Original Article

ISSN (0): 2456-7388; ISSN (P): 2617-5479

Evaluation of Motor Sensory Blockade and Duration of Analgesia in Dexmedetomidine and Dexamethasone as Adjuvant to Bupivacaine

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Abstract

Background: The studies are scant about the analgesic efficacy of the Dexamethasone and dexmedetomidine. Hence this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries. **Subjects and Methods:** 200 patients belonging to ASAI and ASAII were included in the study scheduled for upper limb surgeries after taking informed consent. These patients were divided in to two groups having 50 patients in each group. Group A received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 50µg of dexmedetomidine and group B received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 8mg of dexamethasone. Onset of sensory and motor block, duration of block, quality of intraoperative analgesia and duration of analgesia were recorded. **Results:** Our study revealed similar onset of sensory block in group A and B. Group A showed early onset and longer duration of motor block compared to group B. Intraoperative haemodynamics were similar in both groups. **Conclusion:** Our study concludes that using dexmedetomidine as adjuvant prolongs the duration of block and postoperative analgesia compared to dexamethasone with minimal or negligible adverse events.

Keywords: Bupivacaine, Dexmedetomidine, Dexamethasone.

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Received: November 2019
Accepted: November 2019

Introduction

Pain is defined by the international association for study of pain as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. Pain perception actually begins before birth.[1] Surgical pain not only causes immediate nociceptive response but also results in changes in nociceptive activation pathways leading to hypersensitivity, hyperalgesia and allodynia.[2]

Brachial plexus block is a popular approach for upper limb surgeries as an alternative to general anesthesia. This type of anesthesia mainly helps in to achieve ideal operating conditions by producing muscular relaxation, maintaining stable intraoperative hemodynamic condition and sympathetic block which reduces postoperative pain, vasospasm and edema.[3]

Bupivacaine one is of the local anesthetic used most frequently as it has a longer duration of action varying from 3 to 8 hours. However, it has limiting factors like delayed onset, patchy or incomplete analgesia.[4] To minimize these drawbacks many drugs like Neostigmine, Opioids, Haluronidase, Midazolam, Clonidine, Dexamethasone etc., have been added to local anesthetics to improve the quality and duration of action and postoperative analgesia.[5]

Among the α2 agonists clonidine and dexmedetomidine are commonly used. Dexmedetomidine is a highly selective α2 agonist with sedative and analgesic properties with minimal respiratory depression. It has a α2 /α1 selectivity ratio of (1600:1) which is eight times more potent than clonidine (200:1). It is shorter acting drug than clonidine with a distribution half- life of 9 min and elimination half- life of 2 hours.[6,7]

However the studies are scant about the analgesic efficacy of the Dexamethasone and dexmedetomidine. Hence this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries.

Subjects and Methods

A randomized single blinded study was taken up among 200 patients aged between 18 to 70 years undergoing upper limb surgeries in Hospitals attached to Medical College. Ethical clearance was obtained before Institutional Ethical review committee. An informed written consent was obtained from all the patients. The inclusion and exclusion criteria were,

Inclusion Criteria:

Patients with ASA class I and II and Patients aged between 18 to 70 years.

Exclusion criteria:

Exclusion criteria were patients with a history of significant neurological, psychiatric, neuromuscular, cardiovascular, pulmonary, renal, hepatic disease; alcoholism or drug abuse; pregnancy or lactating women; and patients receiving adrenoceptor agonist or antagonist therapy or chronic analgesic therapy. Also excluded were patients with morbid obesity, diabetes, peripheral vascular disease, suspected coagulopathy, or known allergies.

Patients were randomly allocated in this double blind study (using a sealed envelope technique) into two groups. group A (n = 50) Patients received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 50µg of dexmedetomidine (0.5ml drug plus 1.5ml NS), a total volume of 40ml. Group B (n = 50) Patients received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 8mg of dexamethasone (2ml), a total volume of 40ml. The anesthesiologist performing the block and observing the patient was blinded to the treatment group. Data collection was done by the same anesthesiologist who was unaware of the group allocation.

Patient was taken to OT after starting ringer lactate infusion using 18G I.V cannula in the non – operated hand. Baseline values of heart rate, ECG, non-invasive blood pressure, peripheral oxygen saturation, respiratory rate was noted before execution of block technique. The study drug was prepared by an anaesthesiologist who was not involved in the study. Patient was asked to lie supine and head of the patient was turned to the contralateral side. Interscalene groove was identified and the site was cleaned with povidone iodine solution.

A superficial skin wheal was made one finger breadth above clavicle in the interscalene groove with 0.5% lignocaine. A 5cm insulated nerve stimulator needle was attached to a nerve stimulator and the current to be delivered being set at 2.0mA and a pulse width of 100µs. Needle direction was almost perpendicular with slight inclination towards contralateral nipple and desired response in the form of muscle twitch of fingers were seeked. Once the desired response was attained, current was reduced to 0.5mA and if the response still persisted, the drugs were injected after negative aspiration for blood before injecting the drugs in aliquots of 3ml to a total volume of 40ml.

Onset of sensory block was assessed by spirit swab method. Assessment of motor block was done using the Bromage score.

Grade 0: Normal motor function with full flexion and extension of elbow, wrist, and fingers

Grade 1: Decreased motor strength with ability to move the fingers only

Grade 2: Complete motor block with inability to move the fingers

Surgery duration was noted. Side effects like dryness of mouth, nausea, vomiting and complications like LA toxicity, pneumothorax and post block neuropathy were monitored. Duration of sensory block was defined as the time interval between the end of drug administration and complete resolution of anaesthesia on all nerves.10 The duration of motor block was defined as the time interval between the end of drug administration and the recovery of complete motor function of hand and forearm.

The data was compiled and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Demographic and hemodynamic data were subjected to Student's t-test and for statistical analysis of onset time and duration of sensory and motor blocks, and DOA unpaired t-test was applied. P-value < 0.05 was considered as statistically significant and P < 0.001 as highly significant.

Results

Regarding the age and sex distribution, there was no difference among the two groups taken up for study. The youngest patient in dexmedetomidine group (Group A) was of 20 years whereas oldest was of 54 years. In dexamethasone group (Group B) the youngest patient was of 22 years wheres oldest was of 60 years [Table1].

Table 1: Age distribution among the patients

Age in years	Group A (n = 100)	Group B (n = 100)
18 – 30 years	26	24
31 – 50 years	44	48
41 – 70 years	30	28

Table 2: Time for onset of sensory block

Time for onset	Group A (n = 100)	Group B (n = 100)
3 – 6 minutes	58	48
7 – 10 minutes	36	42
> =11 minutes	6	10
Mean time	5.4 minutes	6.0 minutes

Table 3: Time for onset of motor block

Time for onset	Group A (n = 100)	Group B (n = 100)
<= 11 minutes	74	0
12 – 15 minutes	26	18
> =16 minutes	0	82
Mean time	11.4 minutes	18 minutes

Table 4: Duration of sensory block

Time for onset	Group A (n = 50)	Group B (n = 50)
<= 800minutes	4	90
801 – 900 minutes	38	6
> = 900minutes	58	4
Mean time	911 minutes	730 minutes

Table 5: Duration of motor block

Time for onset	Group A (n = 50)	Group B (n = 50)
<= 700minutes	0	84
701 – 800 minutes	0	12
801 – 900 minutes	54	0
> = 901minutes	6	4
Mean time	842 minutes	613 minutes

The time taken for onset of sensory block was almost same in both groups (Table 2) whereas time taken for onset of motor block was much less when dexmedetomidine was used (Group D) as compared to Group X using dexamethasone [Table 2].

The time taken for onset of motor block was much lesser in group A using dexmedetomidine (mean time – 11.4 minutes) as compared to group B using dexamethasone (mean time - 18 minutes) [Table 3].

Regarding the duration of sensory block, the block lasted much longer for dexemedetomidine group as compared to dexamethasone group [Table 4]. Similar results were

obtained for duration of motor block where mean time for A group was much greater than B group [Table 5]. Regarding the onset of pain in the postoperative period, it was much later in patients given dexmedetomidine as compared to patients given dexamethasone

Discussion

Supraclavicular blocks are performed at the level of the brachial plexus trunks. Here, almost the entire sensory, motor and sympathetic innervations of the upper extremity are carried in just three nerve structures (trunks), confined to a very small surface area.8 Consequently, typical features of this block include rapid onset, predictable and dense anesthesia along with its high success rate. Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have a shorter duration of postoperative analgesia.9 Hence various drugs such as opioids, clonidine, neostigmine, dexamethasone, midazolam, magnesium etc., were used as adjuvant with local anesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with side-effects.[10]

We observed in our study that patients who underwent upper limb surgery after execution of supraclavicular BPB, addition of dexmedetomidine or dexamethasone to LA solution, shortens the motor block onset time and prolongs the duration of block time. BPB is one of the easiest, safest and most commonly performed peripheral nerve blocks in day to day practice of anaesthesia. Using adjuvants like dexmedetomidine or dexamethasone further enhances the onset, quality and duration of analgesia.

Dexamethasone as an adjuvant to local anesthetic for peripheral nerve or neuraxial block has various mechanisms of actions such as direct membrane action in unmyelinated fibers, vasoconstriction, action on potassium channels, and suppression of other inflammatory mediators.[11] Though the exact mechanism of action has not been definitely elucidated, one or more of the above mechanisms alone or in combination could play a role in its use as an analgesic adjuvant.[12]

Dexmedetomidine; a highly selective, α2-adrenergic agonist; has analgesic, sedative, anesthetic sparing effects when used in systemic route.[13] Use of dexmedetomidine as an adjuvant mixed with local anesthetics has been performed with neuraxial anesthesia in both adult and pediatric patients. Mixing dexmedetomidine as adjuvant with local anesthetics during peripheral nerve and nerve plexus blockade has recently been practiced by anesthesiologists.[14]

Conclusion

The present study concludes that Dexmedetomidine is a better alternative for decreasing the onset of motor block along with enhanced quality and duration of supraclavicular block with safe profile. Dexmedetomidine and dexamethasone, both are good as adjuvants in peripheral nerve blocks.

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How to cite this article: Gurbani R, Vachhani R. Evaluation of Motor Sensory Blockade and Duration of Analgesia in Dexmedetomidine and Dexamethasone as Adjuvant to Bupivacaine. Acad. Anesthesiol. Int. 2019;4(2):292-4.

DOI: dx.doi.org/10.21276/aan.2019.4.2.65

Source of Support: Nil, **Conflict of Interest:** None declared.