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Original Research Paper

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# COMPARISON OF BLOCK CHARACTERISTICS OF BUTORPHANOL VERSUS TRAMADOL AS AN ADJUVANT TO BUPIVACAINE WITH LIGNOCAINE FOR BRACHIAL PLEXUS BLOCK AMONG PATIENTS UNDERGOING UPPER LIMB SURGERIES.

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## ABSTRACT

**Background and objectives:** Brachial plexus block provides an useful alternative to general anaesthesia in patients undergoing upper limb surgeries by providing near ideal operating conditions like complete muscle relaxation, intraoperative haemodynamic stability and by producing sympathetic block which reduces postoperative pain and oedema.[1] In this study the block characteristics of butorphanol and tramadol as an adjuvant to local anaesthetics for supraclavicular brachial plexus block were compared in patients undergoing elective upper limb surgeries. **Material and methods:** After obtaining approval from institutional ethical committee one hundred and two patients aged between 18 to 60 years, belonging to ASA physical status I & II posted for elective upper limb surgeries under supraclavicular brachial plexus block were enrolled for the study. They were randomized into three groups of thirty four patients by computer generated random numbers.

- Group T (34 patients) - Patients received Inj. 0.5% Bupivacaine 18ml with 10ml 2% Lignocaine with Inj. Tramadol 2ml (100mg).
- Group B (34 patients) - Patients received Inj. 0.5% Bupivacaine 18ml with 10ml 2% Lignocaine with Inj. butorphanol 2ml (2mg).
- Group C or control group (34 patients) - Patients received Inj. 0.5% Bupivacaine 18ml with 10ml 2% Lignocaine with distilled water 2cc.

Haemodynamic variables like heart rate, blood pressure, SPO2 and respiratory rate were measured at pre-defined time intervals. **Results:** Tramadol and butorphanol improved block characteristics when compared to control group and was statistically significant.Among tramadol and butorphanol group, the onset of sensory block was much quicker with tramadol group and was statistically significant. (Group T 7.47 +/- 2.81 min and Group B 8.68 +/- 2.54 min).The onset of motor block was also quicker in tramadol group compared to butorphanol group. However it was statistically insignificant. (Group T 14.47 +/- 5.71 min and Group B 14.88 +/- 3.30 min). Duration of sensory and motor block and also duration of analgesia was much longer in butorphanol group when compared to tramadol group and it was statistically significant. (Group T 309.03 +/- 75.26min, 279.91 +/- 80.79min and 356.65 +/- 29min Vs Group B 449.68 +/- 32.23min, 424.65 +/- 20.71min and 486.35 +/- 39.71min respectively). **Conclusion:** Butorphanol significantly increased the duration of sensory and motor block of brachial plexus block and also the duration of analgesia without any side-effects. Hence, butorphanol can be used safely in supraclavicular brachial plexus block.

**KEYWORDS :** Supraclavicular brachial plexus block; Butorphanol; Tramadol

## INTRODUCTION

Brachial plexus block provides an useful alternative to general anaesthesia in patients undergoing upper limb surgeries by providing near ideal operating conditions like complete muscle relaxation, intraoperative haemodynamic stability and by producing sympathetic block which reduces postoperative pain and oedema.[1] It also leads to early ambulation and reduced hospital stay. It is worthwhile to explore the options for extending pain relief without increasing the local anaesthetic dose thereby, minimising the adverse effects of local anaesthetics. Various adjuvants have been used along with local anaesthetics for this purpose. [2]

Bupivacaine is an amide local anaesthetic and is preferred over other local anaesthetics because of lesser CNS toxicity and longer duration of action. However, it has few limiting factors like delayed onset, patchy or incomplete analgesia which can be overcome with addition of adjuvants.[1]

Lignocaine, commonly referred to as "Lidocaine", is an amide local anesthetic agent and a Class 1b antiarrhythmic. Lignocaine is an essential drug on World Health Organisation essential drug list, considered efficacious, safe and cost-effective for any health-care system. Similar to other local anesthetics, the mechanism of action of lignocaine for local or regional anesthesia is by reversible blockade of nerve fiber impulse propagation. The agent enters the nerve cells by diffusion through membranes and binds to sodium channels, causing a conformational change that prevents the transient influx of sodium, therefore depolarization. All potentially excitable membranes are affected, however sensory fibers are blocked preferentially because they are thinner, unmyelinated and more easily penetrated. Lignocaine is an intermediate acting drug with rapid onset of action. Blockade, whilst dependent of dose given, 2 concentration used, nerves blocked and status of the patient, may last for up to 5 h when administered as a peripheral nerve block. [3]

Tramadol is a synthetic opioid having dual modes of action for inhibition of pain. An opioid action mediated mainly by 'mu' receptor agonism and a non-opioid action mediated by decreasing the reuptake of nor epinephrine and serotonin. [1] Butorphanol is also a synthetic opioid having partial agonistic and antagonistic activity at 'mu' receptors and agonistic activity at 'kappa' receptors. [4] Tramadol and butorphanol were selected as adjuvants in this study because both of these drugs belongs to the same family, i.e., synthetic opioids and this study was undertaken to study and compare their block

characteristics i.e., to study onset of sensory and motor block and its duration and also the duration of analgesia when they were added as an adjuvant to local anaesthetics in supraclavicular brachial plexus block.

## OBJECTIVES

### Primary

- To compare block characteristics of butorphanol versus tramadol as an adjuvant to bupivacaine with lignocaine for brachial plexus block among patients undergoing upper limb surgeries.

### Secondary

- To compare the haemodynamic and cardio-respiratory variables among the groups peri-operatively.
- To compare incidence of side-effects following brachial plexus block with addition of either butorphanol or tramadol to local anaesthetic mixture.

## MATERIALS AND METHODS

**Source of Data:** The study group comprised of patients admitted in teaching hospital of Mandya Institute of Medical sciences, Mandya, scheduled for elective upper limb surgeries under supra-clavicular brachial plexus

**Study Setting:** Department of Anaesthesiology, Mandya Institute of Medical Sciences, Mandya.

**Design:** A prospective, randomised, placebo controlled, double blinded comparative study.

**Study Period :** 1 year

**Sample Size** : 102

The sample size was calculated using nMASTER2 software which is developed and patented by Department of Bio-statistics, Christian Medical College, Vellore. By considering the standard deviation (SD) of 30 min of duration of analgesia in the previous study (B.upasna et. al.) and expecting a mean difference of 12 min in our study group, keeping an alpha error 5% and beta error 0.2, estimated sample size in each group was 31. Assuming a drop out of around 10% total sample size would be 102 and each group will contain 34 patients.

### Method Of Collection Of Data:

**Sampling method** :

One hundred and two patients fulfilling the inclusion criteria of our study, were subjected to simple randomisation method by using computer generated random numbers and they were divided into three groups of thirty four each.

### Inclusion Criteria:

- Patients willing to participate in the study with informed consent.
- Patients aged 18-60 years.
- Patients with ASA (American Society of Anaesthesiology) class I (i.e., normal healthy individuals) and class II (i.e., patients with mild systemic disease. Ex: Well controlled diabetes mellitus or well controlled hypertension).
- Patients with no known hypersensitive reaction to either bupivacaine or lignocaine or butorphanol or tramadol.

### Exclusion Criteria:

- Pregnant and lactating women.
- Debilitated and severely ill patients.
- Patients with coagulopathy or bleeding diathesis.
- Inadequate block i.e., if the patient was still able to perceive pain and also he was able to move the blocked limb even after 30 min after administration of block then such patients will be given general anaesthesia and such patients will be excluded from the study.

## METHODOLOGY

All patients who were selected as per the inclusion and exclusion criteria undergoing elective upper limb surgeries under brachial plexus block in Mandya Institute of medical sciences were taken for the study after routine pre-anaesthetic checkup. The procedure was explained to the patient and informed consent was obtained.

The patients were assigned to one of the three groups by computer generated random numbers which was known only to investigator one. The patients were given one of the following drug combination by investigator one and were observed for the study.

Group T (34 patients) - The patients in this group received 18ml 0.5% Bupivacaine with 10ml 2% Lignocaine and 2ml tramadol (100mg).

Group B (34 patients) - The patients in this group received 18ml 0.5% Bupivacaine with 10ml 2% Lignocaine and 2ml butorphanol (2mg).

Group C or control group (34 patients) - The patients in this group received 18ml 0.5% Bupivacaine with 10ml 2% Lignocaine and 2ml distilled water.

Patient and investigator 2 (who monitored the patient) were blinded as to which group the patient belonged. The drug solution was injected into the brachial plexus of the patient via supraclavicular approach using peripheral nerve stimulator. Once the drug solution was injected, sensory block was evaluated by pin prick method with a 23 gauge needle. The onset time was defined as the time between injection and complete loss of pin prick sensation in C5 to T2 dermatome and temperature testing.

Motor block was assessed by Bromage three point score which is as follows:

**Table 1: Bromage Three Point Score:**

| GRADE | CRITERIA |
|---|---|
| 0 | Normal motor function with full flexion and extension of elbow, wrist and fingers |
| 1 | Decreased motor strength with ability to move fingers and/or wrist only |
| 2 | Complete motor blockade with inability to move fingers |

The time taken to achieve complete motor blockade was noted. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded at the following intervals: one minute after the block, every five minutes till thirty minutes and every ten minutes till ninety minutes and then every thirty minutes till three hours. Duration of sensory block and duration of motor block was also recorded. Side effects and complications if any were noted and were treated as per the standard treatment protocols. Duration of analgesia was taken as the time taken until patient demands analgesia. Visual analog scale was observed every half hourly in postoperative period till patient received rescue analgesia. Visual analog scale is a 10-cm long slide ruler with 'no pain' written at one end and 'Maximum Pain' at the other. The patient would slide the cursor along the ruler until it reaches the level that represents the intensity of his or her pain. The other side of ruler is graduated over 100 mm and gives the investigator a numerical measure of the pain. Intraoperatively and postoperatively, patients were observed for sedation as per AVPU score which is as follows:

**Table 2: AVPU scale**

| SCORE | DESCRIPTION |
|---|---|
| 0 | Awake |
| 1 | Drowsy but arousable |

| | |
|---|---|
| 2 | Arousable only with painful stimuli |
| 3 | Unarousable |

**Outcome Measures:**

a) Time of onset of sensory and motor block
b) Duration of sensory and motor block
c) Duration of analgesia
d) Cardiorespiratory parameters like alteration in blood pressure, heart rate, respiratory rate and SPO2
e) Incidence of side effects

**Statistical Analysis:**

The collected data was entered using Microsoft Excel software and analyzed using SPSS trial version. Descriptive statistics like mean, Standard Deviation, Proportions etc. Inferential statistics like t- test to know the difference between means, chi-square test to know the association, and other relevant statistical tests were used.

## OBSEVARATION AND RESULTS

**Demographic Details:** All the groups were comparable in view of all the demographic factors like age, sex, height, weight. There was no significant statistical difference between them. All the patients were given equal volume of anaesthetic mixture (thirty milliliter).Duration of surgeries were also comparable lasting not more than two hours.

**Gender Distribution:** There was no statistical difference between the groups with respect to gender distribution.

**Age Distribution:** There was no statistical difference between the groups with respect to age and weight.

**Part of Upper Limb Operated:** There was no statistical difference between the groups with respect to the part of upper limb operated.

**Haemodynamic Variables:**

**Heart Rate:**

There was no statistical difference between the groups with respect to changes in the heart rate.

**Systolic Blood Pressure:** There was no statistical difference between the groups with respect to the changes in systolic blood pressure.

**Diastolic Blood Pressure:** There was no statistical difference between the groups with respect to the changes in the diastolic blood pressure.

**Oxygen Saturation (spo2):** There was no statistical difference between the groups with respect to changes in SPO2.

**Respiratory Rate:** There was no statistical difference between the groups with respect to the changes in respiratory rate.

**Onset And Duration Of Sensory Block:**

Onset and duration of sensory block was much quicker with tramadol and butorphanol group when compared to the control group. Among tramadol and butorphanol group, the onset of sensory block was much quicker with tramadol group and was statistically significant. Duration of sensory block was much longer in butorphanol group when compared to tramadol group and it was statistically significant.

**Table 3: Comparison Of Onset Of Sensory Block Among Groups**

| Variables | Group T | | Group B | | Group C | | F-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| On set of sensory block (min) | 7.47 | 2.81 | 8.68 | 2.54 | 13.62 | 2.46 | 52.9881 | 0.0001* |
| Duration of sensory block (min) | 309.03 | 75.26 | 449.68 | 32.23 | 202.03 | 85.22 | 112.6750 | 0.0001* |

**Table 4: Pair Wise Comparison Between Groups With Respect To Onset Of Sensory Block**

| Variables | Group T vs Group B | Group T vs Group C | Group B vs Group C |
|---|---|---|---|
| On set of sensory block (min) | p=0.0001* | p=0.0001* | p=0.0001* |
| Duration of sensory block (min) | p=0.0001* | p=0.0001* | p=0.0001* |

**Onset And Duration Of Motor Block:**

Onset and duration of motor block was much quicker with tramadol and butorphanol group when compared to the control group. Among tramadol and butorphanol group, the onset of sensory block was much quicker with tramadol group. However it was statistically insignificant. Duration of motor block was much longer in butorphanol group when compared to tramadol group and it was statistically significant.

**Table 5: Comparison Of Onset Of Motor Block Among Groups**

| Variables | Group T | | Group B | | Group C | | F-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| On set of motor block (min) | 14.47 | 5.71 | 14.88 | 3.30 | 20.29 | 2.34 | 22.0120 | 0.0001* |
| Duration of motor block (min) | 279.91 | 75.70 | 424.65 | 31.65 | 172.03 | 85.83 | 116.2432 | 0.0001* |

**Table 6: Pair Wise Comparison Of Onset Of Motor Block Among Groups**

| Variables | Group T vs Group B | Group T vs Group C | Group B vs Group C |
|---|---|---|---|
| On set of motor block (min) | P=0.9074 | p=0.0001* | p=0.0001* |
| Duration of motor block (min) | p=0.0001* | p=0.0001* | p=0.0001* |

*p<0.05 indicates significant

**Duration Of Analgesia:**

Duration of analgesia was much longer with tramadol and butorphanol group when compared to the control group. Duration of analgesia was much longer in butorphanol group when compared to tramadol group and it was statistically significant.

**Table 7: Comparison Of Duration Of Analgesia Among Groups**

| Variables | Group T | | Group B | | Group C | | F-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| Duration of analgesia (min) | 356.65 | 119.00 | 486.35 | 39.71 | 235.71 | 82.09 | 71.3084 | 0.0001* |

*p<0.05 Indicates Significant

**Table 8: Pair Wise Comparison Of Duration Of Analgesia Among Groups**

| Variables | Group T vs Group B | Group T vs Group C | Group B vs Group C |
|---|---|---|---|
| On set of sensory block (min) | p=0.0001* | p=0.0001* | p=0.0001* |

**Visual Analog Score (vas Score):**

There was significant reduction in VAS scores in tramadol and butorphanol group when compared to control group implying that patients were more comfortable when tramadol and butorphanol was added to the anaesthetic mixture. Among tramadol and butorphanol group the VAS score was significantly reduced in butorphanol group from three hours onwards implying that patients were much more comfortable

in butorphanol group compared to tramadol group even after three hours after onset of block.

**Table 9: Comparison Of Vas Score Block Among Groups**

| Time points | Group T | | Group B | | Group C | | F-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| 30 min | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.36 | 5.6897 | 0.0046* |
| 60 min | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.75 | 13.4522 | 0.0001* |
| 90 min | 0.00 | 0.00 | 0.00 | 0.00 | 1.12 | 1.23 | 28.2969 | 0.0001* |
| 120 min | 0.00 | 0.00 | 0.00 | 0.00 | 1.97 | 1.51 | 58.1157 | 0.0001* |
| 150 min | 0.09 | 0.29 | 0.00 | 0.00 | 2.32 | 1.12 | 132.1099 | 0.0001* |
| 180 min | 0.59 | 0.66 | 0.00 | 0.00 | 3.15 | 1.54 | 101.8750 | 0.0001* |
| 210 min | 1.35 | 0.60 | 0.00 | 0.00 | 3.47 | 1.26 | 160.3462 | 0.0001* |
| 240 min | 2.09 | 0.29 | 0.18 | 0.39 | 3.18 | 1.27 | 128.0771 | 0.0001* |
| 300 min | 2.44 | 0.50 | 1.00 | 0.00 | 3.24 | 1.05 | 97.1243 | 0.0001* |

*p<0.05 indicates significant

**Table 10: Pair Wise Comparison Of Vas Score Among Groups**

| Treatment times | Group T vs Group B | Group T vs Group C | Group B vs Group C |
|---|---|---|---|
| 30 min | p=1.0000 | p=0.0120* | p=0.0120* |
| 60 min | p=1.0000 | p=0.0002* | p=0.0002* |
| 90 min | p=1.0000 | p=0.0001* | p=0.0001* |
| 120 min | p=1.0000 | p=0.0001* | p=0.0001* |
| 150 min | p=0.8495 | p=0.0001* | p=0.0001* |
| 180 min | p=0.0364* | p=0.0001* | p=0.0001* |
| 210 min | p=0.0001* | p=0.0001* | p=0.0001* |
| 240 min | p=0.0001* | p=0.0001* | p=0.0001* |
| 300 min | p=0.0001* | p=0.0001* | p=0.0001* |

*p<0.05 indicates significant

## DISCUSSION

Sir William Stewart Halsted was the first to perform brachial plexus block. He performed the brachial plexus block with cocaine in 1885. [37, 38]

Both brachial plexus block (BPB) and general anesthesia (GA) have been extensively employed in upper limb surgery. The unwanted side-effects of drugs used in general anaesthesia and also the stress response and complications associated with laryngoscopy and endotracheal intubation can be prevented with the use of brachial plexus block. [39]

BPB provides near ideal operating conditions like complete muscle relaxation, intraoperative haemodynamic stability and by producing sympathetic block which reduces postoperative pain and oedema. [1]

A brachial plexus block can be performed using several approaches. Selection of the preferred approach is determined by the innervations of the surgical site, risk of regional anesthesia-related complications, as well as the preference and experience of the anesthesiologist. Other factors may be considered, such as the reliability, ease and rapidity, and patient comfort during block performance. The supraclavicular approach to the brachial plexus can provide excellent anesthesia for upper-extremity surgery. [45]

The supraclavicular approach to brachial plexus block is indicated for operations of the upper extremity distal to the shoulder. [46] Blockade occurs at the distal trunk–proximal division level. [47] Brachial plexus block can also be provided via interscaleni approach. However, owing to the block of the ipsilateral phrenic nerve, the technique was associated with a 100% incidence of hemi-diaphragmatic paresis. Furthermore, the phrenic nerve paralysis may result in severe pulmonary compromise, especially in patients with pre-existing obstructive or restrictive lung disease. Also the interscalene block is associated with higher incidence of hoarseness of voice and Horner's syndrome. The study conducted by C.W.guo, et al, in 2017 found that 152 of 712 patients in the supraclavicular group and 166 of 573 patients in the interscalene group had hoarseness (p=0.0002) and interscalene group also had higher incidence of Horner's syndrome which was statistically significant (p = 0.0002). [46] They concluded that supraclavicular block is a very effective technique with a low incidence of hoarseness and Horner syndrome.

The axillary block can also be used for surgery of the elbow, forearm, and hand. [49] Though axillary block is associated with less complications like pneumothorax and Horner's syndrome when compared to supraclavicular block the study conducted by R.M.Hussien, et, al., in 2018 comparing the axillary and supraclavicular block for hand surgeries showed that axillary block was associated with increased needling time compared to supraclavicular brachial plexus (477sec in axillary block vs 293sec in supraclavicular block). [48] The supraclavicular approach was selected in the study as it provides excellent anaesthesia with faster onset of dense block. [45]

The study conducted by H.W.Shin, et.al, showed that BPB with tramadol prolonged the duration of sensory block (mean difference [MD], -61.5 min; 95% CI, -95.5 to -27.6; P = 0.0004), motor block (MD, -65.6 min; 95% CI, -101.5 to -29.7; P = 0.0003), and analgesia (MD, -125.5 min; 95% CI, -175.8 to -75.3; P < 0.0001) compared with BPB without tramadol. Tramadol also shortened the time to onset of sensory block (MD, 2.1 min; 95% CI, 1.1 to 3.1; P < 0.0001) and motor block (MD, 1.2 min; 95% CI, 0.2 to 2.1; P = 0.010). In subgroup analysis, the duration of sensory block, motor block, and analgesia was prolonged for BPB with tramadol 100 mg (P < 0.05) but not for BPB with tramadol 50 mg. [2]

The study conducted by N.K.Regmi, et.al, comparing efficacy of tramadol as an adjuvant to bupivacaine in brachial plexus block, 30 patients in first group were administered 28 ml of 0.5% bupivacaine with 2 ml normal saline and 30 patients in second group were administered 28 ml of 0.5% bupivacaine (plain) with 2 ml(100mg) tramadol. They observed that tramadol significantly increased the duration of analgesia (264min in first group vs 456min in tramadol group) and concluded that tramadol when added to bupivacaine for supraclavicular brachial plexus block increases the duration of analgesia and enhances the quality of anaesthesia without affecting respiratory/hemodynamic parameters. [5] This was also similar to our study (Group T vs Group C).

Suresh.C.et.al, conducted a study to assess the effect of tramadol added to brachial plexus block by supraclavicular approach concluded that Tramadol (2mg/kg) in combination with 38mL of Bupivacaine (0.25%) hastened onset of sensory and motor block, and improved postoperative analgesia when used in brachial plexus block, without producing any adverse events.[1]

In a similar study conducted by H.Ramamoorthy, et.al, to assess the effect of tramadol added to brachial plexus block by supraclavicular approach concluded that tramadol (2mg/kg) in combination with bupivacaine resulted in faster onset of sensory and motor block and increased the duration of analgesia [53]

In the study conducted by G.M.Bhavsar,et.al, to study the effectiveness of Butorphanol as an adjuvant to local anaesthetics in brachial plexus block twenty five patients in group A received 30ml 1.5% Lidocaine with Adrenaline (1:200000) and 10ml Bupivacaine 0.5% and twenty five patients in group B (tramadol group) received 30ml 1.5% Lidocaine with Adrenaline (1:200000), 10ml Bupivacaine 0.5% with Butorphanol 2mg. Onset of sensory and motor block was

significantly faster in group B (11.36 ± 0.81min vs 12.76 ± 1.33min and 8 ± 1.15min vs 10.24 ± 1.33min respectively). Duration of analgesia was also significantly higher in group B (4.34 ± 0.20 hours in group A vs 7.22 ± 0.47 hours in group B). They concluded that butorphanol provides rapid onset of block, better analgesia, good hemodynamic stability and profound and longer analgesia without any adverse effects. [11] These results were similar to our study (Group B vs Group C).

The study conducted by R.Sharan, et.al, showed that addition of 2mg butorphanol (BB group) increased the duration of sensory block, motor block and duration of analgesia significantly when compared to patients receiving block without butorphanol (B group). The mean duration of sensory block was 4.27 ± 0.51 hrs in group B and 9.10 ± 0.71 hrs in group BB and mean duration of motor block was 3.57 ± 0.56 hrs in group B and 5.13 ± 0.51 hours in group BB. The difference in the two groups was found to be statistically highly significant (< 0.001). The duration of post-operative analgesia was 5.27 ± 0.77 in group B and 11.37 ± 0.85 in group BB ($p < 0.001$). [7] These results were similar to our study (Group B vs Group C).

In a similar study done by R. Acharya, et.al, in 2014 comparing 0.5% bupivacaine alone and bupivacaine and butorphanol 2mg in supraclavicular brachial plexus block concluded that addition of butorphanol significantly prolonged the duration of sensory as well motor block.[12] These results were similar to our study (Group B vs Group C)

Our study is comparable to the study conducted by U.Bhatia, et.al, comparing butorphanol and tramadol for axillary brachial plexus block and showed that butorphanol is more potent and produces longer duration of postoperative analgesia than tramadol. [8]

Tramadol and butorphanol were selected as adjuvants in this study because both of these drugs belongs to the same family, i.e., synthetic opioids and this study was undertaken to study and compare their block characteristics i.e., to study onset of sensory and motor block and its duration and also the duration of analgesia when they were added as an adjuvant to local anaesthetics in brachial plexus block. A control group was also formed where the patients received only the local anaesthetics without tramadol and butorphanol.

All the patients in our study were accounted for and completed the study. There were no side-effects in all the three study groups. We noted in our study that both tramadol and butorphanol significantly improved block characteristics when compared to control group.

**Table 11: Comparison Of Block Characteristics Among Different Groups**

| Characteristics | Group T | Group B | Group C |
|---|---|---|---|
| Onset Of Sensory Block | 7.47 +/- 2.81 | 8.68 +/- 2.54 | 13.62 +/- 2.56 |
| Onset Of Motor Block | 14.47 +/- 5.71 | 14.88 +/- 3.30 | 20.29 +/- 2.34 |
| Duration Of Sensory Block | 309.03 +/- 75.26 | 449.68 +/- 32.23 | 202.03 +/- 85.22 |
| Duration Of Motor Block | 279.91 +/- 80.79 | 424.65 +/- 20.71 | 172.03 +/- 89.09 |
| Duration Of Analgesia | 356.65 +/- 29 | 486.35 +/- 39.71 | 235.71 +/- 22.09 |

However, among tramadol and butorphanol groups, addition of butorphanol to the local anaesthetic solution resulted in better block characteristics compared to addition of tramadol. Hence, this proves that butorphanol is more potent than tramadol and can be used safely in brachial plexus block without any additional side-effects.

**Limitations Of Our Study:**

1) We included only ASA physical status I and II patients. Hence the result of our study cannot be extrapolated to general population.
2) Study was done using peripheral nerve stimulator without ultra sound guidance.
3) Our study did not assess the rebound pain which is a significant problem in patients undergoing peripheral nerve block.

## CONCLUSION

The major take away points from the present study are the following:

- Addition of tramadol as well as butorphanol to the local anaesthetic solution improved the block characteristics of supra-clavicular brachial plexus block, compared to plain local anaesthetic solution in the control group.
- Sensory block onset was much quicker in tramadol group when compared to butorphanol group. (7.47min vs 8.68 min). [p value (0.0001)] and was statistically significant.
- Though motor block onset was also quicker in tramadol group compared to butorphanol group (14.47min vs 14.88min), it was statistically insignificant. [p value (0.9079).
- However the duration of sensory block, duration of motor block and duration of analgesia was increased in butorphanol group compared to tramadol group. [p value less than 0.001,0.001 and 0.001 respectively].
- The VAS score was also significantly low in butorphanol group implying that patients were more comfortable in butorphanol group.

To conclude butorphanol significantly increased the duration of sensory and motor block of brachial plexus block and also the duration of analgesia without any side-effects. Hence, butorphanol can be used safely in supraclavicular brachial plexus block in routine clinical practice.

**Summary**

Brachial plexus block provides an useful alternative to general anaesthesia in patients undergoing upper limb surgeries.

Bupivacaine and lignocaine are the most commonly used local anaesthetics for brachial plexus block. Various adjuvants have been used along with local anaesthetics to fasten the onset of block and for extending pain relief without increasing the local anaesthetic dose thereby, minimising the adverse effects of local anaesthetics.

In our present study we tried to evaluate the block characteristics of tramadol and butorphanol as an adjuvant to local anaesthetics along with a control group (without adjuvants).

A prospective, randomized, controlled double blind clinical study was undertaken after obtaining ethical clearance from institutional ethical committee.

One hundred and two patients of ASA physical status class I and II, aged between 18-60 years posted for upper limb surgeries were randomized into three groups of thirty four each. Group T patients received 18ml of 0.5% bupivacaine with 10ml 2% lignocaine and 100mg tramadol and Group B patients received 18ml of 0.5% bupivacaine with 10ml 2% lignocaine and 2mg butorphanol and Group C patients received 18ml of 0.5% bupivacaine with 10ml 2% lignocaine without any adjuvants.

Under aseptic precautions, all the patients were administered supraclavicular brachial plexus block with peripheral nerve stimulator technique and were followed up.

There was no significant demographic variations among the groups and all the patient demographic variables were comparable.

There were no statistically significant haemodynamic variations perioperatively among the groups.

We noted in our study that both tramadol and butorphanol improved block characteristics when compared to control group and was statistically significant. Onset and duration of sensory and motor block was much quicker with tramadol and butorphanol group when compared to the control group.

Among tramadol and butorphanol group, the onset of sensory block was much quicker with tramadol group and was statistically significant. (Group T 7.47 +/- 2.81 min and Group B 8.68 +/- 2.54 min)

The onset of motor block was also quicker in tramadol group compared to butorphanol group. However it was statistically insignificant. (Group T 14.47 +/- 5.71 min And Group B 14.88 +/- 3.30 min)

Duration of sensory and motor block and also duration of analgesia was much longer in butorphanol group when compared to tramadol group and it was statistically significant. (Group T 309.03 +/- 75.26min, 279.91 +/- 80.79min and 356.65 +/- 29min Vs Group B 449.68 +/- 32.23min, 424.65 +/- 20.71min and 486.35 +/- 39.71min respectively)

There were no side effects observed in all the 3 groups in our study.

Therefore to conclude butorphanol is more effective in prolonging the duration of post-operative analgesia compared to control group and tramadol group without any adverse effects.

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