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ORIGINAL RESEARCH

Study to compare the effect of 0.5% bupivacaine with dexmedetomidine versus 0.5% bupivacaine in brachial plexus block through interscalene approach

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ABSTRACT

Introduction: Regional anaesthesia offers precise, efficient, and long-lasting anaesthesia and analgesia. It is often used as a supplement to general anaesthesia or as a primary method. With the invention of newer, safer local anaesthetics, regional anaesthesia has been the primary technique for procedures on the upper limbs. This study is aimed at comparing the effects of dexmedetomidine 50mcg as an adjuvant to 0.5% Bupivacaine in Interscalene brachial plexus blocks.

Methodology: This is a hospital based prospective, double blinded study conducted on 60 patients of age of 18-60 years who were selected for arm surgeries with interscalene brachial plexus block.The selected patients were divided randomly into two groups of 30 each. This study was carried out between January 2021 and December 2022. The statistical analysis was carried out using excel sheet to spread the data and SPSS Version 22.0,Mean ± SD used for descriptive statistics. While categorical variables were compared using chi-square test, continuous variables were compared using the independent samples t test, and the data was represented with tables and figures wherever applicable.

Results: The duration of onset of sensory-blockade is reduced when dexmedetomidine is added to Bupivacaine in Interscalene brachial plexus block. The duration of motor and sensory block is also prolonged when dexmedetomidine is added to Bupivacaine in Interscalene brachial plexus block. Time of analgesia is also prolonged when dexmedetomidine is added to bupivacaine in brachial-plexus block. Sedation is also better in the dexmedetomidine group.

Key words: Bupivacaine, interscalene block, dexmedetomidine, regional anaesthesia, analgesia

INTRODUCTION

Regional anaesthesia has many advantages over general anaesthesia like, prolonged postoperative pain relief, early ambulation, awake patient, no airway manipulation, reduced post-operative vomiting rates, early return to oral feeds, minimal polypharmacy[1]. Single injection peripheral nerve anaesthesia is more effective in delivering long-lasting analgesia than intravenous analgesics [2].

Various approaches of upper limb regional anaesthesia for blocking the brachial plexus are

1. Interscalene approach.
2. Supraclavicular approach.
3. Infraclavicular approach.
4. Axillary approach [3].

The main indication for an Interscalene block is surgery of the shoulder or it‘s manipulation. The blockade is seen at the middle and upper trunks. Though this approach can be used for forearm surgeries, there is often incomplete blockade, so supplementation may be required [4]. Long-acting local anaesthetic agents like Bupivacaine have been commonly used for brachial plexus block. Bupivacaine is an efficient local anaesthetic with unique characteristics from the amide group of local anaesthetics. Keeping postoperative analgesia in mind, various drugs have been used as adjuvants to local anaesthetics to increase the duration of action.

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Drugs like opioids, epinephrine, ketamine, midazolam, clonidine are being currently used [5]. Dexmedetomidine is an alpha 2-adrenoceptor agonist which can be used as an intravenous sedative and co-analgesic drug. It is often associated with decrease in heart rate and blood pressure [6].

This study is aimed at observe the effects of dexmedetomidine 50mcg as an adjuvant to 0.5% Bupivacaine in Interscalene brachial plexus blocks. Objective of this study is to assess the efficacy of dexmedetomidine (50 mcg) as an adjuvant to 0.5% Bupivacaine in Interscalene brachial plexus block.

MATERIALS AND METHODS

This is a hospital based prospective, double blinded study conducted at Guntur medical College, Guntur, Andhra Pradesh.Study was conducted on 60 patients of age of 18-60 years who were selected for arm surgeries with interscalene brachial plexus block. This study was carried out between January 2021 and December 2022.

INCLUSION CRITERIA

1. Patients posted for upper limb surgeries.
2. ASA (American society of anaesthesiologist) grade 1 and 2. 3. Patients between 18-60yrs age.

EXCLUSION CRITERIA

1. Not provided consent of participation in the study.
2. Patients below 18yrs age.
3. Local anaesthetic hypersensitivity.
4. Bleeding disorders.
5. Skin lesions or infections present at the site of injection.
6. Sepsis.
7. Respiratory failure, cardiac disease, renal and hepatic disorders.
8. Previously diagnosed neurological deficits.
9. Inadequate block.

After obtaining institutional ethics committee approval, sixty patients who fitted in the study according to the inclusion criteria were considered for the study. Consent was taken before the procedure to be conducted. Each patient underwent a thorough physical examination, systemic evaluation, and full history as part of the pre-anaesthetic checkup. Basic tests were performed, including full blood counts, random blood sugar, serum urea, serum creatinine, and, if the patient is older than 45 years, an electrocardiogram (ECG). Overnight, patients were kept on nil per oral (8 hrs for solid food)the selected patients were divided randomly into two groups of 30 each using slips in a box.

They were divided as

GROUP A: 30 ml-0.5% bupivacaine with 0.5 ml distilled water.

GROUP B: 30 ml-0.5% bupivacaine with 0.5 ml (50μg) dexmedetomidine.

All patients were given brachial block through interscalene approach by an experienced and competent anaesthetist different from one who assessed patient intraoperatively& postoperatively. Both blinded to treatment groups.

The statistical analysis was carried out using excel sheet to spread the data and SPSS Version 22.0, Mean ± SD used for descriptive statistics. While categorical variables were compared using chi-square test, continuous variables were compared using the independent samples t test, and the data was represented with tables and figures wherever applicable.

RESULTS

Total of 60 patients who met criteria were randomised; 30 patients received 30 ml of 0.5% Bupivacaine and 0.5ml distilled water (Group A), and 30 patients received 30 ml of 0.5% Bupivacaine with 0.5 ml (50μg) of dexmedetomidine (Group B). The two groups were well matched with respect to demographic characteristics and clinical data.

Table 1: Demographic profile and baseline hemodynamic data of study groups

Parameter	Group A (N-30)	Group B (N-30)	P value
Age (in years)	38.8±11.9	40.8±11.1	0.52
Male Gender	13 (43.3%)	12 (40.0%)	0.79
Weight (in kgs)	65.2±8.6	60.5±8.3	0.15
ASA Grade			0.60
Grade 1	13 (43.3%)	15 (50.0%)	
Grade 11	17 (56.7%)	15 (50.0%)	
Hemodynamic variables			
Heart rate	74.5±6.9	79.0±10.6	0.06
Systolic blood pressure	122.8±9.8	119.6±12.5	0.27
Diastolic blood pressure	73.4±6.3	74.6±8.8	0.55

The mean age in Group A was 38.8±11.9 years and 40.8±11.1 years in Group B. There was no statistically significant difference between both the groups (p value-0.52). There were 57% females and 43% males in Group A and 60% females and 40% males in group B. Both the groups were matched (p value-0.79).The mean weight in Group A is 65.2±8.6 kilograms and 60.5±8.3 kilograms. There was no statistical

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significance in both the groups. (p value-0.15).During the enrollment into the study, there were 43.30% ASA grade I and 56.70% Grade II in Group A. In Group B, there were 50.00% in ASA grade I and 50.00% in ASA grade II. There was no significant statistical difference in two groups (p value- 0.60).

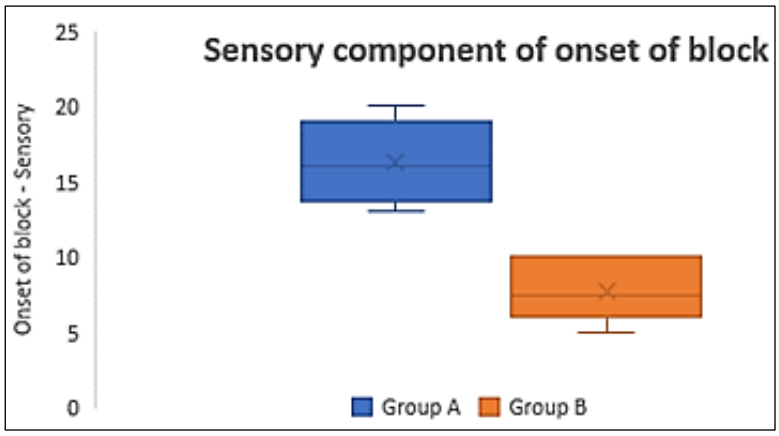

Figure 1: Box plot showing the sensory onset of block among the study groups

In Group A, mean onset of sensory block is 16.3± 2.53 minutes and it is 7.76±1.94 minutes in Group B. There is statistically significant difference between both the groups (p value- 0.0000000004).

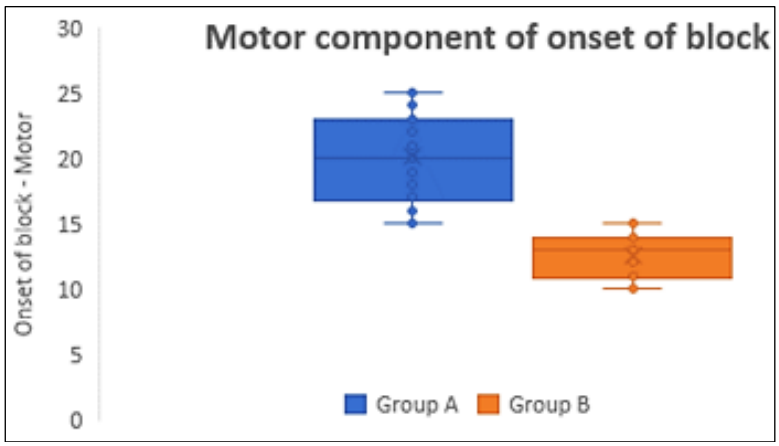

Figure 2: Box plot which shows the motor component of block among the study groups

In Group A, the mean onset of motor component of the block is 20.1 ± 3.39 minutes and the mean onset of motor block in Group B is 12.53 ± 1.80 minutes. There is a statistically significant difference in both the groups (p value-0.000683).

The mean time of sensory block in Group A is 271.63±28.7 minutes and the mean time of block in Group B is 785.76±75.3 minutes. A statistically significant difference was observed between the two groups (p value-0.0000001).

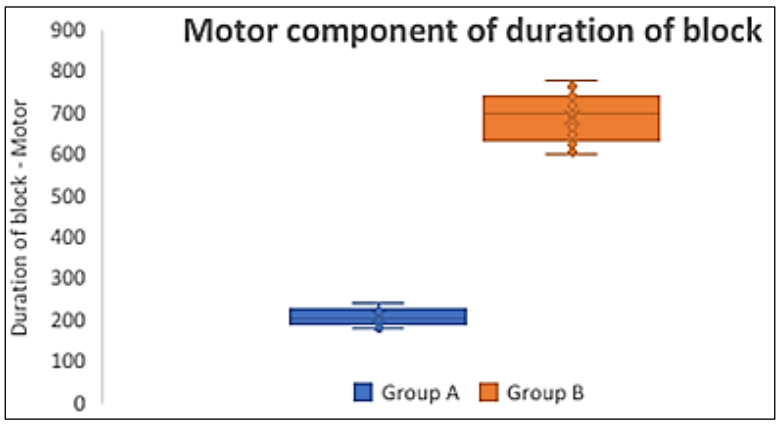

Figure 3: Box plot determining duration of motor block among the study groups

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The mean duration of motor component of duration of block is 207.16±19.79 minutes in Group A and 691±58.13 minutes in Group B. A statistically significant difference has been noted between the two groups (p value-0.000002).

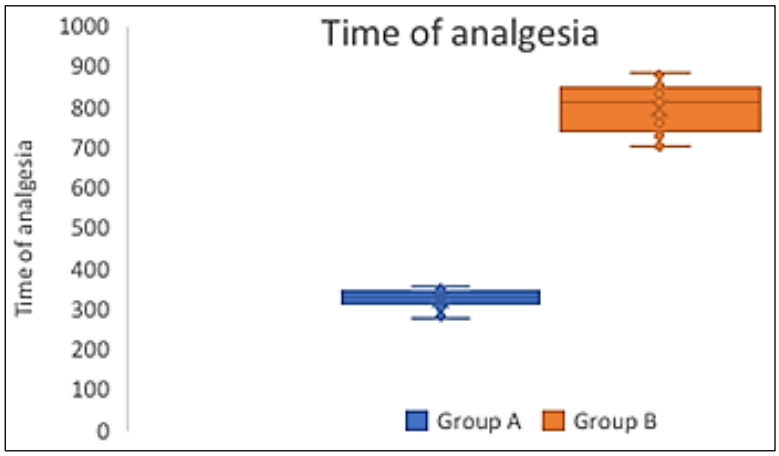

Figure 4: box plot showing time of analgesia in both the study groups

The time of analgesia has been studied in both the groups. The time of analgesia in Group A with Bupivacaine alone is 325.43 ± 22.58 and duration of analgesia in Group B is 797.73± 58.84 minutes. There is statistical difference observed among the two groups in time of analgesia (p value-0.00004).

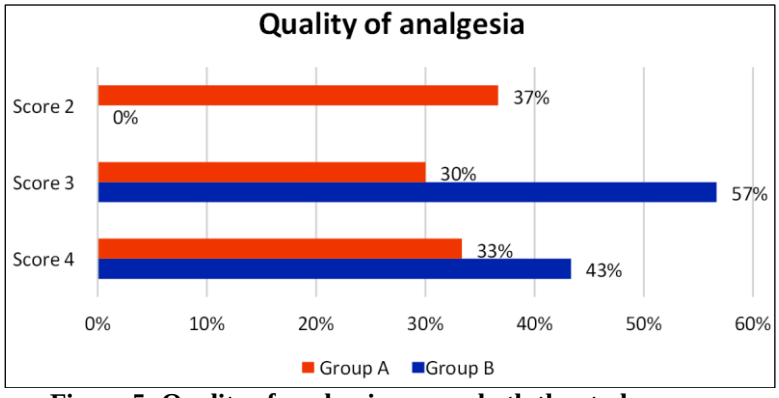

Figure 5: Quality of analgesia among both the study groups

	Group A	Group B
Score 2	37%	0%
Score 3	30%	57%
Score 4	33%	43%

The effectiveness of analgesia was graded on a scale of 2-4. None of the patients in Group B recorded a score of 2, 57% patients received a score of 3, and surprisingly 43% patients obtained a maximum score of 4. Only 33% patients in the Group A achieved the maximum score of 4, while 37% patients achieved score 2 and 30% achieved score 3. The chi-square test revealed there was statistical difference between the two groups in concerned with analgesia levels. (p-0.006769)

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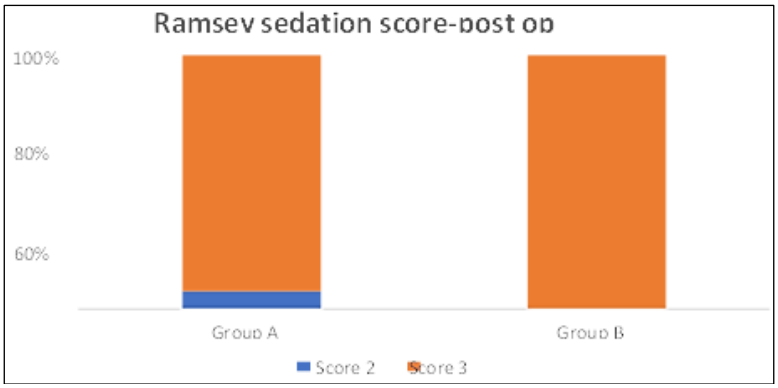

Figure 6: Ramsey sedation score post-operatively among the study groups

	Group A	Group B
Score 2	7%	0%
Score 3	93%	100%

The Ramsey sedation score was evaluated in the two patient groups at arrival and again following the intraoperative brachial plexus block delivery. As anticipated, both groups' scores were the same when they arrived.

In group A with plain Bupivacaine, 2 patients (7%) recorded a score 2 out of the 30 patients and the remaining recorded a score of 3. However, in Group B group all the patients recorded a score of 3.

Heart rate, systolic blood pressure, and diastolic blood pressure were measured during intraoperative hemodynamic monitoring at intervals of 5 minutes, 10 minutes, 15 minutes, 30 minutes, 45 minutes, 60 minutes, 90 minutes, and 120 minutes. As a result, the intraoperative hemodynamic variability was examined using a repeated measures linear model.

There is no statistically significant difference in heart rate recording in both the groups (p value – 0.52).

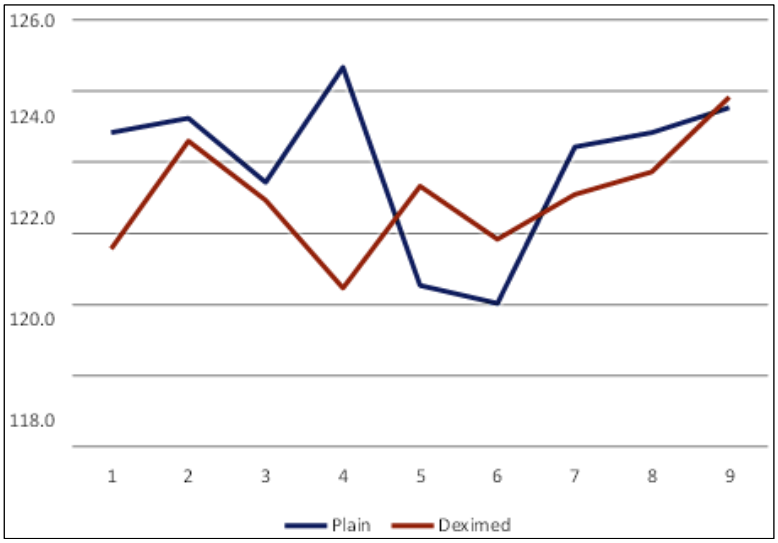

Figure 7: line diagram showing the systolic blood pressure in both groups

Using repeated measures linear model, there is no statistical difference between systolic blood pressures in both the study groups (p value-0.27)

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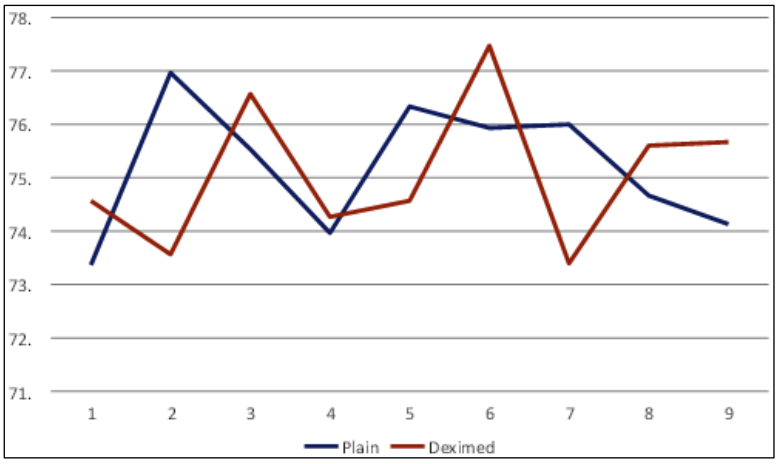

Figure 8:line diagram showing the diastolic blood pressures in both groups

Using repeated measures linear model, there is no statistical difference between diastolic blood pressures in both the study groups (p value-0.55)

DISCUSSION

In upper limb procedures, brachial plexus blocks are useful for both acceptable intraoperative circumstances and postoperative analgesia. In order to extend the effects of plain bupivacaine, which can rarely relieve pain after a peripheral nerve block for more than three to eight hours, indwelling catheters can be inserted to deliver a continuous infusion of local anaesthetic, or analgesic adjuvants can be added. Although indwelling catheter procedures are highly effective, their usage is restricted due to challenges with placement, a high secondary failure rate, challenges with catheter removal, and occasionally infections. To extend analgesia, a variety of adjuvants-including midazolam, neostigmine, and dexamethasone-have been explored with variable degrees of efficacy.

For more than 100 years, alpha 2 adrenergic agonists have been in use. Local anaesthetics have been administered through a variety of methods, including epidural, intrathecal, and peripheral injections, to lengthen and improve the quality of anaesthesia. Alpha 2 agonists that are partial or selective include clonidine and dexmedetomidine. Alpha 2 agonists have a variety of ways to work when blocking peripheral nerves. Direct action on peripheral nerves, analgesia mediated through action at central level, and a vasoconstrictive effect mediated by Alpha 2 receptors are all included. In large doses, these medications can have side effects include bradycardia and hypotension in people who are at high risk.

The practice of nerve blocks recently had undergone a revolution thanks to the recent adoption of ultrasound guidance, which has proven to be both successful and safe. Along with a significant decrease in the dosage of adjuvants and local anaesthetics, it has increased safety. We are able to see the nerve roots and deposit the anaesthetics at the plexus with use of ultrasound. In previous studies higher doses of adjuvants were used. We chose lower doses of adjuvant in order to assess their efficacy. As the procedure was done under ultrasound guidance it was possible to use low dose adjuvant to attain the same regional anaesthesia with minimal side effects.

In this randomised, double-blind trial, we looked at the effects of dexmedetomidine plus bupivacaine versus bupivacaine alone on duration of sensory motor blockage in Interscalene brachial plexus. Hemodynamic stability, sedation, and block quality all were improved without any adverse effects.

In their Randomized controlled trial, Esmaoglu*et al.* [7] and Gandhi *et al.* [8] discovered that in the dexmedetomidine group sensory-motor onset times were much lower. In our study we observed the same that onset of sensory-motor blockade was much lower in the dexmedetomidine group than the group with plain bupivacaine.

In their study, Gandhi R *et al.* [8] found that the dexmedetomidine group had sensory-motor blockade for a longer period of time. In our study we found similar results.

There is no difference in intraoperative hemodynamics between two groups, according to study by Gandhi R *et al.* [8] But in Esmaoglu*et al.* study [7], there was significant decrease in systolic blood pressure after 15 minutes, diastolic blood pressure after 60 minutes and heart rate after 10 minutes.

One of the advantages of our trial was that we evaluated the quality of the block and Ramsey sedation scores, which were both significantly higher when dexmedetomidine was used. These parameters were not evaluated in other investigations.

Bradycardia was seen in 7 out of thirty patients in the Esmaoglu*et al.* [7] trial, compared to only 2 out of 35 patients in Gandhi R *et al.* [8] and 2 out of thirty patients in our investigation. This was likely because Esmaoglu*et al.* study employed a greater dosage of dexmedetomidine (100µg).

Similar to our study, neither the Gandhi R *et al.* [8] study nor the Esmaoglu-*et al.* study reported any instances of hypotension necessitating use of vasopressors.

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A recent study by Agarwal S *et al.* [9] on dexmedetomidine and bupivacaine for brachial plexus block through supraclavicular method showed that onset of sensory-motor blockade in the dexmedetomidine group was early compared to the control group and time of analgesia, sensory motor blockade was prolonged in the dexmedetomidine group, which are comparable to our study.

In their randomised controlled trial on dexmedetomidine and bupivacaine for ultrasound-guided infraclavicular brachial plexus block, Ammar S. *et al.* [10] found that in the dexmedetomidine group there was a reduced onset of sensory-motor blockade. This was comparable to our study.

In a different randomised controlled trial, Mirkheshti A *et al.* [11] discovered that of the sensory and motor block was longer in the dexmedetomidine group compared to the ketorolac group and that the commencement of the sensory-motor blockade occurred earlier in the dexmedetomidine group. This study, which is comparable to ours, demonstrated that adding dexmedetomidine to local anaesthesia lengthens the time the block is in place.

CONCLUSION

Adding dexmedetomidine to Bupivacaine results in better quality of sensory-motor block in Intraoperative period, prolonged postoperative analgesia and adequate sedation without any adverse effects. The observation obtained from this study concludes that the effect of dexmedetomidine is very effective when added to bupivacaine in brachial-plexus block over plain bupivacaine.

CONFLICT OF INTEREST: None to be declared.

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