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ORIGINAL RESEARCH

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 either alone or as a part of an anaesthetic sequence is useful as it provides complete relaxation of muscles of upper extremities. Present study was aimed to study additive effects of butorphanol with 0.375% levobupivacaine in supraclavicular brachial plexus block for upper limb surgeries at a tertiary hospital.

Material and Methods: Present study was single-center, prospective, comparative study in patients aged 18–58 years, of both gender, with body mass index (BMI) <25 kg/m2, of American Society of Anesthesiologists (ASA) physical status I to II, scheduled for elective forearm and hand surgeries, Patients fit for surgery, were randomly allocated into two groups using as Group BB (1 mg of butorphanol) & group B (bupivacaine only).

Results: In present study, general characteristics such as age (year), gender (male/female), ASA (I/II), weight (kg), height (cm) & mean duration of surgery (min) were comparable among both groups & difference was not statistically significant. Time taken for procedure (min) & onset of sensory blockade (min) were comparable in both groups and difference was not statistically significant. Butorphanol when added to levobupivacaine in supraclavicular brachial plexus block had early onset of motor block, improves the quality of block, prolonged the duration of sensory and motor blockade as compared to levobupivacaine alone, and difference was statistically significant. Prolonged the duration of analgesia and late requirement of rescue analgesia as compared to levobupivacaine alone, and difference was statistically significant.

Conclusion: Butorphanol added with 0.375% levobupivacaine in supraclavicular brachial plexus block for upper limb surgeries provides rapid onset of block, better analgesia, good hemodynamic stability and profound and longer analgesia.

Keywords: Brachial plexus block, butorphanol, levobupivacaine, post-operative analgesia.

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INTRODUCTION

Brachial Plexus block either alone or as a part of an anaesthetic sequence is useful as it provides complete relaxation of muscles of upper extremities, sympathetic block of blood vessels which lessens postoperative vasospasm, pain and oedema and most importantly it helps patients to enjoy post-operative period free from nausea, vomiting and immediate postoperative pain.[1]

Various agents used are Lignocaine, Mepivacaine, Bupivacaine and Ropivacaine. [2] The analgesia can further be enhanced and prolonged by the addition of various adjuncts to the local anaesthetic drug. Various additives such as opioids, clonidine, and verapamil were added to local anesthetics to achieve quick, dense, and prolonged block, but the results are either inconclusive or associated with side effects.[3,4,5]

With advent of opioid receptors, variety of opioid agents are used for post-operative analgesia via brachial plexus block. Butorphanol, a synthetic opioid is seven times more potent than morphine.[6,7] Butorphanol is a synthetically derived opioid agonist–antagonist analgesic of the phenanthrene series, having partial antagonistic activity at μ receptors and agonistic activity at kappa receptors.[7] Present study was aimed to study additive effects of butorphanol with 0.375% levobupivacaine in supraclavicular brachial plexus block for upper limb surgeries at a tertiary hospital.

MATERIAL AND METHODS

Present study was single-center, prospective, comparative study, conducted in department of anaesthesiology, at XXX medical college & hospital, XXX, India. Study duration was of 1 year (January 2021 to December 2021). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients aged 18–58 years, of both genders, with body mass index (BMI) <25 kg/m2, of American Society of Anesthesiologists (ASA) physical status I to II, scheduled for elective forearm and hand surgeries, willing to participate in present study

Exclusion criteria

- Pre-existing neuromuscular, severe cardiovascular, or pulmonary disease, renal or hepatic disorder,
- Patients with clinically significant coagulopathy,
- Patients with infection at the injection site, allergy to local anaesthetics,
- Patients with refusal to technique, or failure of block

Study was explained to patients in local language & written consent was taken for participation & study. Patients' demographic, clinical, radiological & laboratory details were noted in case record proforma. Preanesthetic check-up and routine investigations such as complete blood count, serum creatinine, and electrocardiogram (ECG) were done. Patients were kept nil by mouth for 6 h. Patients fit for surgery, were randomly allocated into two groups using standard randomization code.

The Group BB of 30 patients receiving 29 ml of 0.375% with 1 mg of butorphanol diluted in 1 ml of normal saline as an adjuvant (total 30 ml).

The Group B of 30 patients receiving 29 ml of 0.375% with 1 ml of normal saline (total 30 ml).

After shifting the patient into operation theatre, intravenous (IV) line access was established using 18‑G cannula. All non-invasive monitors such as non-invasive blood pressure, pulse rate, oxygen saturation (SpO2), and ECG were applied to all patients, and their baseline vital signs were measured. All patients were provided with supplemental oxygen using nasal cannula at 2 L/min. Patients were sedated with IV administration of midazolam 1 mg and

fentanyl 30 μg before the block. Local anesthetic solution was injected in incremental 5 ml boluses with intermittent aspiration.

The parameters assessed were hemodynamic parameters, time of onset of sensory and motor block and duration of sensory and motor block and postoperative pain assessment by VAS score. After taking a preoperative baseline value, vital parameters, like, systolic blood pressure (SBP), diastolic blood pressure (DBP), arterial saturation (SpO2), respiratory rate (RR), and heart rate (HR) were monitored at every 3 min interval till 30 min of LA injection and then every 5 min till 1st h and thereafter every 30 min till the end of surgery. Post-operatively, when VAS was equal to or more than 4, diclofenac sodium aqueous solution 75 mg was given as rescue analgesic.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, 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. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, general characteristics such as age (year), gender (male/female), ASA (I/II), weight (kg), height (cm) & mean duration of surgery (min) were comparable among both groups & difference was not statistically significant.

Table 1: General characteristics

Characteristics	Group - B (n=30)	Group - BB (n=30)	p value
Age (year)	37.18 ± 9.8	36.46 ± 6.19	0.62
Gender (male/female)	21/9	20/10	0.52
ASA (I/II)	22/8	23/7	0.65
Weight (kg)	65.16 ± 8.54	64.73±9.42	0.84
Height (cm)	166.5 ± 7.3	168.2±6.3	0.74
Mean duration of surgery (min)	94.2±21.5	93.5±17.7	0.53

Time taken for procedure (min) & onset of sensory blockade (min) were comparable in both groups and difference was not statistically significant. Butorphanol when added to levobupivacaine in supraclavicular brachial plexus block had early onset of motor block, improves the quality of block, prolonged the duration of sensory and motor blockade as compared to levobupivacaine alone, and difference was statistically significant.

Table 2: Characteristics of block

Characteristics of block	Group - B (n=30)	Group - BB (n=30)	p value
Time taken for procedure (min)	7.13 ± 0.83	8.33 ± 1.02	0.86
onset of sensory blockade (min)	12.62 ± 1.85	9.46 ± 1.53	0.78
Onset of motor block (min)	19.23 ± 2.34	14.42 ± 1.77	0.043
Duration of sensory blockade (hrs.)	3.71 ± 1.94	6.27 ± 1.48	< 0.001
Duration of motor blockade (hrs.)	3.32 ± 1.69	6.47 ± 1.97	< 0.001

Prolonged the duration of analgesia and late requirement of rescue analgesia as compared to levobupivacaine alone, and difference was statistically significant.

Table 3: Post-operative analgesia

Characteristics of block	Group - B (n=30)	Group - BB (n=30)	p value
Duration of analgesia (hrs.)	6.96 ± 2.68	11.16 ± 3.13	< 0.001
Rescue Analgesia required			< 0.001
After 6 hrs.	10	5	
After 8 hrs.	14	11	
After 10 hrs.	6	10	
After 12 hrs.	0	4	

During the study there were no complications such as vessel puncture, nerve injury, hematoma, hemothorax were noted.

DISCUSSION

Brachial plexus blockade is commonly performed regional anesthetic technique for forearm and hand surgeries, and its blockage provides good surgical anesthesia. It is most compactly arranged in supraclavicular region, and hence smaller volume of local anesthetic drug produces reliable and intense block with optimal tourniquet coverage.[8]

It is always the interest of an anesthetist to increase the quality of local anesthetics, by increasing the duration of the block and decrease the incidence of local anesthetic toxicity. So many adjuvants added to local anesthetics to prolong the block duration and reduce the toxicity, like opioids, dexamethasone, and clonidine.[9,10]

In the present study, the blocks were performed via the supraclavicular approach instead of the axillary approach, as the former was associated with faster onset and many other advantages. It should be noted that the brachial plexus is not surrounded by a 'sheath', instead it lies in a tissue plane closely surrounded by the clavicle, scapula, chest wall and humerus.[11]

Sharan R et al.,[12] in a similar study noted that mean duration of sensory block was 4.27 ± 0.51 hrs. in group B (bupivacaine only) and 9.10 ± 0.71 hrs. in group BB (bupivacaine plus butorphanol) 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 ($p < 0.001$). Addition of butorphanol 2mg with bupivacaine prolongs the duration of blockade and postoperative analgesia in supraclavicular brachial plexus blockade without compromising the hemodynamic parameters or producing any significant adverse drug reactions.

Acharya et al.[13] studied the effect of 2 mg butorphanol as an adjuvant to bupivacaine in supraclavicular nerve block to the patients scheduled for elective surgery upper limb and concluded that butorphanol prolongs the duration of brachial plexus block.

Bharathi B et al.,[14] noted that the onset of sensory ($P = 0.032$) and motor block ($P = 0.026$) was earlier in Group LB2 (2 mg of butorphanol) than in Group LB1 (1 mg of butorphanol). The duration of analgesia was significantly prolonged in Group LB2 (643.55 ± 131.6 vs. 511.73 ± 128.6 min; $P = 0.001$). The incidence of sedation was observed in a greater number of patients in Group LB2 ($P = 0.01$). Furthermore, the incidence of nausea, vomiting, and pruritus were observed in a greater number of patients in Group LB2 ($P < 0.05$). Higher dose of butorphanol in brachial plexus block hastens the onset and prolongs the duration of sensorimotor blockade and analgesia but is associated with a higher incidence of sedation which requires intense monitoring.

Peripheral nerve block given with Local anesthetic drugs produce analgesia, but to prolong duration of post-operative analgesia, many agents including variety of opioids have been used by various investigators. As a mixed agonist-antagonist to opioid receptors, the advantage of butorphanol is that it mainly stimulates κ receptors and has an agonistic effect and antagonistic effect on u receptors which cause a variety of adverse reactions is characteristic enables it to provide effective analgesia and less adverse opioid reactions when used as an adjuvant for local anesthetics.[14,15]

The success of brachial plexus block relies on nerve localization, needle placement, and deposition of local anesthetic solution at right place by a single injection of local anesthetic.[16]

The use of ultrasound (US) to guide regional blocks is becoming increasingly popular as it increases success rates, shortens block onset time and reduces the number of needle insertions and complications. Ultrasound imaging allows direct visualization of peripheral nerves, the block needle tip, and local anesthetic distribution.[17]

Present study has some limitations. First, the dose of butorphanol was single, and it was not shown how different doses of butorphanol affect research results. Second, we included low risk patients, posted for elective surgery & sample size was small, large, multicenter trials in future can confirm the conclusion better.

CONCLUSION

Brachial plexus block with its capability to produce a safe and dense surgical anaesthesia with minimal physiological derangement. Butorphanol added with 0.375% levobupivacaine in supraclavicular brachial plexus block for upper limb surgeries provides rapid onset of block, better analgesia, good hemodynamic stability and profound and longer analgesia.

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