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Dr. Amrita Santosh
Junior Resident, Department of Anaesthesiology, MGM College, Kamothe, Navi Mumbai, Maharashtra, India

Dr. Akansha Sharma
Senior Resident, Department of Anaesthesiology, MGM College, Kamothe, Navi Mumbai, Maharashtra, India

Dr. RL Gogna
Professor and Head, Department of Anaesthesiology, MGM College, Kamothe, Navi Mumbai, Maharashtra, India

Corresponding Author:
Dr. Amrita Santosh
Junior Resident, Department of Anaesthesiology, MGM College, Kamothe, Navi Mumbai, Maharashtra, India

A prospective observational study to compare the effectiveness of bupivacaine versus levobupivacaine in supraclavicular brachial plexus block

Dr. Amrita Santosh, Dr. Akansha Sharma and Dr. RL Gogna

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Abstract
Background: Dexmedetomidine produces manageable hypotension and bradycardia, but the striking feature of this drug is the lack of opioid-related side effects such as respiratory depression, pruritus, nausea and vomiting. Addition of dexmedetomidine to local anaesthetic drugs during peripheral nerve blocks may also prove beneficial for surgical patients. Hence, the present study was performed to compare the effectiveness of bupivacaine and levobupivacaine for supraclavicular brachial plexus block in upper limb surgeries.
Materials and Methods: The present study was conducted in the Department of Anesthesia of MGM Medical College, Navi Mumbai. The ethical clearance for the study was approved from the ethical committee of the hospital. The study was conducted on 100 patients of ASA I & II status in the age group of 18-60 years given brachial plexus block by supraclavicular approach for various upper limb surgeries, after receiving institutional ethics committee approval.
Results: Levobupivacaine had a faster onset & longer duration of both sensory and motor blockade as compared to racemic bupivacaine. The hemodynamic profile of both drugs was similar and no adverse effect was found with either drug.
Conclusion: We conclude that in peripheral nerve blocks where large volumes of local anaesthetic is required, levobupivacaine could be a suitable choice as it is known to have less toxic potential.

Keywords: levobupivacaine, dexmedetomidine, brachial plexus, peripheral nerve block

Introduction
Dexmedetomidine, an α2 agonist, has been studied widely as an adjuvant to local anaesthetics in regional anaesthesia techniques to enhance the quality and duration of analgesia [1]. Dexmedetomidine is highly selective (8 times more selective than clonidine) and a specific α2 adrenergic agonist, having analgesic, sedative, antihypertensive and anaesthetic-sparing effects when given by the systemic route. Dexmedetomidine produces manageable hypotension and bradycardia, but the striking feature of this drug is the lack of opioid-related side effects such as respiratory depression, pruritus, nausea and vomiting. Addition of dexmedetomidine to local anaesthetic drugs during peripheral nerve blocks may also prove beneficial for surgical patients [2]. The role of dexmedetomidine as an adjuvant to local anaesthetic agents in upper limb peripheral nerve blocks has been extensively studied. Dose range of 0.5-2 μg/kg has been used in various studies [3]. Regional anaesthesia is often supplemented with general anaesthesia (GA). Drugs added as adjuvants to LAs may be systemically absorbed and interact with general anaesthetics. Though intravenous (IV) dexmedetomidine may decrease the requirement of anaesthetic agents during GA, the interaction of perineural dexmedetomidine with GA has not been evaluated [4-6]. Hence, the present study was performed to compare the effectiveness of bupivacaine and levobupivacaine for supraclavicular brachial plexus block in upper limb surgeries.

Materials and Methods
The present study was conducted in the Department of Anesthesia of MGM Medical College, Navi Mumbai. The ethical clearance for the study was approved from the ethical committee of the hospital. The study was conducted on 100 patients of ASA I & II status in the age group of 18-60 years given brachial plexus block by supraclavicular approach for various upper limb surgeries, after receiving institutional ethics committee approval.

A written informed consent was obtained. Patients did not receive any sedative premedication before arrival in the operation theatre. In the operation theatre, baseline pulse, blood pressure, oxygen saturation and respiratory rate were noted. The patient was positioned and need for cooperation was emphasized. We used the classical approach to supraclavicular block using a single-injection, nerve-stimulator technique. An experienced anesthesiologist performed the block using a nerve locator (B Braun Germany) with all aseptic precautions. During the conduct of block and thereafter, the patient was observed vigilantly for any toxicity to the drugs injected or complications of the block. This was an observational study where patients who received bupivacaine were included in group 1 and those who received levobupivacaine were included in group 2. As per the operation theatre's routine protocol, patients in group 1 received 20ml bupivacaine (0.5%), 10ml lignocaine (2%) with adrenaline (1:200,000) while those in group 2 received 20ml levobupivacaine (0.5%), 10ml lignocaine (2%) with adrenaline (1:200,000). Intensity of postoperative pain was assessed using the NRS explained to the patient preoperatively. Rescue analgesia was given in the form of diclofenac sodium (1.5 mg/kg) intravenously at NRS of 3 and the time of administration was noted. Duration of analgesia was considered as the time from onset of sensory block till NRS score of 3 was achieved. Patients were observed postoperatively for any complications of the block. In case of suspected pneumothorax, a chest X-ray was done. The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

Results

Table 1 shows demographic data of patients in Group 1 and Group 2. There was no statistically significant difference between two groups in demographic data i.e. age, gender, weight, ASA status. The mean onset time of sensory block was 13.58 minutes in group 2 was 10.68 minutes while the mean onset time of motor block was 15.41 minutes in group 1 & 12.91 in group 2. Mean onset time of sensory and motor block were significantly shorter in group 2 than in group 1(Table 2).

Discussion

Brachial plexus block is close to the ideal anaesthetic technique for upper limb surgeries as it provides good intraoperative anaesthesia & postoperative analgesia. Racemic bupivacaine is the most commonly used local anaesthetic agent for brachial plexus block. Bisui B *et al.* [7] assessed the efficacy of adding dexmedetomidine to levobupivacaine during placement of supraclavicular brachial plexus blockade. This prospective observational double-blinded study was conducted over a 1-year period among randomly selected seventy (n = 35) American Society of Anesthesiologists Classes I and II patients of ages between 18 and 60 years of both sexes scheduled to undergo upper limb surgery. With nerve locator, levobupivacaine (0.5%) 28 ml and 2 ml normal saline for Group L and levobupivacaine (0.5%) 28 ml and 0.75 μg/kg dexmedetomidine made up a solution of 2 ml, for Group D, a total 30 ml will be injected locally, in both the groups. Onset and duration of sensory and motor block will be assessed. One patient in Group L and two patients in Group D failed to achieve block within 30 min. Those three patients were then excluded from the analysis. Hence, the analysis was done by taking 34 patients in Group L and 33 patients in Group D. Onset of sensory and motor block was earlier in Group D (12.03 ± 0.85 and 13.58 ± 0.97) than Group L (14.32 ± 1.15 and 15 ± 0.98), and the difference is statistically significant ($P < 0.0001$). Duration of sensory and motor block was longer in Group D (563.94 ± 15.60 and 495.15 ± 10.34) than Group L (368.53 ± 9.89 and 321.47 ± 7.84), and the difference is also statistically significant ($P < 0.0001$). Duration of analgesia was longer in Group D (672.12 ± 11.39) than Group L (506.47 ± 9.497), and the difference is statistically significant ($P < 0.0001$). Heart rate and mean arterial pressure were well maintained within the presumed range of significant variation, i.e., 20% from baseline, though at some point of time, intergroup comparison was statistically significant. Visual analog scale score compared at the time for administration of rescue analgesic between the groups come out to be statistically significant. They concluded that addition of 0.75 μg/kg dexmedetomidine to 0.5% levobupivacaine for supraclavicular plexus block shortens sensory and motor block onset time and extends sensory block, motor block, and analgesia duration. Kaur M *et al.* [8] evaluated and compared the effect of dexmedetomidine versus fentanyl as an adjuvant with levobupivacaine in ultrasound-guided supraclavicular brachial plexus block. This study design was a prospective, randomized, double-blind controlled study. A total of 120 patients in the age group of 30-55 years with physical status American Society of Anesthesiologists Classes I and II undergoing elective upper limb surgeries under ultrasound-guided supraclavicular brachial plexus block were randomly divided into three groups of forty each after taking informed consent and approval from Hospital Ethics Committee: Group A received 25 ml of 0.5% levobupivacaine with 5 ml normal saline (NS). Group B received 25 ml of 0.5% levobupivacaine with 1 μg/kg dexmedetomidine diluted to the volume of 5 ml NS. Group C received 25 ml of 0.5% levobupivacaine with 1 μg/kg fentanyl diluted to the volume of 5 ml NS. Onset and duration of sensory and motor block and duration of analgesia were noted and any side effects were observed. There was fastest onset time as well as longer duration of sensory and motor block in dexmedetomidine group, intermediate in fentanyl group as compared to levobupivacaine group. This study concluded that addition of dexmedetomidine to levobupivacaine for supraclavicular brachial plexus block shortens the onset time and prolongs the duration of sensory and motor blockade as compared to the addition of fentanyl.

Somsunder RG *et al.* [9] compared perineural dexmedetomidine and intravenous (i.v.) dexmedetomidine when used as an adjuvant with levobupivacaine using a nerve stimulator-guided supraclavicular block. Sixty patients of either sex, aged between 18 and 60 years, belonging to the American Society of Anesthesiologists Physical Status Classes I and II posted for upper limb surgeries under supraclavicular brachial plexus block were enrolled for a prospective observational study. The patients were categorized into two groups: Group levobupivacine with perineural dexmedetomedine (LDP) received 20 mL of 0.5% levobupivacaine plus 10 mL of 2% lignocaine plus 1 μg.kg-1 dexmedetomidine perineurally, and Group

levobupivacaine with intravenous dexmedetomedine (LDV) received 20 mL of 0.5% levobupivacaine plus 10 mL of 2% lignocaine and 1 µg.kg-1 dexmedetomidine in 50 mL of normal saline administered as infusion over 10 min and given 10 min before start of the supraclavicular block. Onset and duration of sensory and motor blocks, hemodynamic variables, adverse effects, and duration of analgesia were assessed. Demographic profile, onset and duration of sensory and motor block, and duration of analgesia were comparable in both the groups. The incidence of hypotension was high in Group LDV compared to Group LDP, which was found to be statistically significant. Twelve patients in LDV group had Ramsay sedation score >3 whereas In LDP group two patients had Ramsay Sedation score >3 which was statistically significant. They concluded that the i.v. dexmedetomidine is equally effective as compared to perineural dexmedetomidine with respect to onset and duration of block and duration of analgesia but has greater hemodynamic instability. Venkatesh RR *et al.* [10] investigated and compared the effectiveness of supraclavicular brachial plexus anaesthesia with two different concentrations of ropivacaine (0.5% and 0.75%) and to compare them with the standard 0.5% bupivacaine. Ninety patients of age 18 to 60 years belonging to American Society of Anaesthesiologists (ASA) status 1 or 2, admitted to Pondicherry Institute of Medical Sciences were chosen for the study and were divided into three groups. Group A received 30 ml of 0.5% bupivacaine, group B received 30 ml of 0.5% ropivacaine and group C received 30 ml of 0.75% ropivacaine into the supraclavicular region, by a nerve-stimulator technique. Onset time of each of the drug was recorded both for the sensory and motor block. Duration of sensory and motor block was recorded along with peri-operative haemodynamic monitoring. The onset of complete sensory and motor block observed with both ropivacaine groups and bupivacaine was similar; onset of motor block. The duration of sensory block with 0.5% bupivacaine was 11.58 hours, with 0.5% ropivacaine was 9.02 hours with 0.75% ropivacaine was 8.87 hours. The duration of motor block with 0.5% bupivacaine was 12.94 hours, with 0.5% ropivacaine was 8.29 hours with 0.75% ropivacaine was 7.89 hours. Multiple comparison test with Bonferroni correction showed there was statistically significant difference in mean duration of sensory block between Group A (0.5% bupivacaine) and Group B (0.5% ropivacaine) and also between Group A (0.5% bupivacaine) and Group C (0.75% ropivacaine). However, there were no statistically significant difference in mean duration of sensory block between Group B (0.5% ropivacaine) and Group C (0.75% ropivacaine). The preoperative, intra operative and postoperative heart rate, systolic & diastolic blood pressure and oxygen saturation were comparable among the three study groups ($p>0.05$). No side effects were recorded in the study. They concluded that the onset of sensory and motor block was similar in all the three groups. However, when compared to bupivacaine group, recovery of motor functions was faster in both the ropivacaine groups. Patients in all the 3 groups did not experience any adverse effects.

Conclusion

We conclude that levobupivacaine has a faster onset of both sensory and motor blockade as compared to racemic bupivacaine. Also, the duration of both sensory and motor block is longer with levobupivacaine. The hemodynamic profile of both drugs was similar and we did not find any adverse effect with either drug.

Table 1: Demographic data of patients in Group 1 and Group 2

Study parameters	Group 1	Group 2	p-value
Age (years)	37.29	38.39	0.09
Weight (kg)	62.280	64.29	0.72
ASA I	35:15	29:21	0.81

Table 2: Mean onset time of sensory and motor block in Group 1 and Group 2

Study parameter	Group 1	Group 2	p-value
Onset of sensory block	13.58	10.68	0.002
Onset of motor block	15.41	12.91	0.001

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