Original Research Article

Prospective single blind control study of additive effects of butorphanol with 0.375% levobupivacaine in supraclavicular brachial plexus block for upper limb surgeries

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Abstract

Background: Brachial plexus block by supraclavicular approach is one the most popular and reliable techniques to provide anesthesia and postoperative analgesia for forearm and hand surgeries. Present study was planned to evaluate onset, duration of analgesia, duration of sensory motor blockade and adverse effect of Butorphanol 1 mg added to 0.375% Levobupivacaine in patient posted for elective upper limb surgeries under supraclavicular brachial plexus block. **Material and Methods:** Present study was single center, prospective, comparative, parallel group, interventional, randomized study, conducted in patients admitted for orthopaedic and surgery ward for upper limb surgery, of either gender, from age group 18-60 years, normal cardio respiratory status, ASA status I/II and willing to participate. Total of 60 patient satisfying inclusion criteria allocated into two group each 30 participants. Group A - Receive inj. 0.375% Levobupivacaine (29 ml) + 1 ml saline dose. and Group B - Receive inj. 0.375% Levobupivacaine 29 ml) + 1 ml (1 mg) Butorphanol dose. **Results:** The mean age of patients from group A was 38.23±11.11 yrs. and group B was 40.13±15.30 yrs. with male patients were more than female patients in both the groups. The difference between two group was not statistically significant hence groups were comparable. Respiratory Rate was less in group A at baseline as well as on all time period and difference was statistically significant. (P value <0.05) Early onset and prolonged duration of sensory as well as motor blockade was noted in group B and difference was statistically significant. (P value <0.05) Rescue analgesia required in both the groups was similar in both groups. **Conclusion:** Butorphanol when added to local anaesthetic solution in supraclavicular brachial plexus block, it provides rapid onset of block, better analgesia, good hemodynamic stability and profound and longer analgesia.

Keywords: Butorphanol, supraclavicular brachial plexus block, levobupivacaine, upper limb surgeries.

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INTRODUCTION

Brachial plexus block by supraclavicular approach is one the most popular and reliable techniques to provide anesthesia and postoperative analgesia for forearm and hand surgeries.[1] Various local anesthetic agents have been used to produce brachial plexus block. Bupivacaine 0.5% is one of the most commonly used local anesthetic agents because of its higher potency and prolonged duration of action. One of the drawbacks of bupivacaine is its cardiotoxicity, especially when injected accidentally into the artery.[2] Levobupivacaine – S enantiomer of bupivacaine is reported to have a safer pharmacological profile with lesser cardiac and neurological adverse effects

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due to its faster protein binding rate.[3,4] Various adjuvants are in use to hasten the onset of the block and prolong the duration of postoperative analgesia such as tramadol, butorphanol, buprenorphine, α2 adrenergic agonists, and dexamethasone.[5] Opioids have synergistic action with local anesthetics, and thus, their addition to bupivacaine prolongs the duration of analgesia and improves the quality of block.[6] Butorphanol is a synthetic opioid like morphine having partial antagonistic activity at μ receptors and Butorphanol is a synthetically derived opioid agonist antagonist analgesic of the phenanthrene series.[1] Butorphanol has been used alone and in combination with a local anaesthetic like mepivacaine. Present study was planned to evaluate onset, duration of analgesia, duration of sensory motor blockade and adverse effect of Butorphanol 1 mg added to 0.375% Levobupivacaine in patient posted for elective upper limb surgeries under supraclavicular brachial plexus block.

MATERIAL AND METHODS

Present study was single center, prospective, comparative, parallel group, interventional, randomized study, conducted in Department of Anesthesiology, Vilasrao Deshmukh Government Medical College, Latur, India. Study duration was of 2 years (September 2019 to August 2021). Study was approved by institutional ethical committee.

Inclusion criteria: Patients admitted for orthopaedic and surgery ward for upper limb surgery, of either gender, from age group 18-60 years, normal cardio respiratory status, ASA status I/II and willing to participate.

Exclusion criteria: Patient with III and IV ASA**,** History of bleeding disorders**,** Allergy to local anesthetics**,** Patient with heart disease**,** Pregnancy

After explaining study to patients in local language and a written informed consent was taken for participation. A detailed preanaesthetic checkup of patient selected for study was conducted a day before surgery and recorded as per proforma and relevant and needed investigation were performed. The interpretation of visual linear analogue scale was explained one day prior to surgery to the selected patient taken for study to determine the analgesia in post-operative period.

Total of 60 patient satisfying inclusion criteria with ASA I or II grade admitted in orthopaedic and surgery ward were randomly allocated into two group each 30 participants.

1. Group A - Receive inj. 0.375% Levobupivacaine (29 ml) + 1 ml saline dose.
2. Group B - Receive inj. 0.375% Levobupivacaine 29 ml) + 1 ml (1 mg) Butorphanol dose.

In operation theater, neural localization was achieved by using nerve locater connected to 22 G 55 mm long stimulating needle. Following negative aspiration 29 ml of 0.375% Levobupivacaine plus 1 ml (1 mg) Butorphanol diluted in 1 ml of normal saline (total 30 ml) All monitors were attached and baseline parameter were noted. Monitoring included oxygen saturation, systolic and diastolic blood pressure, respiratory rate, sensory and motor level of anesthesia, duration of analgesia. Data was collected every 3 min for first 15 min next every 5 min for 15 min and after completion of surgery sensory and motor blockade was assessed every 30min till complete recovery of blockade. Patient blood pressure, pulse rate, heart rate, oxygen saturation was monitored every 5 min. Time of onset of analgesia, time of onset sensory motor blockade, duration of sensory and motor blockade was noted. Data was collected and compiled using Microsoft Excel 2013 and then analyzed using SPSS 23.0 version and Open Epi Software Version 2.3 by calculating frequency, percentage and cross-tabulations between various parameters. The means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. Percentage, odds ratio and 95% confidence interval was estimated, wherever necessary. For comparison between the two means of quantitative data, student's t- test applied. P value less than 0.5 was considered as statistically significant.

RESULTS

The mean age of patients from group A was 38.23±11.11 yrs. and group B was 40.13±15.30 yrs. with male patients were more than female patients in both the groups. The difference between two group was not statistically significant hence groups were comparable. (P value >0.05)

Table 1: Distribution of Patients according to Age

	Group A	Group B	P value
Age group (yrs.)			
15 to 30	09	12	0.58
31 to 45	12	08	
46 to 60	09	10	
Mean±SD	38.23±11.11	40.13±15.30	
Gender			
Male	27	27	1
Female	03	03	

In present study, pulse rate was significantly less at 15 and 60 minutes, difference was statistically significant ($p< 0.05$). At other points comparable pulse rate was noted among both groups.

Table 2: Comparison between the groups according to Pulse Rate

Pulse rate	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Baseline	80.83	6.634	80.00	6.103	0.61
1 Minute	81.03	6.739	83.00	5.675	0.22
2 minutes	81.03	6.739	79.87	6.056	0.48
5 minutes	81.17	6.675	79.73	6.005	0.38
15 minutes	80.77	6.632	74.13	6.146	0.001
60 minutes	81.10	6.840	74.17	6.137	0.001
240 minutes	81.14	6.83	78.33	5.53	0.08
480 minutes	81.10	6.840	79.47	5.355	0.30

In present study, systolic blood pressure was less at various interval in which difference was statistically significant from 2 minutes to 480 minutes. (P value <0.05)

Table 3: Comparison between the groups according to Systolic BP

Systolic BP	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Baseline	118.67	11.366	117.00	10.058	0.55
1 Minute	116.00	9.410	117.00	10.058	0.69
2 minutes	112.73	8.859	116.93	9.976	0.09
5 minutes	111.27	7.922	116.47	9.680	0.02
15 minutes	110.80	7.658	115.93	9.606	0.02
60 minutes	110.80	7.640	116.40	10.483	0.02
240 minutes	111.07	6.762	115.53	9.493	0.04
480 minutes	111.17	7.316	117.00	9.780	0.01

Respiratory Rate was less in group A at baseline as well as on all time period and difference was statistically significant. (P value <0.05)

Table 4: Comparison between the groups according to Respiratory Rate

Respiratory Rate	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Baseline	19.00	2.665	21.13	2.662	0.003
1 Minute	17.40	1.831	21.13	2.662	0.001
2 minutes	16.33	1.061	20.93	2.766	0.001
5 minutes	15.87	0.730	20.00	2.573	0.001
15 minutes	15.93	0.365	18.47	2.209	0.001
60 minutes	15.93	0.365	17.13	1.943	0.001
240 minutes	15.93	0.365	16.73	1.701	0.01
480 minutes	16.13	.507	17.40	2.044	0.002

Early onset and prolonged duration of sensory as well as motor blockade was noted in group B and difference was statistically significant. (P value <0.05) Rescue analgesia required in both the groups was similar in both groups.

Table 5: Comparison between the groups according to Sensory Blockade

Variable	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Sensory Blockade					
Onset	15.13	1.47	7.63	0.61	0.0001
Duration	624.00	30.011	757.67	27.125	0.0001
Motor Blockade					
Onset	19.53	1.008	11.93	1.437	0.0001
Duration	566.00	30.468	707.33	21.162	0.0001
Rescue Analgesia					
Yes	03		3		1

DISCUSSION

Use of adjuvant drugs enhances the analgesic efficacy, while reducing the incidence of adverse reactions related to local anaesthetics. Tramadol and fentanyl were used as adjuvant to local anaesthetics in brachial plexus block.[7,8] It was seen that adrenergic receptor agonists improve the nerve block by local anaesthetics either due to vasoconstriction.[9] or facilitation C fiber blockade.[10] Use of opioids in conjunction with local anaesthetics for supraclavicular brachial plexus block has been associated with decreased pain scores and decreased analgesic requirements in the post-operative period. In group A onset of sensory and motor blockade was more than in group B. The difference was statistically highly significant. It means in group B sensory and motor onset was earlier than in group A. Similarly, in terms of sensory and motor duration in group A duration was less than in group B and difference was highly statistically significant. It suggests that longer duration in group B. Basavaraj Bommalingappa[11] mentioned in his study that there was significant faster onset of both sensory and motor analgesia in butorphanol group in comparison to control group, which was statistically significant ($p<0.001$). The mean time from block placement to first request for analgesia (The duration of analgesia) was 279.16±12.1 mins. In the butorphanol treated group, but 218.64±11.4 mins. in the control group which was significant ($p <0.001$). Results of this study were in concordance with experimental evidence of synergistic interaction between opioids and local anaesthetics. This synergism is due to drug's separate mechanism of action. Blockade of Na+ channels by local anaesthetics and voltage gated Ca++ channels by opioids.[12] B. Bharathi *et al.*,[13] observed that the onset of sensory and motor block was earlier with the higher dose of butorphanol (2 mg). Pokharel *et al.*,[14]. reported that the addition of butorphanol to local anesthetic in epidural route produces earlier onset analgesia and times to reach peak analgesia. They also found that higher dose of butorphanol also hastens the onset of analgesia compared with lower dose. B. Bharathi *et al.*,[13] also mentioned that the duration of sensory block (521.67±71.3 min in Group LB2 vs. 396.23±90.5 min in Group LB1) was significantly increased in LB2 group than in the LB1 group ($P=0.001$). The duration of motor block (418.40±73.8 min in LB2 Group vs. 305.60±66.6 min in LB1 Group) was also significantly prolonged in LB2 Group than in LB1 Group ($P=0.001$). These results were very similar with Kumar *et al.*,[15] who reported that, in subarachnoid route, sensory and motor blocks were significantly prolonged in butorphanol treated group while compared with fentanyl group. B. Bharathi *et al.*,[13] observed that the duration of analgesia was 643.55±131.6 min and 511.73±128.6 min in LB2 and LB1 groups, respectively. The duration of analgesia was significantly ($P=0.001$) prolonged in higher dose butorphanol group. Gargi M. Bhavsar *et al.*,[16] also mentioned that significant difference was seen between the onset of motor and sensory blockade between the two groups. The mean time of onset of motor and sensory blockade was 10.24±1.33 min and 12.76±1.33 min respectively for Group A and 8±1.15 min and 11.36±0.81 min respectively for Group B. The onset of motor block was found to be faster than the onset of sensory block in both groups. This is attributed to somatotrophic arrangement of fibers in a nerve bundle at the level of the trunks in which motor fibers are located more peripherally than sensory fibers. Therefore a local anaesthetic injected perineurally will begin to block motor fibers before it arrives at the centrally located sensory fibers. In I.H.Mir *et al.*,[17] study, no significant difference was seen between the onset of motor and sensory blockade was 25±6 min and 10±5 min respectively for Group A and 23±7 min and 12±3 min respectively for Group B. The onset of sensory block was found to be faster than the onset of motor block in both groups. In Murphy *et al.*,[18] study of novel analgesic adjuvants for brachial plexus block they found no significant difference between onset of motor and sensory block between the groups. Ravi *et al.*,[19] in their study of adding tramadol and Fentanyl to 0.75% Ropivacaine in supraclavicular brachial plexus block found no significant difference between onset of motor and sensory blockade between the groups. The mean time of onset of motor and sensory blockade was 14 min and 5 min. Gargi M. Bhavsar *et al.*,[16] mentioned that the mean duration of motor blockade was 3.59±0.38 hrs. in Group A and 4.68±0.40 hrs. in Group B. The duration of motor block was more in Group B ($P<0.05$). The mean duration of sensory blockade was 3.75±0.24 hrs. in Group A and 5.71±0.36 hrs. in Group B, so it was longer in Group B ($P<0.05$). In I.H. Mir *et al.* study, the mean duration of motor blockade was 125±35 min in control group and 313±81 min in Butorphanol group. The duration of motor block was more in Group B ($P<0.05$). The mean duration of sensory blockade was 101±35 min in control Group and 240±80 min in Group B so it was longer in Group B ($P<0.05$). Ravi Madhusudhana *et al.*,[19] found that addition of opiates to Ropivacaine had an additive effect in terms of postoperative analgesia. The duration of sensory (9 hrs.) and motor block (8 hrs.) was significantly longer with additive groups when compared to control group (sensory 6 hrs., motor 5 hrs.). In this study, we found that butorphanol prolongs the duration of supraclavicular brachial plexus blockade when given along with levobupivacaine, addition of butorphanol 1 mg to levobupivacaine in supraclavicular brachial plexus block increases the duration of blockade and postoperative analgesia without compromising the haemodynamic parameters.

CONCLUSION

Butorphanol when added to local anaesthetic solution in supraclavicular brachial plexus block, it provides rapid onset of block, better analgesia, good hemodynamic stability and profound and longer analgesia. Addition of butorphanol with 0.375% levobupivacaine should be preferred in supraclavicular brachial plexus block for upper limb surgeries.

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