality of block as compared with dexamethasone.

Materials and Methods

A double-blind prospective study involving 40 patients, belonging to ASA Grade I and II, who were posted for elective surgeries was carried out in Tertiary care teaching hospital-major operation theatre, Dept of Anaesthesiology, Pushpagiri Institute of Medical Sciences, Tiruvalla, Kerala. 40 patients of the age group 18-60 years who were posted for upper limb orthopaedic surgeries under supraclavicular brachial plexus block. Selection was based on inclusion and exclusion criteria.

Sample Size

With 80% power and 95% confidence, assuming equal number in both groups, to estimate a difference of four hours of sensory and motor blockade between dexmedetomidine and dexamethasone with pooled variants of 16, a sample size of 17 per group was estimated. For accounting drop outs the sample size is rounded to 20.

Inclusion criteria

1. Age between 18–60 years
2. Physical status American Society of Anaesthesiologist (ASA) I and II

Exclusion criteria

- 1) ASA grade more than two
- 2) Known hypersensitivity to local anaesthetic drugs
- 3) Bleeding disorders
- 4) Pregnant women
- 5) Pre-existing peripheral neuropathy
- 6) Patients already on dexamethasone or any adrenoceptor agonist/antagonist

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Ethical Issues

Written informed consent was taken from the participants and study was approved by Institutional Ethical Committee.

Methodology

Patients were assigned to two groups of 20 each as follows

Group 1: Dexmedetomidine group

Injection 0.25% Bupivacaine 2 milligram/kg as local anaesthetic and Dexmedetomidine 1 microgram/kg as adjuvant.

Group 2: Dexamethasone group

Injection 0.25% Bupivacaine 2 milligram/kg and Dexamethasone 100 microgram/kg as adjuvant.

All patients were kept fasting for eight hours before surgery. All the subjects were premedicated with Tab. Ranitidine 150 mg Tab. Alprazolam 0.25 mg on previous night and two hours prior to surgery. All the patients were given brachial plexus through supraclavicular approach by an experienced anaesthesiologist different from one assessing the patient intra and postoperatively.

Sensory block was assessed by the pin prick method. Assessment of sensory block was done in the dermatomal areas at specified time

Results**Table 1- Age and Gender wise distribution of Study participants**

Group	Sample	Mean	Standard Deviation	P value
Dexmedetomidine	20	41.20	14.443	0.22>0.05
Dexamethasone	20	36.00	11.938	

As per table 1 Mean age in group 1 (Dexmedetomidine) and group 2 (Dexamethasone) were 41.20±14.443 years and 36.00±11.938 years respectively. This difference in the ages between the two groups was statistically significant that the two groups are more or less homogenous with respect to age and are hence comparable. There is no significant difference (p value=0.337>0.05) between group 1 (Dexmedetomidine) and group 2 (Dexamethasone) with respect to gender of the patients included in the study.

Table 2- Onset of Sensory Block

Group	Sample	Mean	Standard Deviation	T value (with degrees of freedom)	P value
Dexmedetomidine	20	11.40	3.575	2.343(38)	0.024<0.05
Dexamethasone	20	14.45	4.594		

As per table 2 Onset of sensory block was earliest in group 1 (Dexmedetomidine) and this was statistically significant when compared to group 2 (Dexamethasone) (p value=0.024<0.05).

Table 3 – Onset of Motor Block

Group	Sample	Mean	Standard Deviation	T value (with degrees of freedom)	P value
Dexmedetomidine	20	15.57	4.575	2.918(38)	0.006<0.01
Dexamethasone	20	20.25	5.159		

According to table 3 Onset of motor block was earliest in group 1 (Dexmedetomidine) and this was statistically significant when compared to group 2 (Dexamethasone) (p value=0.006<0.01).

Table 4- Duration of Sensory Block

Group	Sample	Mean	Standard Deviation	t value (with degrees of freedom)	P value
Dexmedetomidine	20	1005.10	201.814	3.206(38)	0.003<0.01
Dexamethasone	20	823.75	152.530		

As per table 4 Mean duration of sensory block was higher in group 1 (Dexmedetomidine) and this was statistically significant when compared to group 2 (Dexamethasone) (p value=0.003<0.01).

Table 5- Duration of Motor Block

Group	Sample	Mean	Standard Deviation	t value (with degrees of freedom)	P value
Dexmedetomidine	20	983.10	196.756	2.465(38)	0.018<0.05
Dexamethasone	20	833.25	187.633		

As per table 5 Mean duration of motor block was higher in group 1 (Dexmedetomidine) and this was statistically significant when compared to group 2 (Dexamethasone) (p value=0.018<0.05).

Discussion

The brachial plexus block for upper limb surgery has proved to be a safer and effective method of regional anaesthesia. But it is a common observation that surgeries on upper limb are still being performed mainly under general anaesthesia despite unanimous consensus toward regional anaesthesia, due to one or the other reasons. Various approaches have been described such as supraclavicular, interscalene, transscapular, infraclavicular and axillary, but they all are associated with some technical difficulties, inadequate blocks and significant complications. The rate of conversion or supplementation with

general anaesthesia from brachial block is quite high. The supraclavicular block of the brachial plexus has many advantages over other approaches to brachial plexus block [7,8,9]. It has the reputation of providing most complete and reliable anaesthesia for upper limb surgery. It is performed at the trunk level where the plexus is presented most compactly. Swami et al. in 2012 concluded that dexmedetomidine (1 µg/kg) when added to local anaesthetic (bupivacaine 0.25%) in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia [10]. Zhang et al. in 2014 also reported prolonged sensory

intervals after completion of drug injection. Sensory onset was considered when there was a dull sensation to pin prick. Assessment of motor block was carried out by the same anaesthesiologist at specified time intervals till complete motor blockade after drug injection. Onset of motor blockade was considered when there was grade 1 motor blockade.

The duration of sensory block was defined as the time interval between complete injection of local anaesthetic and when the patient first experienced pain in the post operative period. The duration of motor block was defined as the time interval between complete administration of local anaesthetic and complete recovery of motor function. All patients were observed for any side effects and complications.

Statistical Analysis

Collected data were compiled, entered and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) Version 20. For all statistical evaluation, an independent sample t test was applied with probability value of <0.05 was considered significant.

and motor blockade duration in patients who received dexmedetomidine[11]. Agarwal, et al. concluded, that dexmedetomidine when added to bupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs their duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability, and minimal side effects makes it a potential adjuvant for nerve blocks⁶. Kathuria, et al. in 2015 concluded that in supraclavicular brachial plexus block addition of dexmedetomidine as adjuvant shortens the sensory and motor block onset time, prolongs both sensory and motor block duration. It also significantly delays the first demand for analgesia supplementation, decreases 24h analgesic consumption and is not associated with any major side-effect. The action of dexmedetomidine is most probably peripheral than centrally mediated[12].

Esmooglu et al. added dexmedetomidine to levobupivacaine for axillary brachial plexus block and showed that it shortens the onset time of both sensory and motor block, prolongs the duration of block and the duration of post-operative analgesia[13]. As per Umari P et al. dexmedetomidine 1 µg.kg⁻¹ with 35 ml of 0.5% ropivacaine provided significantly longer duration of postoperative analgesia and earlier sensory block as compared to clonidine 1 µg.kg⁻¹ with same dose of ropivacaine in ultrasound-guided supraclavicular brachial plexus block[14]. Median (interquartile range) times to first dose of analgesia in the Control, DMED, DEXA, and DMED-DEXA groups were 8.1 (6.2-11.6), 9.0 (8.1-11.3), 10.7 (8.1-20.5), and 13.2 (11.5-19.1) hours, respectively (p < 0.001). Pairwise comparisons showed significant prolongation of analgesia in the DEXA included groups compared with the non-DEXA included groups (DEXA vs. control, p = 0.045; DEXA vs. DMED, p = 0.045; DMED-DEXA vs. control, p < 0.001; DMED-DEXA vs. DMED, p < 0.001)[15].

Conclusion

We conclude that in supraclavicular brachial plexus block addition of dexmedetomidine as adjuvant to 0.25% bupivacaine shortens the sensory and motor block onset time, prolongs both sensory and motor block duration and is not associated with any major side-effect. The added advantage of conscious sedation makes it a potential adjuvant for nerve blocks. Thus it can be concluded that dexmedetomidine is a better adjuvant than dexamethasone in supraclavicular brachial plexus block.

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Conflict of Interest: Nil Source of support: Nil