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Original Research Article

Comparative study between dexamethasone and dexmedetomidine in supraclavicular block

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ABSTRACT

Background: With the addition of adjuvants to local anaesthetics the onset, duration and quality of brachial plexus block improves to a marked extent. The intent of this study was to compare onset, duration of sensory and motor block along with duration of analgesia when an α-2 agonist dexmedetomidine or a steroid dexamethasone was added to a mixture of 2% lignocaine with adrenaline and 0.5% bupivacaine.
Methods: 100 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 D received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 50µg of dexmedetomidine and group X 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 D and X. Group D showed early onset and longer duration of motor block compared to group X. Intraoperative haemodynamics were similar in both groups.
Conclusions: 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, Lignocaine, Peripheral nerve stimulator, Supraclavicular brachial plexus block

INTRODUCTION

Peripheral nerve block has taken patient care in anaesthesia to a whole new level. Because of the advent of nerve stimulator and peripheral nerve block techniques, even patients in ASA grade 3 and 4 can be taken up for surgery safely. Moreover, with the use of adjuvants in brachial plexus block (BPB), one can extend patient care in the form of extended postoperative analgesia, ensure compliance of patient with physiotherapy and early mobilization of patient with stable haemodynamic variables. Dexmedetomidine is a highly selective α-2 adrenergic agonist with an affinity of 8 times greater than clonidine.[1]

Various studies have shown that dexmedetomidine prolongs the duration of sensory and motor block and provide a very good analgesia when used as an adjuvant to local anaesthetics for nerve blocks.[2-5] The anaesthetic and the analgesic requirement are reduced substantially because of its analgesics properties and augmentation of local anaesthetics (LA) effects as they cause hyperpolarization of nerve tissues by altering transmembrane potential and ion conductance at locus ceruleus in brain stem. Dexmedetomidine provides stable

haemodynamics and decreases oxygen demand due to enhanced sympathoadrenal stability and hence makes it a very useful pharmacological agent for this purpose.

Steroids have powerful anti-inflammatory as well as analgesic property. Perineurally injected steroids is reported to influence postoperative analgesia. Dexamethasone microspheres have been found to prolong the block duration in animal and human studies and adding methyl prednisolone to local anaesthetic increase the duration of brachial plexus block.[6-9]

Because of the above mentioned profiles of the drugs, we have chosen dexmedetomidine along with dexamethasone for our study and evaluate their onset time, duration of sensory - motor blocks and quality of intraoperative as well as postoperative analgesia.

METHODS

This study was conducted in Department of Anaesthesia of our Medical College and Hospital from December 2016 to November 2017. Our study was conducted in 100 ASA grade I and II patients aged between 20 - 60 years of either sex posted for elbow, forearm and hand surgeries using peripheral nerve stimulator guided supraclavicular brachial plexus block after attaining permission from institutional ethical committee and written informed consent.

Group D

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 X

Patients received 20ml of 2% lignocaine with adrenaline plus 18ml of 0.5% bupivacaine plus 8mg of dexamethasone (2ml), a total volume of 40ml

Exclusion criteria

ASA class 3, 4 and 5, Infection at the site of injection, Presence of coagulopathies, Hypersensitivity to any of bupivacaine, dexamethasone or dexmedetomidine, Unwilling patient

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.

Table 1: Bromage score.

Score	Response
0	Normal motor function with full extension and flexion of elbow, wrist and fingers
1	Decreased motor strength with ability to move fingers only and or wrist only
2	Complete motor block with inability to move elbow, wrist and fingers

Sedation was assessed using Ramsay sedation score.

Table 2: Ramsay sedation score.

Score	Response
1	Anxious or restless or both
2	Co-operative, oriented and tranquil
3	Responding to commands
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

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.[10]

The data was compared using various statistical tools like mean, range and percentage.

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 D)

was of 22 years whereas oldest was of 60 years. In dexamethasone group (Group X) the youngest patient was of 20 years wheres oldest was of 56 years (Table 3).

Table 3: Age distribution among both group.

Age in years	D group (N=50)	X group (N=50)
18-30 years	13	12
31-45 years	22	24
46-60 years	15	14

N- Number of patients

Majority of patients in both groups were males (Figure 1).

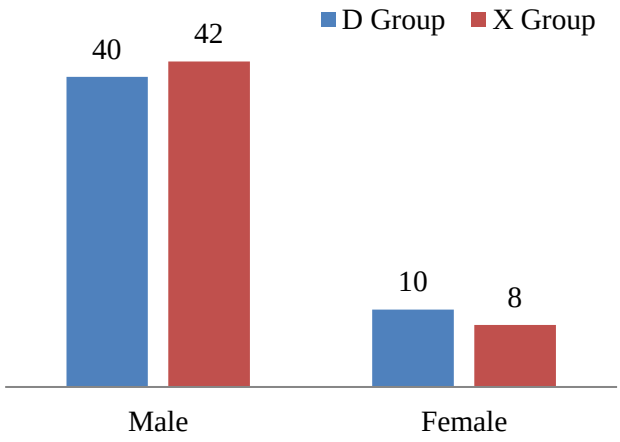

Figure 1: Sex distribution among both groups.

Regarding the duration of surgery, no major difference was found in both groups (Figure 2).

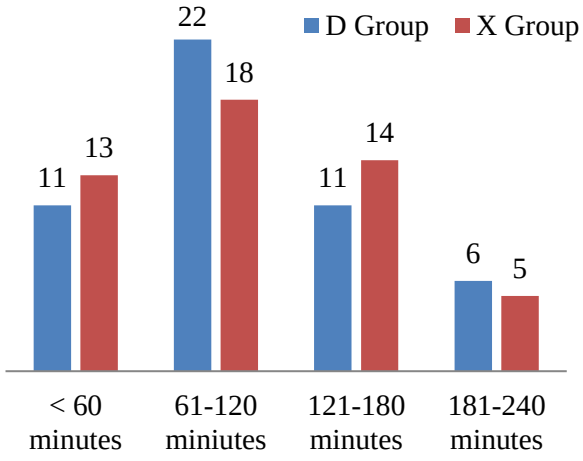

Figure 2: Duration of surgery in both groups.

The time taken for onset of sensory block was almost same in both groups (Table 4) 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 4).

Table 4: Time for onset of sensory block.

Time for onset	D Group (N=50) (%)	N Group (N=50) (%)
3-5 minutes	29 (58%)	24 (48%)
6-8 minutes	18 (36%)	21 (42%)
>= 9 minutes	3 (6%)	5 (10%)
Mean time	5.6 minutes	6.2 minutes

N = Number of patients, % = Percentage of patients

The time taken for onset of motor block was much lesser in group D using dexmedetomidine (mean time – 11.8 minutes) as compared to group X using dexamethasone (mean time - 19.2 minutes) (Table 5).

Table 5: Time for onset of motor block.

Time for onset	D Group (N=50) (%)	X Group (N=50) (%)
<= 12 minutes	37 (74%)	0 (0%)
13-16 minutes	13 (26%)	9 (18%)
>= 17 minutes	0 (0%)	41 (82%)
Mean time	11.8 minutes	19.2 minutes

N = Number of patients, % = Percentage of patients

Regarding the duration of sensory block, the block lasted much longer for dexemedetomidine group as compared to dexamethasone group (Table 6).

Table 6: Duration of sensory block.

Duration	D Group (N=50) (%)	X Group (N=50) (%)
<= 800 minutes	0 (74%)	50 (100%)
801-900 minutes	21 (42%)	0 (0%)
>= 901 minutes	29 (58%)	0 (0%)
Mean time	902.8 minutes	736.4 minutes

N = Number of patients, % = Percentage of patients

Similar results were obtained for duration of motor block where mean time for D group (858.2 minutes) was much greater than X group (684.6 minutes) (Table 7).

Table 7: Duration of motor block.

Duration	D Group (N=50) (%)	X Group (N=50) (%)
<= 700 minutes	0 (0%)	44 (88%)
701-800 minutes	0 (0%)	6 (12%)
801-900 minutes	47 (94%)	0 (0%)
>= 901 minutes	3 (6%)	0 (0%)
Mean time	858.2 minutes	684.6 minutes

N = Number of patients, % = Percentage of patients

Regarding the onset of pain in the postoperative period, it was much later in patients given dexmedetomidine as compared to patients given dexamethasone (Table 8).

Table 8: Time of onset of post operative pain.

Time of onset	D Group (N=50) (%)	X Group (N=50) (%)
<= 800 minutes	1 (2%)	36 (72%)
801-850 minutes	12 (24%)	13 (26%)
851-900 minutes	29 (58%)	1 (2%)
>= 901 minutes	8 (16%)	0 (0%)
Mean time	874.6 minutes	772.6 minutes

N = Number of patients, % = Percentage of patients

DISCUSSION

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.[11]

We chose supraclavicular approach for BPB as the narrowest part of plexus is located there and anaesthesia will be rapid, dense and predictable for the entire upper limb. By using nerve stimulator, we avoided problems associated with conventional technique, like discomfort, nerve injury and higher failure rates.[5]

Dexmedetomidine is a selective α-2 agonist, a pharmacological active d-isomer of medetomidine. One of the highest densities of α-2 receptors have been located in locus ceruleus. The hypnotic and sedative effects of α-2 adrenoreceptor activation have been attributed to this site in CNS. It is also the site of origin of the descending medullospinal noradrenergic pathway, known to be an important modulator of nociceptive neurotransmission. In the region of the brain, α-2 adrenergic and opiodergic system have common effector mechanisms, indicating that dexmedetomidine has a supraspinal site of action. Presynaptic activation of α-2 adrenoreceptor in CNS inhibits the release of norepinephrine, terminating the propagation of pain signals and their postsynaptic activation inhibits sympathetic activity, thereby decreasing the heart rate and blood pressure in higher doses.[11]

Addition of steroid to LA effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action.[12] Steroids are very potent anti-inflammatory and immunosuppressive agents. Dexamethasone, a synthetic glucocorticoid derivative is preferred because of its highly potent anti-inflammatory property, about 25-30 times more potent than hydrocortisone and without any mineralocorticoid activity. Preoperative administration of dexamethasone has been shown to reduce overall pain scores and analgesia requirements in the postoperative period without any adverse effects.[13] The possible mechanism of analgesia and antiemetic actions are due to the anti-inflammatory property of dexamethasone.[9,12]

CONCLUSION

Dexmedetomidine and dexamethasone, both are good as adjuvants in peripheral nerve blocks. But the study conducted by us revealed 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.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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