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A Comparative Study of Efficacy of Bupivacaine (0.5%) Alone and in combination with Dexmedetomidine in Supraclavicular Brachial Plexus Block

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Abstract

Aim and objectives: To compare the efficacy of dexme dito midine adjuvant to 0.5% bupivacaine and 0.5% bupi caine alone in supraclavicular branchial plexus block.

Material and methods: A total of n=60 patients with ASA I, II status, age 20 to 60 years, unilateral upper limb surgeries were included in the study. Patients were randomly divided into 2 groups according to computer-generated random number codes that were placed in a sealed envelope. Each group consisted of n=30 patients and were named according to drugs used such as bupi vacaine and dexme deto midine (BD) group, and bupi vacaine-only (B) group. Patients in BD group received 29 ml of 0.5% bupivacaine and 1 ml (100 µgm) dexme deto midine and B group patients administered with 29 ml of 0.5% bupi vacaine and 1 ml normal saline to induce supra clavicular brachial plexus block.

Results: Intra operative PR, and MAP were found to be increased at all assessment points except at 5 minutes (P <0.05). The onset of sensory block (Group BD 4.60 ±0. 77 minutes vs Group B 8.47±1 minutes P=0.0000) and motor block (Group BD 9.63±0.89 minutes vs Group B 13. 10 ±1.42 minutes P=0.0000) was rapid in BD group patients compared to B group patients. The mean duration of sensory block (Group BD 557±32.87 minutes vs Group B 390.17 ± 28.33 minutes P=0.0000) and motor block (Group BD 466.03±27.88 minutes vs Group B 355. 80 ± 29.90 minutes P=0.0000) was more in BD group patients compared to B group patients. The duration of analgesia was more in BD group patients compared to group B patients (655.87±37.04 vs 473.70±24.79, P = 0.0 000).

Conclusion: Bupivacaine with dexmedetomidine cases rapid onset and prolonged of sensory and motor block with prolonged duration of analgesia.

Keywords: Branchial plexus block, bupivacaine, dexme detomidine, sensory block, motor block

Introduction

Brachial plexus block provides adequate muscle relax ation and a minimal alteration in hemodynamics, intra operative analgesia and post-operative pain relief. It also reduces the com plications and reduced post anesthesia

care unit stay and the stress of laryngoscopy and tracheal intubation is avoided, thus brachial plexus block is preferable to general anaesthesia. [1] Adjuvants have been administered to achieve prolonged block with im proved quality of anaesthesia and to decrease the total dose of local Anaesthetic used. [2] Adjuvants with local anaesthetics in brachial plexus block are used to achieve a quick, dense and prolonged block. [3]

Brachial plexus block is administered by various approa ches viz. supraclavicular, interscalene, infra clavicular and axillary routes. The supraclavicular approach is the oldest way to accomplish anaesthesia of the brachial plexus. Brachial plexus block is a popular and widely employed regional nerve block of the upper extremity. Various approaches to brachial plexus block have been described but supraclavicular approach is the easiest and most consistent method for anaesthesia and peri operative pain management in surgery below the shoulder joint.

Pneumothorax (1-6%) [4, 5, 6] Hemothorax, Horner's syn drome and phrenic nerve block are the potential com plications.

Recent days offer various adjuvants with local an esthe tics in brachial plexus block to achieve quick, dense and pro longed block. Drugs like morphine, pethidine, cloni dine, dexme deto midine, butorphanol, buprenorphine are commonly used along with local anesthetics for this purpose. Bupi vacaine, a short-acting local Anaesthetic drug causes differential sensory nerve block with a dose dependent motor blockade. [7]

Dexmedetomidine a highly selective α2 adrenoreceptor agonist has been shown to have both sedative and anal gesic effects and in combination with local anesthetics facilitates better anesthesia and analgesia and also has cardio vascular stabilizing effects. [7] Dexmedetomidine is being used for intravenous regional anesthesia (Bier's block), [8.9] intravenous (i. v.) sedation and analgesia for intubated and mechanically ventilated patients in in tensive care units (ICUs), [10,11] and nonintubated patients for surgical and other procedures. It has been re ported to improve the quality of intrathecal and epidural anesthesia. [12,13,14,15] Its use in peripheral nerve blocks has recently been described. However, the reports of its use in supraclavicular brachial plexus block are limited. Moreover, there is paucity of data regarding com parison of dexme detomidine with bupivacaine and bupi vacaine alone in supraclavicular blocks. Therefore, the present study was undertaken to compare dexme deto midine with bupivacaine and bupivacaine alone in PNS-guided supraclavicular blocks in patients undergoing upper limb surgeries.

Material and methods

The present prospective randomized comparative study was conducted in the department of anaesthesia, GMC, Miraj. This study was performed after the approval from Institutional Ethics Committee. A total of n=60 patients with ASA I, II status, age 20 to 60 years, unilateral upper limb surgeries, patient willing to participate in the study were recruited into the study.

Whereas, patients on adre noceptor agonist or antagonist therapy, suspected coagulo pathy, infection at the site of block, history of respiratory, cardiac, hepatic or renal disease, patients with medical complications like severe anemia, diabetes mellitus, severe hypo volemia, shock, septicemia, allergy to local anesthetics and study drug, and pregnant women were ex cluded from the study.

Post obtaining informed consent from included subjects, detailed demographical, history, clinical, and laboratory investigation were performed. Patients were randomly divided into 2 groups according to computer-generated random number codes that were placed in a sealed envelope.

Each group consisted of n=30 patients and were named according to drugs used such as bupivacaine and dexme detomidine (BD) group, and bupivacaine-only (B) group. Pre-Anaesthetic evaluations were performed one day before the surgery. Patients in BD group received 29 ml of 0.5% bupivacaine and 1 ml (100 µgm) dexme deto midine and B group patients administered with 29 ml of 0.5% bupivacaine and 1 ml normal saline to induce supraclavicular brachial plexus block. The study solutions were prepared with identical syringes by an anaesthesio logist who was not involved in the subsequent patient care or assessment.

Under aseptic conditions, brachial plexus block was induced by the nerve stimulator technique. Here, the patient was kept in the supine position, head at a 45º angle from the site to be blocked, arm adducted, and hand extended towards the ipsilateral knee.

The point of entry was the lateral border of the anterior scalene muscle, the target was confirmed by palpating the subclavian artery pulsation, about 1 cm above the mid clavicular point just lateral to the subclavian artery pulsation, the needle was introduced and directed to wards the caudal downward and medial direction towards the first rib until the desired response was obtained (mu scle twitching, and current strength reduced to 0.6mA). In case of no adequate response, the needle was moved anteriorly or posteriorly along the first rib to elicit a response.

The block was considered to be success ful when at least 3 out of 4 nerve territories (ulnar, radial, median, and musculocutaneous) were effectively blocked for both sensory and motor. Post-negative aspiration for blood or air, the study drug was administered.

The data regarding haemodynamic such as blood pres sure and HR was obtained. In case of bradycardia (HR <50 bmp), patient were administered with inj. Atro pine (0.6 mg). In case of hypotension (<20% from baseline), Inj. Me phentermine 6mg IV was given. The sensory block was assessed using a pin prick test. A modified Bromage scale was used to assess the motor block. Whereas, Ramsay sedation scale was used assess intraoperative sedation in subjects.

The onset of the sensory block was defined as the time elapsed between the end of local Anaesthetic administ ration and the complete sensory block.

The absence of anaesthesia in >2 peripheral nerves was considered a failure of anaesthesia and the patient was discontinued from the study. The onset of motor block was defined as the time elapsed between the injections of the drug to complete motor block.

Bromage scale score <2 was considered as the motor block failure. The dur ation of sensory block was defined as the time between onsets of action to the return of pinprick response. The duration of analgesia was defined as the time between the onset of action and the onset of pain when the patient was administered the first dose of analgesic. For patients with VAS score more than IV I.V. inj.

Tramadol 100 mg was given as a rescue analgesic. The uncomforted patient was converted to general anesthesia. Hemodynamic adverse events such as hypotension and bradycardia were managed using inj. me phentermine in 6mg incremental doses and 0.6mg atropine respectively.

Sensory and motor block were evaluated for every minute during the first 5 minutes then every 3 minutes until 30 minutes, followed by post-operative evaluation every hour for 12 hours or until the block was present. The vital signs and level of sedation were recorded every 5 minutes to 30 minutes and 15 minutes to 2 hours and continued every 30 minutes thereafter.

Statistical analysis

Data were collected and entered into a Microsoft excel sheet. Using the SPSS IBM 20 version categorical variables were evaluated in terms of frequency and per centages.

Continuous variables were analyzed using measures of central tendency (mean) and dispersion (Stan dard deviation), line chart was used to represent data in di agrammatic form.

Independent sample T test and Mann Whitney u test were used to find the significant difference between the groups. P<0.05 was considered statistically significant.

Results

The age of study patients of both the groups was com parable (36.70 ± 9.93 years vs 38.63 ± 11.85 years P = 0.4962). In both groups male were predominantly present than female (n=20 and n=26).

Baseline hemo dynamic parameters were comparable between groups (P>0.05) (table 1). The mean duration of surgery of the group BD was 145.67 ± 46.70 minutes and the group B was 136.67 ± 32.75 minutes.

The difference was statistically insignificant (P>0.05).

Table 1: Comparison of baseline hemodynamic variables between the two groups.

Baseline Parameter	Group BD		Group B		P-Value
	Mean	SD	Mean	SD	
PR	83.27	5.39	83.40	5.43	0.9243
MAP	93.27	0.66	93.50	6.47	0.8896
SpO2	98.33	0.66	98.23	0.73	0.5796

Intraoperative PR, and MAP were found to be increased at all assessment points except at 5 minutes (P<0.05) (figure 1 and figure 2). Whereas, postoperatively hemo dynamics were comparable at all time intervals (P>0.05) except at 1hr (P=0.000).

Figure 1: Comparison of intraoperative PR between two groups atvarious time intervals.

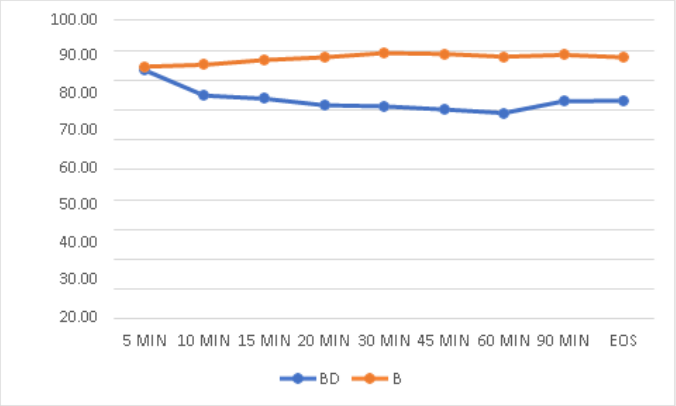
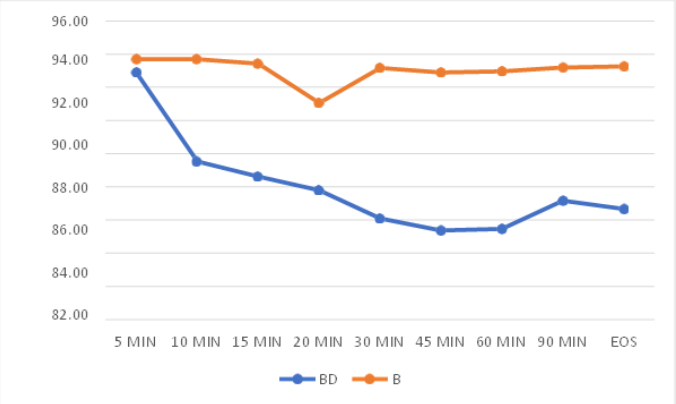


Figure 2: Comparison of intraoperative MAP between two groups atvarious time intervals.



The onset of sensory block (Group BD 4.60±0.77 minutes vs Group B 8.47±1 minutes P=0.0000) and motor block (Group BD 9.63±0.89 minutes vs Group B 13.10±1.42 minutes P=0.0000) was rapid in BD group patients compared to B group patients.

The mean duration of sensory block (Group BD 557±32.87 minutes vs Group B 390.17±28.33 minutes P=0.0000) and motor block (Group BD 466.03±27.88 minutes vs Group B 355.80±29.90 minutes P=0.0000) was more in BD group patients compared to B group patients.

The duration of analgesia was more in BD group patients compared to group B patients (655.87 ±37.04 vs 473. 70 ± 24.79, P=0.0000).

Discussion

In current study, intraoperative PR and MAP were found to be increased in patients administered with bupivacaine alone compared to adjuvant with dexme dito midine (P<0.05). These findings suggested that bupivacaine adjuvant with dexme dito midine produces stable haemo dy namic responses. Further, the patients administered with dexme deto midine adjunctive to the bupi vacaine showed significantly rapid onset of sensory and motor block compared to bupivacaine alone (P<0.0000). Similarly, various studies have shown that the addition of dexme deto midine to the local anaesthetics improve onset of sensory and motor block. [16-19] Moreover, Hussain N et al. suggested that addition of Dexme deto midine as an adjuvant to local anesthesia in brachial plexus block, reduced onset time of sensory blockade by 3.19 minutes and reduced the onset of motor blockade by 2.92 minutes. [20] Rapid onset of sensory and motor block may be due to its selective effect on sensory and motor nerves.

In this study, we found that the duration of motor and sensory block was more in BD group patients compared to B group patients (P=0.0000). Ran court et al. per formed a prospective, randomized, controlled, double-blind, cross over trial in 14 healthy volunteers to study the effect of ropivacaine alone and in combination with dexme deto midine. They reported a prolonged duration of sensory block in patients treated with combination drugs.[21] Similarly, Chinna ppA J. et al. showed increased duration of sensory and motor block in patients who received ropivacaine and dexme deto midine com pared to those treated with ropivacaine alone.[3] Dharma Rao PS. et al. depicted a better duration of sensory and motor block in dexme deto midine with the ropivacaine group than fentanyl with the ropivacaine group. [16] Furthermore, a meta-analysis conducted by Hussain N et al. suggest that on addition of dexme deto midine as an adjuvant to local anesthesia in brachial plexus block, pro longed the duration of sensory blockade by 261.41 minutes and motor blockade by 200.90 minutes.[20]

In this study, the duration of postoperative analgesia required was significantly more in patients administered with bupi vacaine combined with dexme detomidine compared to bupivacaine alone groups (P=0.0000). These findings are similar with the previous reports. [17, 22, 23]

These findings suggest that dexmedetomidine adjunctive to bupi vacaine has prolonged duration postoperative analgesia. In this study no adverse effects were found in either group subjects which might be due to uniform application of protocol and precautionary measures.

The study suggested that the dexme dito midine as adjuvant to bupivacaine produced stable hemodynamics, rapid sensory and motor block, prolonged duration of blocks, and analgesia. The limitations of such a study were singly cantered, and postoperative follow-up was relatively short. Another important limitations of the study were the volume of local Anaesthetic used in our study was quite high though there were no side effects of such doses noted. The use of a nerve stimulator could have helped identify the plexus with a higher degree of accuracy and could have resulted in the use of a lower volume of drug which was unlike what happened in our study.

Conclusion

Brachial plexus block by supraclavicular approach using dexme deto midine adjuvant to bupivacaine produces faster onset of sensory and motor blockade, increase in dur ation of sensory and motor block, and total duration of analgesia. The hemodynamic parameters were within optimal range in both the groups, No side effects were reported in our study groups.

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