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Original Research Article

# Comparative Study of Butorphanol and Dexmedetomidine Combined with Levobupivacaine (0.5%) in Supraclavicular Brachial Plexus Block

**Dhwani A. Chaudhari[1], Sonali A. Joshi[2], Arti R. Rathod[3]**

[1]Senior Resident, Department of Anesthesia, NAMO Medical Education & Research Institute, Silvassa, India

[2]Associate Professor, Department of Anesthesia, Surat Municipal Institute of Medical Education & Research, Surat, Gujarat, India

[3]Senior Resident, Department of Anesthesia, JIS School of Medical Science & Research, West Bengal, India

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**Corresponding Author: Dr. Dhwani A. Chaudhari**

**Conflict of interest: Nil**

**Abstract:**

**Background and Aim:** Supraclavicular brachial plexus provides complete and reliable anesthesia for upper limb surgeries. Adjuvants are added to local anesthetists to improve various block characteristics. The present study aimed to compare the clinical efficacy of butorphanol and dexmedetomidine in supraclavicular brachial plexus block when given with 0.5% levobupivacaine.

**Material and Methods:** Present observational study was carried out in 54 adult patients posted for various elective upper limb surgeries. Total patients taking part into study were divided into two groups: Group D: Patients received 24 ml of 0.5% levobupivacaine + 50 µg(1ml) of dexmedetomidine = 25 ml. Group B: Patients received 24 ml of 0.5% levobupivacaine + 2 mg(1ml) of butorphanol = 25 ml. Onset and duration of sensory and motor block and duration of analgesia were noted and any side effects were observed.

**Results:** The mean Onset of sensory block was significantly faster in Group D as compared to Group B ($P<0.05$). The mean Onset of motor block was significantly faster in Group D as compared to Group B ($P<0.05$). Hemodynamic parameters were comparable in both the groups at all-time intervals ($p>0.05$). Mean duration of sensory block was significantly prolonged in Group D (591.87±75.71 minutes) as compared to Group B (391.31±59.60 minutes) ($P<0.05$). Mean duration of analgesia was significantly prolonged in Group D as compared to Group B ($P<0.05$).

**Conclusion:** Dexmedetomidine when added to Levobupivacaine in supraclavicular brachial plexus block has faster onset, longer duration of sensory and motor block and prolonge duration of analgesia as compared to Butorphanol that too without any complications.

Thus, Dexmedetomidine is better adjuvant than Butorphanol when added to Levobupivacaine in supraclavicular brachial plexus block.

**Keywords:** Butorphanol, Dexmedetomidine, Levobupivacaine, Supraclavicular Brachial Plexus Block.



## Introduction

Like general anesthesia, which has been used for more than a century, regional anesthesia has phases of rising and falling popularity. Currently, regional anesthesia is being used more often in clinical settings. Regional anesthesia technique has many advantages over general anesthesia, including effective analgesia with good motor blockade, awake patients, prolonged postoperative analgesia, early mobilization, no airway manipulation, avoiding polypharmacy, and a decreased incidence of postoperative nausea and vomiting. Peripheral nerve blocks, in orthopedic surgical procedures, have the advantage of good intra and post-operative analgesia and improved patient comfort. Brachial plexus block is the most practical & dependable regional anesthesia technique for upper limb surgery. It offers both postoperative analgesia and intraoperative anesthesia. [1,2] Post-operative pain management is a challenge to the attending physician. Stress-related problems, particularly hemodynamic and cardiac issues, are brought on by improper or insufficient analgesia. Therefore, it is the responsibility of the anesthesiologist to give the patient the best analgesia possible in the early aftermath of surgery, particularly in the first 24 hours. [3] Kulenkampff originally presented the supraclavicular brachial plexus block in 1911 as a landmark-based strategy. With the development of

technology throughout time, block techniques have altered, and innovative methods have been promoted using peripheral nerve stimulators and ultrasound. [3] Use of PNS in regional anaesthesia has many advantages over conventional technique like minimal discomfort to patient, no need for patient cooperation, improved success rate, less volume of LA required and less chances of nerve damage.4 Successful block of the plexus branches depends on the fact that these branches are encased in a tubular fascial sheath. If one of the branches is identified and a sizable amount of anesthetic drug is given, block of the plexus as a whole may be anticipated. [2]

Brachial plexus block has been achieved using a variety of local anesthetics. Bupivacaine is the most popular one of them because of its increased potency and longer duration of effect but Cardiotoxicity is one of the major concerns. Levobupivacaine, a local anaesthetic agent with qualities comparable to bupivacaine but less toxic, was created as the (s) enantiomer of bupivacaine. [5]

Although a supraclavicular brachial plexus block offers quick, comprehensive, and dense analgesia for operations involving the upper limbs, the effect tends to wear off quickly because of the site's high vascularity. [6] To combat this, a number of adjuvants are employed to increase the duration and speed up the onset of peripheral nerve blockage. As an adjuvant to local anesthetics, medications such as opioids, Alpha-2-adrenergic agonists, sodium bicarbonate, neostigmine, adrenaline, ketamine, etc. are used to decrease the dosages of local anaesthetic drug, improve analgesic effectiveness, and lessen the likelihood of adverse effects. Butorphanol and dexmedetomidine have lately grown in popularity significantly as an adjuvant to local anaesthetics.

Butorphanol is a synthetic opioid similar to morphine that acts agonistically at kappa receptors and somewhat antagonistically at μ receptors. [5] Dexmedetomidine, the medetomidine d-isomer that is pharmacologically active, is a highly selective and specific agonist of the α2 adrenoceptors, which lessens the undesirable effects of α1 receptor. When used as an adjuvant to local anaesthetic in nerve blocks, dexmedetomidine has also been shown to extend the sensory and motor duration of nerve blocks. [7]

The present study aimed to compare the clinical efficacy of butorphanol and dexmedetomidine in supraclavicular brachial plexus block when given with 0.5% levobupivacaine.

## Material and Methods

After approval from institutional ethical committee, present observational study was carried out in 54 adult patients of ASA I or II aged between 18 to 55 years of either sex posted for various elective upper limb surgeries after taking written informed consent for the duration of 14 months.

Sample size (n=27 cases in each group) is calculated by using open epi software with taking Mean SD of 'onset of motor block' between group-D (Dexmedetomidine) and group-B (Butorphanol) respectively.

All patients completed a thorough pre-anesthesia assessment that comprised a systemic examination, general examination, and taking a thorough medical history. All patients underwent standard examinations such as a full haemogram, blood urea, serum creatinine, random blood sugar, an ECG, and a chest X- ray. If necessary, special investigations into the specific case were conducted.

**Inclusion Criteria:**

- ASA class I and II enrolled for elective upper limb surgeries
- Age: 18 to 55 years
- Sex: Male or Female

**Exclusion Criteria:**

- Any bleeding disorder or patient on anticoagulants
- Neurological deficit involving brachial plexus
- Allergy to local anaesthetics
- Patients on any sedatives or antipsychotics
- Patients suffering from any cardiac or respiratory disease

All patients were advised to remain nil by mouth for 6-8 hours before surgery. An intravenous line was secured with an intravenous cannula in the unaffected limb. Pulse oximeter, non-invasive blood pressure cuff and ECG electrodes were applied and baseline pulse, blood pressure, oxygen saturation were recorded.

Premedication: given 30 minutes before Surgery

- Inj. Glycopyrrolate 0.2 mg i.m.
- Inj. Midazolam 2 mg i.m.

Total patients taking part into study were divided into two groups.

Group D: Patients received 24 ml of 0.5% levobupivacaine + 50 μg(1ml) of dexmedetomidine = 25 ml. Group B: Patients received 24 ml of 0.5% levobupivacaine + 2 mg(1ml) of butorphanol = 25 ml.

In this method, the negative electrode from the PNS was connected to a 22G insulated needle and the positive electrode from the PNS was coupled to an ECG lead and inserted in the ipsilateral shoulder. The subclavian artery was palpated in the supraclavicular region after skin preparation, and

the skin immediately lateral to the artery was infiltrated with 2% lignocaine. The site of needle entry was located on the clavicle about an inch laterally to the sternocleidomastoid insertion. The PNS was adjusted to deliver 1.5-2.5 mA current at 1 Hz frequency and 0.1 ms of pulse duration while the needle was inserted into the skin in a downward and inward orientation. Following obtaining the finger twitch, the current was gradually decreased to 0.5 mA, and after negative aspiration, the local anaesthetic solution was injected. The drug injection time was recorded. Onset of sensory and motor block was assessed every minute after the end of injection till peak effects occurs. Onset time, Duration of sensory block and Motor Block was also assessed. Pulse rate, Blood pressure, Oxygen saturation and level of sedation were monitored immediately after giving the block, 5 min, 10 min, 15 min, then every 15 min up to 60 min, then every 30 min up to completion of surgery in intra-operative periods. Pain was assessed using 10-point Visual Analogue Scale (VAS). Patients were observed for any cardiovascular or central nervous toxicity by changes in hemodynamic or signs of CNS stimulation.

### Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA).

Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

### Results

**Table 1: Comparison of Age and Weight**

| Variables | Group - B (Butorphanol)(n=27) | | Group - D (Dexmedetomidine)(n=27) | | P value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Age (years) | 36.49 | 14.48 | 39.68 | 16.45 | 0.452 |
| Weight (kg) | 61.08 | 10.03 | 63.83 | 7.69 | 0.263 |

Mean age of patients in group D and B were (39.68± 16.45 vs 36.49 ± 14.48) years. Patients in group D had mean weight of 63.83 ± 7.69 kg and in group B had 61.08 ± 10.03 kg. Patients were comparable in two groups according to age and weight (p>0.05). Mean duration of surgery in group Dexmedetomidine (129.60 min) and in group Butorphanol (114.45 min) were comparable (p>0.05). Both the groups were comparable in terms of ASA grading (p>0.05).

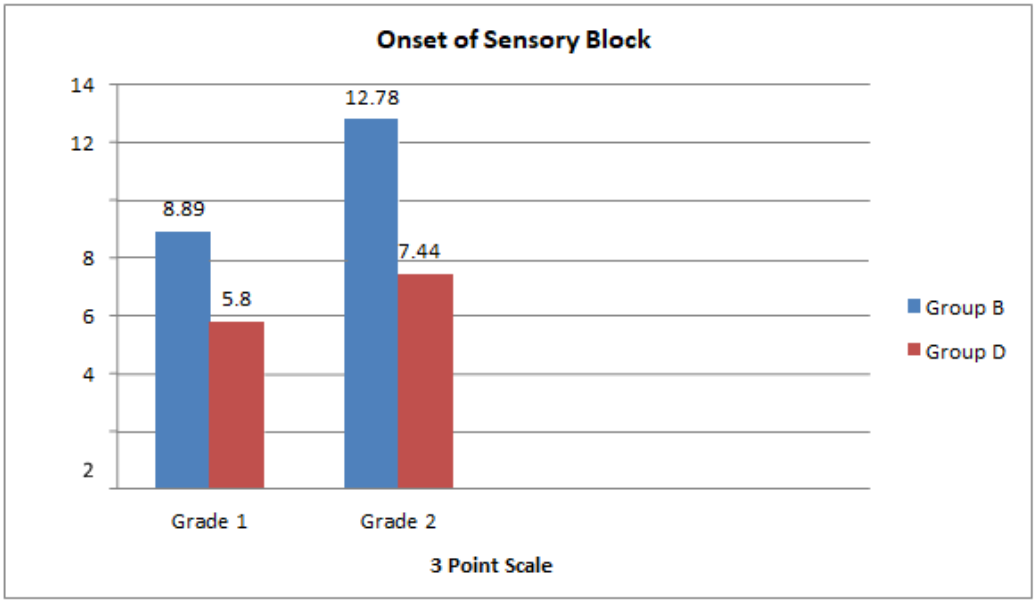


**Figure 1: Onset of sensory Block**

Onset of grade 1 sensory block in dexmedetomidine group (5.8 ± 2.11 mins) was found to be faster than butorphanol group (8.98 ± 2.3 mins), which was statistically highly significant (p<0.001). In dexmedetomidine group onset of grade 2 sensory block was (7.44 ± 3.03 mins) and it was faster than butorphanol group (12.78 ± 2.69 mins), which was statistically highly significant (p<0.001).

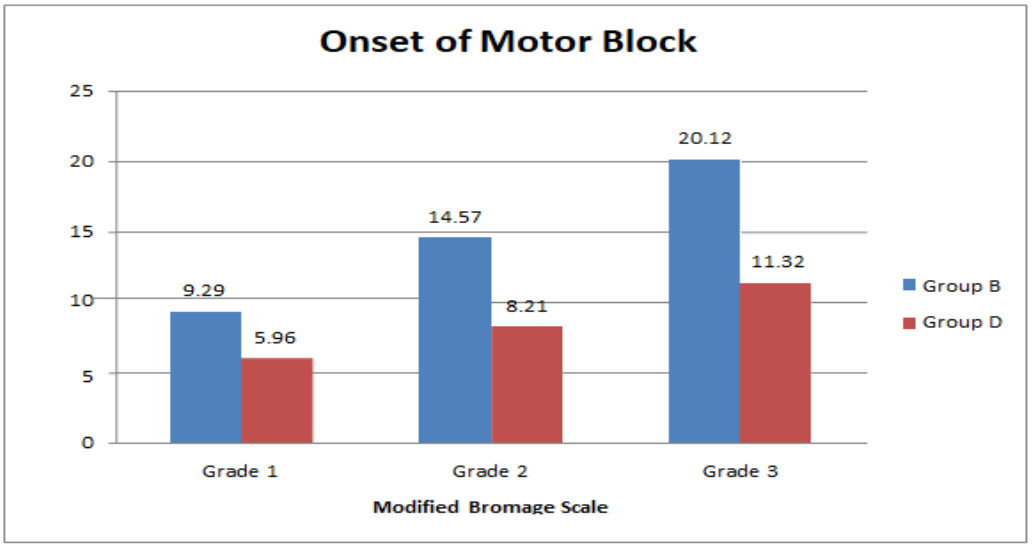


**Figure 2: One set of motor Block**

Time of onset of motor blockage was faster in dexmedetomidine group (11.32± 2.86 mins) as compared to butorphanol group (20.12± 3.26 mins).

The difference in the time of onset of motor blockade between the groups were statistically significant ($p<0.05$). No significant difference found in pulse rate, systolic blood pressure, diastolic blood pressure, mean Arterial Pressure, Oxygen Saturation and respiratory rate in two groups during the entire duration of block and post-operatively ($p>0.05$).

**Table 2: Duration of Sensory and Motor Block**

| Duration of Block | Group - B (Butorphanol)(n=27) | | Group - D (Dexmedetomidine)(n=27) | | P value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Sensory Block(min) | 391.31 | 59.60 | 591.87 | 75.71 | <0.001 |
| Motor Block(min) | 369.61 | 67.13 | 568.69 | 86.90 | <0.001 |

Total duration of sensory blockade was longer in dexmedetomidine group (591.87±75.71 mins) as compared to butorphanol group (391.31±59.60 mins), which was statistically highly significant between the groups. ($p<0.001$). Dexmedetomidine group provided extended duration of motor block (568.69 ± 86.90 mins) as compared to butorphanol group (369.61± 67.13 mins), which was statistically highly significant. ($p<0.001$).

Duration of analgesia was maximum in group D 776.40±138.6 mins whereas it was 643.55 ± 131.6 mins in group B. The difference was statistically highly significant ($p<0.001$).

**Table 3: Postoperative Visual Analogue Score**

| VAS (Post-operative) | Group - B (Butorphanol)(n=27) | | Group - D (Dexmedetomidine)(n=27) | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **Immediate** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **1 hour** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **2 hour** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **3 hour** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **4 hour** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **5 hour** | 0.00 | 0.00 | 0.00 | 0.00 | - |
| **6 hour** | 0.08 | 0.01 | 0.00 | 0.00 | - |
| **7 hour** | 0.56 | 0.08 | 0.18 | 0.06 | - |
| **8 hour** | 1.36 | 0.19 | 0.78 | 0.22 | <0.001 |
| **9 hour** | 2.37 | 0.42 | 1.29 | 0.38 | <0.001 |
| **10 hour** | 3.07 | 0.67 | 1.91 | 0.45 | <0.001 |
| **12 hour** | 3.94 | 0.77 | 2.94 | 0.63 | <0.001 |
| **24 hour** | 3.84 | 0.84 | 3.01 | 0.70 | <0.001 |

The above table shows VAS comparison between two groups at different time intervals. At 8 hours postoperatively, VAS in group D was 1.36 ±0.19 and in group B was 0.78 ± 0.22 which was statistically significant (p<0.001). The difference in VAS remained significant up to 24 hours in both the groups. VAS was ≥ 4, at 12th hour in group B and at 24th hour in group D. The VAS ≤ 4 remained for longer period in dexmedetomidine group as compared to butorphanol group.

**Table 4: Side Effects**

| Side Effect | Group - B (Butorphanol)(n=27) | | Group - D (Dexmedetomidine)(n=27) | | P value |
|---|---|---|---|---|---|
| | Cases | Percentage | Cases | Percentage | |
| **Hypotensionon** | 0 | 0.00% | 0 | 0.00% | - |
| **Bradycardiaa** | 1 | 3.70% | 0 | 0.00% | - |
| **Fall inSPO2** | 0 | 0.00% | 0 | 0.00% | 0.552 |
| **Nausea** | 3 | 11.11% | 1 | 3.70% | 0.304 |
| **Vomiting** | 1 | 3.70% | 0 | 0.00% | - |
| **Pruritus** | 1 | 3.70% | 0 | 0.00% | - |

One patient (3.70%) in dexmedetomidine group and three patients (11.11%) in butorphanol group had nausea, which is statistically insignificant (p>0.05). One each in Butorphanol group experienced vomiting, pruritus and bradycardia. The incidence of side effect was higher in group B as compared to group D. None of the patients in my study experienced failed or insufficient block that is probably due to use of PNS.

**Discussion**

Dexmedetomidine is a member of the imidazole subclass of α2 receptor agonists. It act directly on the peripheral nerves and at the same time, it produce analgesia via central action by activating α-2 adrenoceptors in locus coeruleus and suppressing substance P release. It also has α2 mediated vasoconstrictive effect. [8]

The current observational study was conducted in supraclavicular brachial plexus block to compare Dexmedetomidine and butorphanol with levobupivacaine (0.5%). In our study, a total of 54 patients of either sex, ranging in age from 18 to 55, who were having upper limb procedures were enrolled. Patients were randomly divided into two groups, each consisting of 27 patients.

No significant difference found in pulse rate, systolic blood pressure, diastolic blood pressure, mean Arterial Pressure, Oxygen Saturation and respiratory rate in two groups during the entire duration of block and post-operatively (p>0.05). The Findings of our study were in accordance with the following studies: Kundan sandugir gosavi et al and Ankita Atri et al. [9,10]

In present study, mean onset of sensory block in Group D (7.44 ± 13.03 min) and in Group B (12.7 ± 2.69 min). Onset of sensory block was rapid with dexmedetomidine as compared to butorphanol. This difference was statistically significant (P<0.001). Sandhya agarwal et al (2014), [7] observed that Mean onset time of sensory block was 13.2±1.8 min in Group SD (Bupivacaine + Dexmedetomidine) and 19.0±3.2 min in Group S (control). Mean onset time of sensory block was found to be faster in dexmedetomidine group than plain local anaesthetic group. This difference was statistically significant (P<0.05). Ankita Atri et al [10] observed that onset of sensory block at T10 level was 20.00 ± 2.94 min in group LB (butorphanol) and 15.17 ± 2.82 min in group LD (dexmedetomidine). There was much faster onset of sensory block in dexmedetomidine group (P<0.05).

In present study, the mean time of onset of motor block in Group D was 11.32 ± 2.86 minutes while it was 20.12 ± 3.26 minutes in Group B. The onset of motor block was significantly faster with dexmedetomidine as compared to butorphanol (P<0.05). Similar findings were observed by Sandhya agarwal et al [7] and Haramritpal et al. [11]

No Significant differences in Sedation score between two groups were observed in intra-operative periods (P>0.05). None of the patient experienced airway compromise or required airway assistance. Ankita Atri et al (2021) [10] observed All patients remained arousable to verbal commands and sedation score of more than 3 was not seen in any patient during this study.

In present study, the mean duration of sensory block was found to be prolonged in dexmedetomidine group (591.87 ± 75.71 minutes) as compared to butorphanol group (391.31 ± 59.60 minutes). This difference was statistically significant (P<0.05). Kundan sandugir gosavi et al observed that total duration of sensory block in group D was 543±69.46 min and in group B was 359±54.68 min. They concluded that dexmedetomidine enhanced the duration of sensory block. This difference among the two groups was statistically significant (P<0.05). Gargi et al (2016) [12] observed that total duration of sensory block was found to be longer in butorphanol group (342.6±21.6 minutes) than in plain local anaesthetic

group (225±14.4 minutes) (P<0.05). This finding was comparable with duration of sensory block of butorphanol group of present study. In present study, the mean duration of motor block was prolonged with dexmedetomidine (568.69 ± 86.90 minutes) as compared to Butorphanol (369.61 ± 67.13 minutes). This difference was statistically significant (P<0.05). In our study, patient demanded rescue analgesia at 643.55 ± 131.6 minutes in Group B and it was 776.40 ± 138.6 minutes in Group D. The mean duration of analgesia was found to be prolonged with dexmedetomidine as compared to Butorphanol. This difference was statistically significant (P<0.05). Bharthi et al (2019)5 conducted study to compare Different doses of Butorphanol combined with levobupivacaine in supraclavicular brachial plexus block. There was prolonged duration of analgesia in 2mg butorphanol group (633.58±121.6 min). This difference was statistically significant (P<0.05). This finding was comparable with duration of analgesia of butorphanol group of present study. Upasna Bhatia et al (2018) [6] in her study observed that total duration of analgesia was 619.96 ± 26.96 min in Butorphanol group, which was comparable with the duration of analgesia of butorphanol group of our study. Visual analogue scale (VAS) was used to asses Post-operative Pain. The differences in VAS between two groups were statistically significant from 8 hours to 24 hours post-operatively (P<0.05).

One patient (3.70%) in dexmedetomidine group and three patients (11.11%) in butorphanol group had nausea, which is statistically insignificant (p>0.05). One each in Butorphanol group experienced vomiting, pruritus and bradycardia. The incidence of side effect was higher in group B as compared to group D, but they were found insignificant. Ankita Atri et al (2021) [10] observed increased Nausea/vomiting in LB as compared to LD and L group. Shivering was seen in 1 patient in L group, 1 patient in LB group and was not observed group LD.

## Conclusion

Based on above findings we concluded that Dexmedetomidine when added to Levobupivacaine in supraclavicular brachial plexus block has faster onset, longer duration of sensory and motor block and prolonge duration of analgesia as compared to Butorphanol that too without any complications. Thus, Dexmedetomidine is better adjuvant than Butorphanol when added to Levobupivacaine in supraclavicular brachial plexus block.

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