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Original Research Article

Effect of dexmedetomidine as adjuvant in supraclavicular block for upper limb orthopedic surgeries

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ABSTRACT

Background: Dexmedetomidine has anxiolytic, sedative, hypnosis, analgesic, antisialogogue and sympatholytic properties which render it suitable as an adjuvant. Hence this study was aimed to prove its efficacy as an adjuvant to lignocaine and bupivacaine for supraclavicular block in patients undergoing orthopedic upper limb surgeries. Other objectives of the study were to evaluate and compare the onset and duration of sensory and motor block as well as total analgesia, to compare effect on hemodynamic and respiratory parameters and to study any adverse effect associated with dexmedetomidine as adjuvant.
Methods: Sixty patients of ASA physical status class I & II of elective upper limb forearm orthopedic surgeries were selected in our study. Patients in group NS (n=30) received 10 ml lignocaine 2% + 20 ml bupivacaine 0.5% + 1 ml normal saline for supraclavicular block and group D (n=30) received 10 ml lignocaine 2% + 20 ml bupivacaine 0.5% + 1 µg/kg of Dexmedetomidine for the same block. The onset and duration of sensory and motor block, total duration of analgesia, need of rescue analgesic postoperatively, postoperative VAS score was assessed and compared between the two groups.
Results: Demographic data and surgical characteristics are comparable in both the groups. The onset of sensory and motor block was significantly lower ($p < 0.05$) in group D than in group NS. The duration of sensory and motor block was significantly higher ($p < 0.01$) in group D when compared to group NS. The duration of analgesic requirement postoperatively was significantly higher ($p < 0.01$) in group D than group NS. No significant change in observations was made for hemodynamic parameters in both the groups.
Conclusions: Dexmedetomidine can be considered as an adjuvant to lignocaine and bupivacaine mixture for excellent quality supraclavicular block without any side effects and provide good sedation in patients undergoing orthopedic upper limb surgeries.

Keywords: Bupivacaine, Dexmedetomidine, Lignocaine, Supraclavicular block

INTRODUCTION

Regional anesthesia is one of the most challenging and satisfying modalities for anaesthesiologist. The use of peripheral nerve blocks for anesthesia and post op analgesia has increased frequently in recent years. Upper extremities orthopaedic surgeries can be performed safely in brachial plexus block as sole anaesthesia and offers many advantage over general anaesthesia, such as improved postoperative pain relief, early recovery, less PONV and no or minimal systemic side effects of anaesthesia drugs and analgesics.[1,2]

Brachial plexus block given by different approaches like axillary, supraclavicular, infraclavicular and interscalene block. But among all approaches, Supraclavicular block for forearm surgeries provide consistent, reliable, complete and uniform upper extremity anaesthesia with

comfort of patient and minimum complications. Anatomical landmarks and various techniques help to increase success rate of block. It also relieves tourniquet pain during surgery.[1,3-5]

Various adjuvants are frequently added to local anesthetics to take advantage of properties of adjuvants and excellent quality block. Adjuvants which are commonly used are opioids, steroids, sodium bicarbonate, Hyaluronidase, α_2 agonists, neostigmine, magnesium and adrenalin.[6,7] Dexmedetomidine is highly specific α_2 adrenoreceptor agonist and has sympatholytic, sedative, hypnotic, Anxiolytic, analgesic, anti-shivering properties and promotes cardio- respiratory stability as well as neuroprotecion.[6-9] Different local anesthetic agents are used in brachial plexus block individually or in mixture. Combination of local Anaesthetic agents, like lignocaine and bupivacaine- provides early onset of action, longer duration of block and reduced incidence of local anaesthesia toxicity. Now a day, availability of various equipments like nerve stimulator, different sizes needles as well as technology like ultrasonography has ease supraclavicular block, quality and high success rate.[10-16]

So, we designed this study to evaluate the effect of dexmedetomidine 1 µg/kg as adjuvant with combination of lignocaine and bupivacaine using nerve stimulator for supraclavicular block in patients undergoing orthopedic upper limb surgeries. Our objectives of the study were to evaluate and compare the onset and duration of sensory and motor block as well as total analgesia, sedation score, to compare effect on hemodynamic and respiratory parameters and to study any adverse effect associated with dexmedetomidine as adjuvant.

METHODS

A randomised prospective comparative study was carried out at GMERS Medical College and Hospital, Dharpur-Patan, Gujarat, India during June 2015 to April 2016.

After obtaining written informed valid anesthesia consent and explaining patients about drugs and procedure in detail, 60 patients of ASA physical status class I and II of elective upper limb forearm orthopedic surgeries were selected in our study. Patients in group NS (n=30) received 10 ml lignocaine 2% + 20 ml bupivacaine 0.5% + 1 ml normal saline for supraclavicular block and group D (n=30) received 10 ml lignocaine 2% + 20 ml bupivacaine 0.5% + 1 µg/kg of Dexmedetomidine for the same block.

Inclusion criteria were patients with age group 18-45 years and for surgeries of duration 2 hours or surgeries completed between 45 minutes to 2 hours.

Exclusion criteria were patients with <18 and >45 years, patients with high risk ASA III, IV, V grades, H/O allergic to local anaesthetic agents or with any other drugs, coagulopathy, local infection / inflammation, systemic diseases i.e. HT/ DM/ Liver/ Renal/ CNS/ Respiratory disease), poly trauma patients, pregnant women and who are not willing to give consent. All patients were examined clinically in the preoperative period and whole procedure was explained. They were kept nil by mouth for 10 hours before surgery. In pre-operative room patients were kept in calm comfortable position. Heart rate, SBP, DBP, RR, SPO_2 noted with Drager vista 120 monitor. I.V line Secured with 20G i.v. cannula in opposite arm and Inj. DNS was started. Patients were shifted in operation theatre. All surgeries are performed in supine position on straight table. Drager vista 120 monitor was attached and Baseline pulse (HR), SBP, DBP, RR, SPO_2 and ECG noted and I.V drip continued. All patients were premedicated with Inj. Glycopyrrolate 0.2 mg I.V. and Inj. Ondansetrone 4 mg I.V. before procedure.

Procedure

All patients were received brachial plexus block by supraclavicular route in supine position and making area prominent by keeping pint below shoulder. Under all antiseptic and aseptic precautions, brachial plexus through supraclavicular route was located by nerve stimulator (stimuplex, B Braun) using 22 g × 2″ Needle. Location end point was a distal motor response with an output lower than 0.5 mA in the median nerve region or movements of the fingers and the thumb. During administration of the drugs solution, negative aspiration was done at every 5 ml to avoid accidental intravascular injection.

Successful brachial plexus block was defined as when 3 or more nerve territories (median, radial, ulnar musculocutaneous nerve) were effectively blocked for both sensory and motor block. The onset of sensory block was defined as time interval between the end of drugs solution administration to sensory block (score 3). The duration of sensory block was defined as time interval between complete sensory block (score 3) to completed resolution of anesthesia on all nerves (score 0). The onset of motor block was defined as time interval between total drug solution administration to complete motor block (score 2) and the duration of motor block was defined as time interval from complete motor block (score 2) to complete recovery of motor function of hand and forearm (grade 0). Sensory blockade was assessed by pin prick method and motor block assessed by modified Bromage scale on 3 point scale. Sensory and motor blocks were assessed every 5 minutes for 30 minutes, every 10 minutes for 30 minutes, every 20 minutes for 60 minutes, every 30 minutes for 2 hours, and every 1 hour after surgery till effect was resolved. After taking preoperative base line values for all vital parameters (heart rate, SBP, DBP, RR, SPO_2) once again they were monitored at different time intervals 0, 5 min, 10 min, 15 min, 30 min, 1 hr, 2 hr. 4 hr, 6 hr, 8 hr, 10 hr, 12 hr intra and postoperatively. Patients' sedation score was evaluated by

modified Ramsay sedation scale (RSS). Intraoperative complications like bradycardia (HR< 60 Beats/min), hypotension (20% decrease to baseline), nausea / vomiting, respiratory depression and hypoxia and any other were recorded. Postoperative pain was evaluated by using VAS score (grade 0 - 10). VAS score noted at 30 min, 60 min, every 1 hour after surgery. Rescue analgesia was administered in form of Inj. Diclofenec sodium 75 mg/ml diluted with normal saline up to 5 ml slowly intravenously when VAS score ≥4.

Statistical analysis

Statistical analysis performed by using "Unpaired student t-test". P value was calculated using software. p value was applied as follows: if p more than 0.05 means no significant difference between two groups. p less than 0.05 indicates significant difference. p less than 0.01 means highly significant difference.

RESULTS

A total of 60 patients were enrolled in the study of which 30 patients were in group NS and 30 were in group D. The age, weight, sex distribution and duration of surgery between the two groups were found to be comparable and statistically insignificant as shown in Table 1.

Table 1: Comparison of demographic data between the two groups.

Variables	Group NS	Group D
Age in years (Mean±SD)	33.83±11.45	32.61±12.90
Weight in kgs (Mean±SD)	63.08±10.22	65.54±9.06
Gender (M:F)	24:6	22:8
Duration of surgery (minutes) (Mean±SD)	78.40±32.46	84.60±36.44

Onset of sensory and motor block was earlier in group D than group NS and the difference were statistically highly significant (p <0.05) as shown in Figure 1. The sensory and motor block durations was significantly higher in group D than group NS as in Figure 2 (p <0.01).

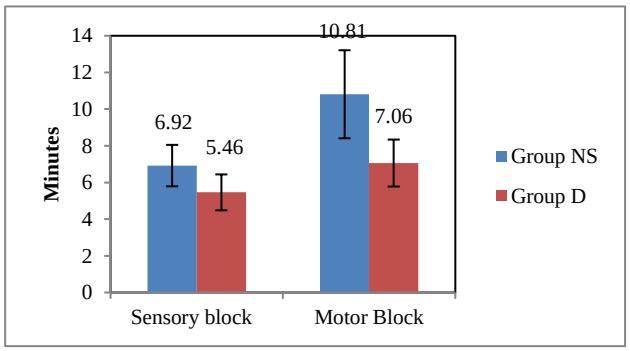

Figure 1: Comparison of mean onset of sensory and motor block.

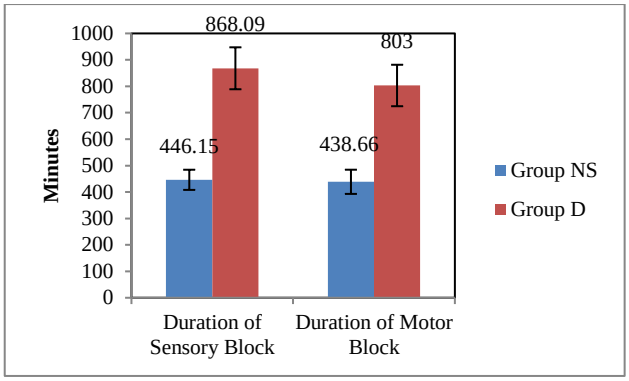

Figure 2: Comparison of mean duration of sensory and motor block.

Table 2 shows that group D required less number diclofenac sodium injections as rescue analgesics than group NS and the difference was statistically highly significant (p <0.01). The duration of analgesic requirement postoperatively was significantly higher (p <0.01) in group D than group NS as given in Table 2.

Table 2: Comparison of mean rescue analgesic requirement and mean duration of postoperative analgesia in both study groups.

Groups	Postoperative rescue analgesia	Duration of postoperative analgesia
Group NS (Mean±SD)	364±72.4	516.24±83.40
Group D (Mean±SD)	726±80.9	1063.55±249.60

Figure 3 and 4 shows hemodynamic parameters in terms of mean heart rate, systolic and diastolic blood pressure. All parameters are comparable in both the groups but the difference was not significant statistically. Both the groups were comparable for RR and SpO2 at each interval, and the results were statistically insignificant as in Table 3 and 4.

Table 3: Comparison of mean respiratory rate among study groups at different time intervals.

Time	Group NS	Group D
0 Min	15±0.9	14±0.85
5 Min	14±1.24	14±1.04
10 Min	14±0.84	14±0.9
15 Min	13±1.38	15±0.99
30 Min	13±1.04	15±0.85
1 Hours	14±0.99	14±0.84
2 Hours	14±1.22	14±0.91
4 Hours	14±0.96	13±0.94
6 Hours	14±1.17	13±0.84
8 Hours	15±0.85	14±1.24
10 Hours	15±0.95	14±1.17
12 Hours	14±0.84	15±0.96

Table 4: Comparison of mean SPO_2 among study groups.

	Group NS	Group D
>98%	24	22
97%	06	05
96%	0	03
<95%	0	00

As shown in Figure 5, None of the patients had mean sedation score 3 and 4 in group NS whereas mean sedation score 3 and 4 observed in group D in 6 and 2 patients respectively and the difference among the groups was statistically highly significant (p <0.01).

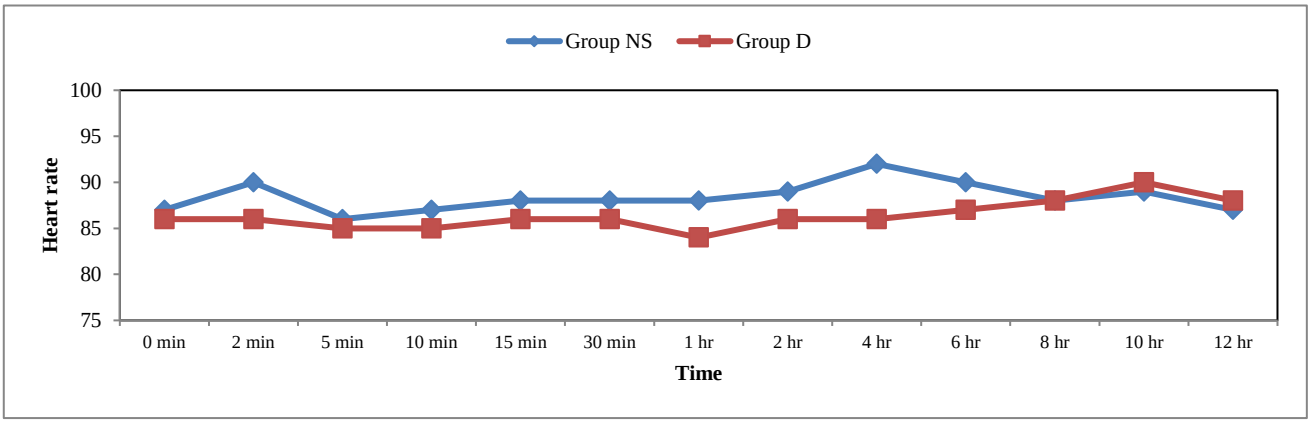

Figure 3: Mean heart rate at different time intervals.

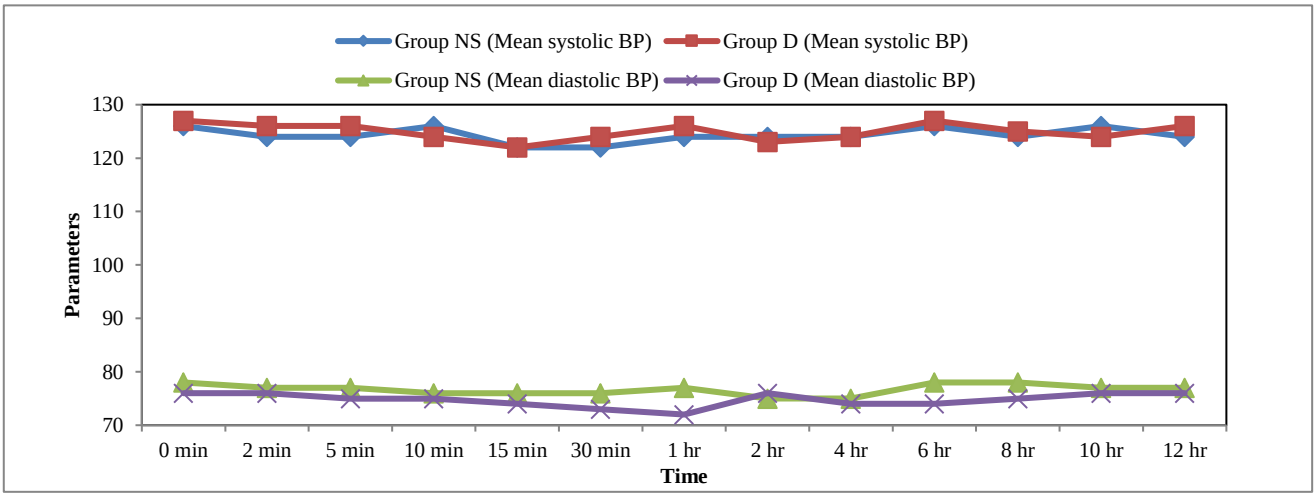

Figure 4: Mean systolic and diastolic blood pressure at different time intervals.

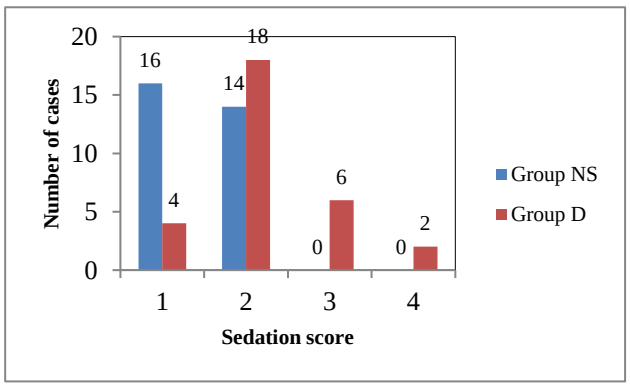

Figure 5: Sedation score.

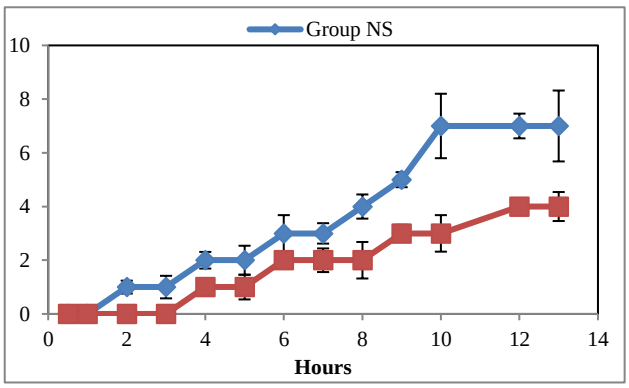

Figure 6: Postoperative VAS score.

DISCUSSION

In this study, we determined the effect of dexmedetomidine 1 ug/kg as an adjuvant with lignocaine and Bupivacaine mixture can shortens the time of onset of sensory and motor block, prolongs the duration of motor and sensory block, sedation score, reduces the need of post op analgesic consumption, lower postoperative VAS scores.

Dexmedetomidine is an alpha-2-adrenergic receptor (α2-AR) agonist. It promotes sedation, hypnosis, analgesia, sympatholysis, neuroprotection and inhibition of insulin secretion.[17] Dexmedetomidine exerts analgesic effects at the spinal cord level and at supraspinal sites. It causes activation of alpha-2A receptors, inhibition of the conduction of nerve signals through C and Aδ fibres and the local release of encephalin.[20]

In previous studies combination of lignocaine and bupivacaine proved to be efficient in producing early onset of sensory and motor block. In this study, dexmedetomidine produced synergistic effect with local anesthetic agents and provide significant early onset as compared to only individual local anesthetic agents or in combinations. These results are supported by Yoshitomi et al, Agarwal et al.[21,22]

In our study duration of sensory block (868.09±79.33 minutes in group D versus 446.15±38.12 minutes in group NS) was significantly prolonged in the dexmedetomidine group compared to normal saline group. Duration of motor block (803.2±78.38 minutes in group D versus 438.66±45.77 minutes in group NS) was also significantly longer in group of people received dexmedetomidine. Dexmedetomidine has direct effect on nerves and blocking cations enhances hyperpolarisation and inhibits subsequent action potential. Other mechanisms are decreasing inflammatory mediators and localised vasoconstrictor effects. These findings lend support to the observations of previous studies.[23-25]

In our study patients of group D required significantly less number of diclofenac sodium injections as recsue analagesics than the patients of group NS. This finding correlates with the study of Agarwal et al.[22] Reduced requirement of analgesia postoperatively in group D was due to prolonged sensory blockade action of dexmedetomidine.[26]

In this study, sedation score 3 and 4 was observed in group D patients and none of the patients in group NS experienced this score. This is similar with the reports observed by Agarwal et al.[20,22] In his study sedation score 3 was observed in 18 patients who received dexmedetomidine. Sedation with dexmedetomidine was due to presynaptic activation of α 2A adrenorereptor in the locus ceruleus which inhibits the release of norepinephrine, anxiolytic properties and exellent pain relief. "Conscious and arousable sedation" is feature of Dexmedetomidine sedation.[18,19,20]

CONCLUSION

Dexmedetomidine 1µg/kg as an adjuvant in supraclavicular block provide early onset of sensory and motor block, prolonged duration of sensory and motor analgesia as well as provide good sedation and quality block without any side effects and that decrease requirement of postoperative analgesics.

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

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