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# Dexmedetomidine as an Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block

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## Abstract

**Background:** Many drugs have been used as adjuvants to local anesthetic agents to prolong the duration of peripheral nerve blocks and decrease the time of onset.

In this study we assessed the effect of dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block in terms of onset and duration of sensory and motor blockade, intraoperative sedation, postoperative analgesia, sedation and Complications /side effects if any.

**Methods:** 60 patients of age 18-70 yrs were divided into two equal groups for upper limb surgeries under supraclavicular brachial plexus block. Group BD was given 39 millilitres (ml) of 0.5% Bupivacaine+1 microgram/kg dexmedetomidine; Group BS was given 39 ml of bupivacine+1 ml of saline.

The following brachial plexus nerve block parameters were assessed hemodynamic parameters, onset and duration of sensory and motor blockade, Ramsay sedation score, verbal rating score, duration of analgesia, duration for rescue analgesia and number of analgesia given.

**Results:** The onset of sensory blockade was 2.54 minutes less in Group (BD) when compared to Group (BS). The onset of Motor Blockade is 3.26 minutes less in Group (BD) when compared to Group (BS).

The duration of sensory blockade is 195.65 minutes more in Group (BD) then Group (BS). The duration of Motor Blockade is 190.33 minutes more in Group (BD) when compared to Group (BS). The duration of Analgesia is 207.83 minutes more in Group (BD) when compared to Group (BS).

Ramsay sedation score in Gp (BD)continued to show slightly higher sedation scores at all times including postoperative period in comparison to Gp (BS) ($P<0.01$).

**Conclusion:** Dexmedetomidine is good adjuvant to local anesthestic agents, as its addition to bupivacaine was associated with prolonged sensory and motor blockade, mild sedation and prolonged analgesia.

Satisfactory hemodynamic stability without observed immediate post-operative side effects are other significant qualities related to it.

**Keywords:** Analgesia; Bupivacaine; Spuraclavicular brachial plexus block; Dexmedetomidine; Sedation

## Introduction

An increasing demand for regional anesthesia from patients and surgeons both matches the fact that regional anesthesia can provide superior pain management and perhaps improves patient outcome.

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 perioperative pain management in surgery below the shoulder joint.

Many drugs have been used as adjuvants to local anesthetic agents to prolong the duration of peripheral nerve blocks and decrease the time of onset.

Opioids, ketamine, dexamethasone, tramadol, Clonidine and few others drug have been reported to prolong the duration of anesthesia and analgesia during such blocks [1-3] all the adjuvants have some side effects and limitation on the basis of their mechanism of action.

The α2:α1 selectivity of dexmedetomidine is eight times that of clonidine and its high specificity for α2 subtype makes it a much more effective sedative and analgesic agent [4].

In this study we assessed the effect of dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block in terms of (Figure 1):

- Onset and duration of sensory and motor blockade.
- Intraoperative sedation and postoperative analgesia and sedation.
- Complications /side effects if any

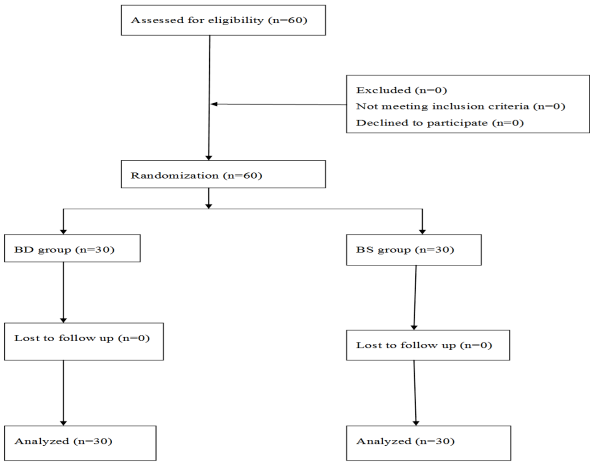


**Figure 1:** BD group (bupivacine+dexmedetomidine), BS group (bupivacine+normal saline).

## Material and Method

This prospective, randomized, double blinded study was performed on 60 adult patients of age undergoing upper limb surgeries under supraclavicular brachial plexus block. Approval from local ethical committee was taken and written informed consent was obtained from patients. All patients were assessed for ASA physical status I and II.

### Exclusion criteria

- ASA class III, IV and V
- Patient refusal for procedure
- Any bleeding disorder or patient on anticoagulants
- Neurological deficits involving brachial plexus
- Patients with allergy to local anaesthetics, dexmeditomidine.
- Local infection at the injection site
- Patients on any sedatives or antipsychotics
- Severe obesity/ Body mass index >35
- Hepatic impairment (CHILD B or higher)
- Renal impairment (creatinine >2 mg/dl)

### Procedure

The patients were randomized by computer generated random number tables and divided into two equal groups:

- Group BS-(n=30) 39 millilitres (ml) of 0.5% Bupivacaine+1 ml saline
- Group BD-(n=30) 39 millilitres (ml) of 0.5% Bupivacaine+1 microgram (mcg)/kilogram (kg) Dexmedetomidine (dexem, by Themis, India) was given.

The drug solutions were prepared by an anesthesiologist not involved in the study. The anesthesiologist performing the block and observing the patient was blinded to the treatment group. Data collection was done by the same anesthesiologist who was unaware of the group allocation.

The patients undergoing surgical procedure were explained about the procedure. Intravenous cannulation with 18 G venflon was secured in the non-operating upper limb and inj. Midazolam 1 mg i.v and inj. ondansetron 4 mg i.v was given. ECG leads, $O_2$ saturation probe and NIBP cuff was attached. The patient was positioned supine with a roll under the shoulder to enhance neck extension and the head turned away from the side to be injected. The patients were administered brachial plexus block by supraclavicular route via the subclavian perivascular approach. Under all aseptic precautions, the injection site was identified to be 1 cm behind the midpoint of the clavicle, (where the pulsation of the subclavian artery was felt) and infiltrated with 1 ml of 2% lignocaine subcutaneously. A nerve stimulator (Neurostim LA II, Hugo Sachs Electronik, type 220/1 with 22G × 2" Pajunk needle) was used to locate the brachial plexus. The location endpoint was a distal motor response, that is, the movement of the fingers and the thumb with an output current of 0.5 mA. During injection of the drug solution, negative aspiration was done every 5 ml to avoid intravascular injection. Plexus block was considered successful when at least two out of the four nerve territories (ulnar, radial, median, and musculocutaneous) were effectively blocked for both sensory and motor block.

Onset of sensory time was defined as the time elapsed between the injection of drug and complete loss of cold perception of the arm, while motor blockade was defined as the time elapsed from injection of drug to complete motor block. Sedation of the patient was categorized using Ramsay Sedation Score.

Heart rate, NIBP, $SpO_2$, Respiratory rate was noted every 5 minutes (mins) during the first 15 mins, then every 15 mins throughout the surgery and first hour of postoperative period. Duration of sensory block (time elapsed between injection of drug and appearance of pain requiring analgesia) and duration of motor block (time elapsed between injection of drug and complete return of muscle power) was also recorded.

I.m Injection of Tramadol 150 mg was given as rescue analgesic when patients complained of pain which was assessed with visual analogue scale (VAS). Patients with VAS >3 (mild, annoying pain) received Inj. Tramadol 100 mg, IV for post op pain up to 12 hrs. When required.

### Power of analysis

It was calculated according to duration of analgesia. With two sided type I error of 5% and study power at 80%, it was calculated that 25 patients were required in each group in order to detect difference of 35 min in the duration of analgesia between two groups.

### Statistical analysis

The obtained data was analyzed using SPSS 16; descriptive data was compared and presented as Mean ± SD for continuous variables and as number and percentage for normal variable. The venous parameters studied during observation period were compared using student's 't' test or paired 't' test, for parametric variables and Chi-square test used for non-parametric variables.

The critical value of 'p' indicating the probability of significant difference was taken as <0.05 for comparison.

## Results

The patients demographic data were recorded, observations were made perioperatively and postoperatively for changes in heart rate, blood pressure, oxygen saturation, sedation score, postoperative pain relief, onset of sensory and motor blockade, duration of sensory and motor blockade and duration of analgesia (Table 1).

As shown in Table 2, Base line heart rate was comparable in both groups (p>0.05). After 10 minutes of giving block there was decrease in heart rate ,which was more in Group (BD) compared to Group (BS) which is statistically significant (p<0.05).

| | Group BD (n=30 ) | Group BS (n=30 ) |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| Sex (M/F ) | 20/10 | 20/10 |
| ASA I/II | 21/9 | 22/8 |
| Weight (Kg ) | 62.27 ± 7.70 | 63.60 ± 7.87 |
| Height (Cm) | 162.13 ± 7.56 | 162.13 ± 6.84 |
| Age (yrs) | 43.27 ± 12.81 | 43.7 ± 13.21 |

**Table 1:** Demographic and ASA characteristics.

| Time interval | BD | BS | t-value | p-value |
|---|---|---|---|---|
| HR Baseline | 74.57 ± 8.05 | 74.87 ± 8.95 | -0.136 | 0.892 |
| HR 5 min | 75.70 ± 8.33 | 75.83 ± 8.27 | -0.062 | 0.951 |
| HR 10 min | 75.00 ± 8.32 | 78.70 ± 8.02 | -1.752 | 0.085 |
| HR 15 min | 71.23 ± 8.43 | 80.40 ± 6.81 | -4.631 | <0.001 |
| HR 30 min | 68.23 ± 7.09 | 80.40 ± 6.81 | -6.776 | <0.001 |
| HR 45 min | 66.77 ± 6.14 | 80.37 ± 6.82 | -8.110 | <0.001 |
| HR 60 min | 64.73 ± 2.71 | 79.67 ± 7.60 | -10.130 | <0.001 |
| HR 75 min | 65.23 ± 4.24 | 81.30 ± 6.75 | -11.031 | <0.001 |
| HR 90 min | 65.00 ± 3.69 | 80.70 ± 7.11 | -10.725 | <0.001 |
| HR 120 min | 64.97 ± 3.89 | 80.23 ± 6.95 | -10.491 | <0.001 |
| HR 150 min | 65.23 ± 4.24 | 81.30 ± 6.75 | -11.031 | <0.001 |
| HR 180 min | 66.77 ± 6.18 | 80.37 ± 6.72 | -8.111 | <0.001 |

**Table 2:** Comparison of Heart Rate (min) between both groups in perioperative and postoperative period.

As shown in Table 3 mean ± standard deviation of systolic blood pressure of patients in both groups were comparable at baseline (p>0.05), After giving the block there was fall in systolic blood pressure in both groups, but was not statistically significant until 15 minutes after giving block (p>0.05). After15 minutes till the end of surgery and also in the postoperative period ,there is more decrease in systolic blood pressure in Group (BD) compared to Group (BS), which is also statistically significant (p<0.05).

| Time interval | BD | BS | t-value | p-value |
|---|---|---|---|---|
| SBP Baseline | 125.40 ± 11.11 | 122.33 ± 10.99 | 1.074 | 0.287 |
| SBP 5 min | 125.47 ± 10.55 | 119.47 ± 6.53 | 2.647 | 0.010 |
| SBP 10 min | 117.20 ± 8.13 | 117.40 ± 5.63 | -0.111 | 0.912 |
| SBP 15 min | 113.87 ± 7.51 | 118.60 ± 5.53 | -2.776 | 0.007 |
| SBP 30 min | 114.00 ± 5.89 | 117.07 ± 5.50 | -2.083 | 0.042 |
| SBP 45 min | 111.47 ± 5.53 | 118.87 ± 5.39 | -5.243 | <0.001 |
| SBP 60 min | 110.60 ± 6.06 | 118.47 ± 5.21 | -5.388 | <0.001 |
| SBP 75 min | 113.40 ± 5.63 | 119.00 ± 5.67 | -3.835 | <0.001 |
| SBP 90 min | 109.13 ± 5.29 | 119.07 ± 5.77 | -6.946 | <0.001 |
| SBP 120 min | 109.13 ± 6.69 | 118.33 ± 5.48 | -5.820 | <0.001 |
| SBP 150 min | 110.6 ± 5.99 | 118.57 ± 5.14 | -5.384 | <0.001 |
| SBP 180 min | 113.40 ± 5.60 | 119.00 ± 5.64 | -3.835 | <0.001 |

**Table 3:** Comparison of Systolic blood pressure (SBP) in mm Hg during perioperative and post-operative period among both groups.

As shown in Table 4 mean ± standard deviation of Diastolic blood pressure (DBP) of patients in both groups were comparable at baseline (p>0.05), After giving the block there was fall in Diastolic blood pressure (DBP) in BD group, It was statistically not significant until 10 minutes after giving block (p>0.05).

After 10 minutes till the end of surgery, there was fall in Diastolic blood pressure(DBP) in Group (BD) compared to Group (BS), which is statistically significant too (p<0.05).

During post-operative period, the diastolic blood pressure is constantly very close to base line in Group (BS). While in Group (BD), DBP continued to be low and stable which is statistically significant (p<0.05) (Figure 2).

| Time interval | BD | BS | t-value | p-value |
|---|---|---|---|---|
| DBP Baseline | 79.60 ± 6.15 | 80.67 ± 5.59 | -0.702 | 0.485 |
| DBP 5 min | 78.87 ± 6.25 | 81.60 ± 4.99 | -1.871 | 0.066 |
| DBP 10 min | 70.73 ± 3.98 | 80.60 ± 5.53 | -7.923 | <0.001 |
| DBP 15 min | 69.73 ± 4.25 | 81.60 ± 4.99 | -9.904 | <0.001 |

| | | | | |
|---|---|---|---|---|
| DBP 30 min | 68.53 ± 3.67 | 80.60 ± 5.53 | -9.946 | <0.001 |
| DBP 45 min | 67.90 ± 3.68 | 82.00 ± 5.06 | -12.335 | <0.001 |
| DBP 60 min | 67.33 ± 3.75 | 81.60 ± 4.99 | -12.508 | <0.001 |
| DBP 75 min | 67.17 ± 4.13 | 80.60 ± 5.53 | -10.645 | <0.001 |
| DBP 90 min | 67.60 ± 4.14 | 81.60 ± 4.99 | -11.821 | <0.001 |
| DBP 120 min | 68.17 ± 3.36 | 80.60 ± 5.53 | -10.511 | <0.001 |
| DBP 150 min | 67.17 ± 4.13 | 81.60 ± 5.53 | -11.60 | <0.001 |
| DBP 180 min | 68.17 ± 3.36 | 80.60 ± 4.5 | -11.52 | <0.001 |

**Table 4:** Comparison of diastolic blood pressure (DBP) in mmHg during perioperative and post-operative period among both groups.

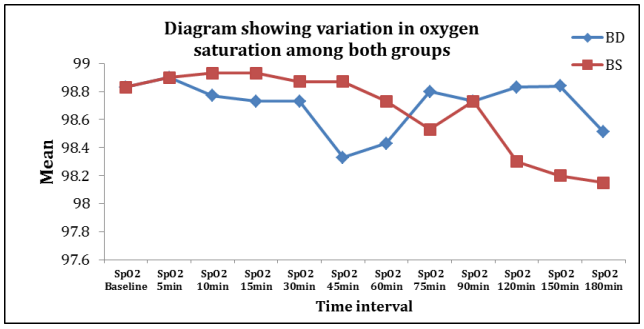


**Figure 2:** Variation in oxygen saturation.

As shown in Table 5 the mean ± standard deviation of Ramsay sedation scores (RSS) of patients in both groups were comparable at baseline and at 5, and 10 minutes. But after 15 minutes, the patients in Group (BD) continued to show slightly higher sedation scores at all times including postoperative period 150 and 180 minutes when compared with Group (BS) which was statistically significant too (p<0.01).

| Time interval | BD | BS | t-value | p-value |
|---|---|---|---|---|
| RSS baseline | 1.00 ±0 .000a | 1.00 ± 0.000a | - | - |
| RSS 5 min | 1.13 ± 0.346 | 1.43 ± 0.679 | -2.157 | 0.035 |
| RSS 10 min | 1.43 ± 0.568 | 1.50 ± 0.682 | -0.411 | 0.682 |
| RSS 15 min | 2.07 ± 0.640 | 1.50 ± 0.682 | 3.319 | 0.002 |
| RSS 30 min | 2.10 ± 0.607 | 1.50 ± 0.682 | 3.598 | 0.001 |
| RSS 45 min | 2.10 ± 0.607 | 1.50 ± 0.682 | 3.598 | 0.001 |
| RSS 60 min | 2.10 ± 0.607 | 1.57 ± 0.679 | 3.207 | 0.002 |
| RSS 75 min | 2.13 ± 0.571 | 1.50 ± 0.682 | 3.898 | 0.000 |
| RSS 90 min | 2.20 ± 0.484 | 1.43 ± 0.626 | 5.306 | 0.000 |
| RSS 120 min | 2.10 ± 0.607 | 1.50 ± 0.682 | 3.598 | 0.001 |
| RSS 150 min | 2.13 ± 0.571 | 1.50 ± 0.682 | 3.898 | 0.000 |
| RSS 180 min | 2.20 ± .484 | 1.43 ± .626 | 5.306 | 0.000 |

**Table 5:** Comparison of Ramsay sedation score (RSS) during perioperative and post operative period among both groups.

As shown in Table 6, The mean ± standard deviation of visual analogue scale (VAS) of patients in both groups during postoperative period shows better pain relief score in Group (BD) when compared to Group (BS),but it is not statistically significant(p<0.01). No patients in any group required rescue analgesic after 1st hour of surgery. Injection tramadol 100 mg intravenous was given for postoperative pain in both groups among patient having VAS>3.

| Time interval | BD | BS | t-value | p-value |
|---|---|---|---|---|
| VAS Baseline 120 min | 0.13 ± 0.346 | 0.20 ± 0.407 | -0.684 | 0.497 |
| VAS 125 min | 0.13 ± 0.346 | 0.30 ± 0.466 | -1.573 | 0.121 |
| VAS 135 min | 0.13 ± 0.346 | 0.33 ± 0.479 | -1.853 | 0.069 |
| VAS 150 min | 0.67 ± 0.711 | 0.37 ± 0.556 | 1.820 | 0.074 |
| VAS 180 min | 0.83 ± 0.747 | 0.77 ± 0.728 | 0.350 | 0.727 |

**Table 6:** Visual analog score *vs.* group.

No. of analgesia required is less in group BD in comparison to BS and is also statistically significant (Figure 3).

As shown in Table 7, The mean ± standard deviation of the Onset of Sensory Blockade (OS) shows the time taken for onset of sensory blockade is less in Group (BD) when compared to Group (BS) and is statistically significant (p<0.01).

The onset of sensory blockade was 2.54 minutes less in Group (BD) when compared to Group (BS).

The mean ± standard deviation of the Onset of Motor Blockade (OM) shows the time taken for onset of motor blockade is less in Group (BD) when compared to Group (BS) and is statistically significant (p<0.01).

The onset of Motor Blockade is 3.26minutes less in Group (BD) when compared to Group (BS).

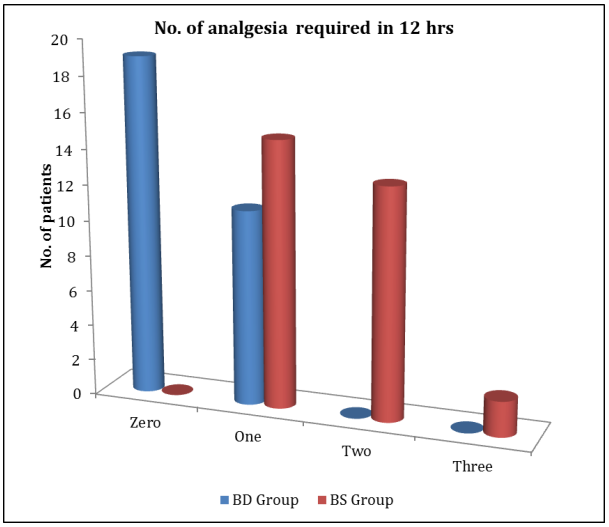


**Figure 3:** No of analgesia required in 12 hour.

| Variables | BD | BS | t-value | p-value |
|---|---|---|---|---|
| Surgery time | 72.83 ± 31.69 | 57.00 ± 26.11 | 2.112 | 0.039 |
| Onset sensory block | 8.83 ± 1.62 | 11.37 ± 1.56 | -6.160 | <0.001 |
| Duration of sensory block | 532.33 ± 85.32 | 336.67 ± 71.71 | 9.615 | <0.001 |
| Onset motor block | 10.33 ± 1.60 | 13.07 ± 1.59 | -6.615 | <0.001 |
| Duration of Motor block | 486.67 ± 88.68 | 296.33 ± 75.28 | 8.962 | <0.001 |
| Duration of analgesia | 569.00 ± 78.88 | 361.17 ± 71.22 | 10.710 | <0.001 |

**Table 7:** Comparison of onset of Sensory Blockade (OS), Onset of Motor Blockade (OM), Duration of Sensory Blockade (DS), and Duration of Motor blockade (DM) and Duration of analgesia (DA) among both groups.

The mean ± standard deviation of the Duration of Sensory Blockade (DS) shows the duration of sensory blockade is more in Group (BD) when compared to Group (BS) and is statistically significant ($p<0.01$). The duration of sensory blockade is195.65 minutes more in Group (BD) when compared to Group (BS).

The mean ± standard deviation of the Duration of Motor Blockade (DM) shows the duration of motor blockade is more in Group (BD) when compared to Group (BS) and is statistically significant ($p<0.01$).The duration of Motor Blockade is 190.33 minutes more in Group (BD) when compared to Group (BS).

The mean ± standard deviation of the Duration of Analgesia (DA) shows the duration of Analgesia is more in Group (BD) when compared to Group (BS) and is statistically significant ($p<0.01$).The duration of Analgesia is 207.83 minutes more in Group (BD) when compared to Group (BS).

## Discussion

Anesthesiologists routinely use peripheral nerve blocks as an alternative or as an adjunct to general anesthesia, as well as for postoperative analgesia for a wide variety of procedures.

The selection of the optimal long-acting local anesthetic and its concentration for supraclavicular brachial plexus block has always been a debate. Bupivacaine, a local anaesthetic has faster onset and longer duration of action. Bupivacaine has been used with various adjuncts; more commonly with alpha-2 adrenergic receptors agonists. In this study we compared bupivacaine alone and bupivacaine with dexmedetomidine (an alpha-2 adrenergic receptor agonist).

In our study we found that heart rate was decreased from base line in the BD (bupivacaine + dexmedetomidine) group after 15 minutes ($p<0.05$) when compared to (BS) group (Table 2). Systolic blood pressure was decreased from base line in BD (bupivacaine +dexmedetomidine) group after 15 minutes and beyond in comparison to BS (bupivacaine) group (Table 3). Diastolic blood pressure was also decreased from base line after 15 minutes ($p<0.05$) in BD (bupivacaine + dexmedetomidine) group when compared to BS (bupivacaine) group (Table 4).

Marina Simeoforidou et al. suggested that spraclavicular block, possibly through extension of block to the ipsilateral stellate ganglion, alters the autonomic outflow to the central circulatory system and this influence depends on the block site [5]. Bradycardia and hypotension during surgery under brachial plexus block have been reported by many investigators; though most are transient, isolated and uncomplicated. Few cases with severe cardiovascular instability have occurred, including asystolic cardiac arrest. Ozalp et al. also noted that there was fall in heart rate and systolic blood pressure in their study on the analgesic efficacy of dexmedetomidine added to bupivacaine in patient controlled supraclavicular analgesia via the posterior approach [6].

Injection midazolam 1 mg was given to all patients and sedation was assessed using Ramsay sedation score (Table 5). There was no statistical significance in both groups until first 15 minutes after which patients in (BD) group showed RSS of 3 most of the times, with statistical significance of ($p<0.05$). Ozalp et al. [6] and Aliye Esmaoglu et al. [7] also observed that patients who received dexmedetomidine as adjuvant in brachial plexus block were sedated throughout the surgery. Though the exact mechanism of action is not known, centrally-acting alpha-2 agonists produce analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of alpha-2 adrenoceptors in the locus coeruleus [8].

The onset of sensory and motor blockade was quick in group (BD) when compared with the group (BS) ($p<0.05$) (Table 7). Esmaoglu et al. [7] in his study on Dexmedetomidine added to Levobupivacaine in Axillary Brachial Plexus Block, observed that Sensory and motor block onset time were significantly shorter in group LD (levobupivacaine+ Dexmedetomidine) than in group L (levobupivacaine), and the difference was statistically significant ($P<0.05$) [8]. The onset of sensory blockade was 2.54 minutes less in Group (BD) when compared to Group (BS). The onset of motor Blockade was 2.66 minutes less in Group (BD) when compared to Group (BS).

In our study, the duration of sensory and motor blockade was prolonged in BD (bupivacaine + dexmedetomidine) group when compared to BS (bupivacaine) group ($p<0.05$) (Table 7). Duration of

sensory blockade was prolonged by 195.66 minutes and motor blockade by 190.34 minutes. Esmaoglu et al. [7], Amar et al. [9] also found in their studies that administering perineural dexmedetomidine as part of a brachial plexus block resulted in a prolongation of motor block duration. The mechanism by which alpha-2 adrenergic receptor agonists produce analgesia and sedation is not fully understood but is likely to be multifactorial. Peripherally, alpha-2 agonists produce analgesia by reducing release of norepinephrine and causing alpha-2 receptor independent inhibitory effects on nerve fiber action potentials.

In this study, pain was assessed by visual analogue scale (VAS), and found that VAS score at 120, 125, 135, 150 and 180 minutes was less in group (BD) when compared to group (BS) ($p<0.05$) (Table 6) Duration of analgesia was prolonged by 207.8 minutes in group (BD). Esmaoglu et al. [7], Gandhi et al. [8] and Amar et al. [9] studies were analysed together and found out that there was increase in time to first analgesic request by 345 min (95% CI: 102.68, 587.23, $P<0.005$) or 70% when Dexmedetomidine was used as an adjunct to local anesthetics in various blocks when compared with local anesthetics alone.

No. of analgesia required in post-operative period was less in group BD when compared to group BS and also statistically significant ($p<0.05$) (Figure 3).

Oxygen saturation remained >95% at all times in groups, with no statistically significant difference between bupivacaine (BS) and bupivacaine+dexmedetomidine group (BD) ($p>0.05$). Respiratory rate of patients in both groups were comparable at baseline and at 5 minutes after the block ($p>0.05$). There was decrease in respiratory rate in Group (BD) after 10 min, which was statistically significant ($p<0.05$) (Figure 2) when compared with group (BS).

## Summary and Conclusion

From this study we concluded that Dexmedetomidine is a good adjuvant to local anesthestic agents, as its addition to bupivacaine was associated with prolonged sensory and motor blockade, mild sedation and prolonged analgesia. Satisfactory hemodynamic stability without observed immediate post-operative side effects are other significant qualities related to it.

## Conflict of Interest

There is no conflict of interest

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