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SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING 0.5% BUPIVACAINE WITH AND WITHOUT FENTANYL

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ABSTRACT

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Introduction: Brachial plexus block is good alternative to general anesthesia for upper limb surgery. This avoids the unwanted effect of anesthetic drugs used during general anesthesia and the stress of upper airway instrumentation. **Objective:** To assess the supraclavicular brachial plexus block using 0.5% bupivacaine with and without fentanyl. **Materials and Methods**: This study design was a prospective randomized controlled double-blinded clinical study was carried out at Department of Anaesthesiology, Shaheed M. Monsur Ali Medical College and Hospital, Sirajganj, Bangladesh from January to June 2021. Fifty (50) patients with American Society of Anesthesiologists physical status Classes I and II, aged 18–50 years, scheduled for upper limb surgery were randomly divided into Two study groups each group contains 25 patients: A Group: receive 0.4 ml/kg bupivacaine up to a maximum of 30 ml volume plus 1ml of normal saline. The dose of bupivacaine was 2 mg/kg. B Group: Bupivacaine as control group plus 1 mcg/kg fentanyl. Patients were excluded if they had sepsis at the site of injection, body wt<50kg, pregnant women, known hypersensitivity, circulatory instability, diabetes, coagulopathy, history of neurological, renal & liver diseases, mental disease and malignancy. **Results**: Total 50 patient were included both groups. The groups were comparable with respect to age, height, and weight, and ASA physical status. There was no significant difference in the type and duration of surgery. The

characteristics of sensory block are summarized. Demographic characteristics and duration of surgery were comparable in both the groups and the difference was not statistically significant ($p>0.05$). Duration of sensory and motor blockade was longer in group B and shorter in group A. The differences in duration of sensory and motor blocks were statistically significant in both groups. Pulse rate, blood pressure, oxygen saturation was monitored throughout the surgery and also postoperatively. All values were within the normal range. There was no statistically significant difference between the mean preoperative, intra-operative and postoperative values. The vitals were well maintained in all the patients. The timing of the first rescue analgesia was significantly late and the total consumption of analgesia was significantly less in the first 24 hours in Bupivacaine group. **Conclusion:** Supraclavicular brachial plexus block using local anesthetic, with or without fentanyl revealed that addition of fentanyl to bupivacaine significantly causes early onset of anesthesia and longer duration of analgesia without any side effects. On the basis of the results of the present study, integrated with understanding from the available literature it may be recommended that, this technique will open new perspective for upper limb surgery under regional anesthesia.

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INTRODUCTION

Brachial plexus block is a good alternative to general anesthesia for upper limb surgery. This avoids the unwanted effects of the anesthetic drugs used during general anesthesia and the stress of upper airway instrumentation [1-4]. Various adjuvants, including opioids, midazolam, magnesium sulfate, dexamethasone, dexmedetomidine and clonidine have been added to local anesthetics in an attempt to increase the duration of block and postoperative analgesia [5-6]. Bupivacaine is a local anesthetic of amide group, four times more potent than lignocaine, slower in onset but has a significantly longer duration of action [7, 8]. However local anesthetics provide analgesia for not more than 4 hrs. It has been suggested since long, that peripheral nerve possess opioid receptors and this has tempted clinicians to add narcotics to local anesthetics to prolong the analgesic effects of these solutions [9]. The peripheral administration of opioid provides stronger and longer lasting analgesia with a lower dose of opioid without central side effects such as respiratory depression, nausea, vomiting and pruritus [10]. Addition of fentanyl to local anesthetics reported to influence post-operative analgesia in a study on brachial plexus block [11].

MATERIALS AND METHODS

This study design was a prospective randomized controlled double-blinded clinical study was carried out at Department of Anaesthesiology, Shaheed M. Monsur Ali Medical College and Hospital, Sirajganj, Bangladesh from January to June 2021. Fifty (50) patients with American Society of Anesthesiologists physical status Classes I and II, aged 18–50 years, scheduled for upper limb surgery were randomly divided into Two study groups each group contains 25 patients: A Group: receive 0.4 ml/kg bupivacaine up to a maximum of 30 ml volume plus 1ml of normal saline. The dose of bupivacaine was 2 mg/kg. B Group: Bupivacaine as control group plus 1 mcg/kg fentanyl. Patients were observed for onset and duration of sensory and motor blockade, duration of analgesia, postoperative pain, and adverse effects. Patients were

excluded if they had sepsis at the site of injection, body wt<50kg, pregnant women, known hypersensitivity, circulatory instability, diabetes, coagulopathy, history of neurological, renal & liver diseases, mental disease and malignancy.

Patients were randomly selected by card sampling method into two groups. After selecting the patient entry of the name of the patients in the case record form and initial pulse, NIBP (Noninvasive Blood Pressure) RR (Respiratory Rate) Saturated Pulse Oximetry (SpO_2) were monitored and were recorded as base line value. The patients were randomly divided into two study groups as simple randomization by computer-generated random numbers. Each group contains 25 patients:

- Group A (control group): Bupivacaine + saline.
- Group B (fentanyl group): Bupivacaine + fentanyl.

After block given, Patients pulse, Blood pressure, RR, SpO_2 were recorded and then first 30 mins at 10 mins interval then 15 mins interval up to the end of surgery. The onset of sensory block was assessed in every minute using pin prick method in different areas innervated by radial, ulna, median and musculocutaneous nerve. The onset of motor block was assessed in every minute by modified bromage scale compared to the opposite limb by asking the patient to raise their hand or move their fingers. The time of onset of sensory block (The time elapsed between the injection of local anesthetic drugs and just impaired sensation to pinprick perception i.e. grade 1 compared to the opposite upper limb). The time of onset of motor block (The time elapsed between the injection of local anesthetic drug and just impaired ability to raise the hand i.e. grade1 of modified bromage scale, compared to the opposite limb) was noted. Duration of block (Time between onset of sensory anesthesia and patient complaining of pain visual analog scale>3) and quality of block by Numeric scale was noted. Any incidence of nausea, vomiting, pruritus, respiratory distress, dryness of mouth, local anesthetic toxicity, Pneumothorax, hematoma formation or any others was noted by yes/no. If respiratory distress develops, phrenic nerve block and Pneumothorax were excluded by X-ray chest posterior anterior view. If any side effects detected clinically in per and post-operative period, then it was managed according to the need. The patient who needed sedative drug assessed by Ramsay Score was recorded.

Statistical analysis: Statistical presentation and analysis of the present study were conducted, using SPSS software version 21.0 (IBM Corporation, Armonk, NY, USA) statistics. Quantitative variables were presented as mean and standard deviation and were analyzed by one-way ANOVA test. Significant ANOVA test was further analyzed by post hoc test to determine the significant group. Qualitative variables were presented as numbers and percentages and were analyzed by Chi-square test. $P < 0.05$ was considered significant and <0.01 was considered highly significant.

RESULTS

Table-1: Demographic characteristics in different study groups (N=50)

Demographic characteristics	Group A	Group B	p- value
Age (years)	30.2+9.6	32.35+9.2	0.38
Weight (kg)	73.5+7.6	71.67+6.7	0.55
Sex Male Female	 20 (80.0) 5 (20.0)	 18 (72.0) 07 (28.0)	 0.52
ASA Physical Status			

I II	21 (84.0) 04 (16.0)	21 (84.0) 04 (16.0)	0.86
Duration of Surgery(min)	68.0+28.5	67.8+28.8	0.51

Total 50 patients were included both groups. The groups were comparable with respect to age, height, and weight, and ASA physical status. There was no significant difference in the type and duration of surgery. The characteristics of sensory block are summarized. Demographic characteristics and duration of surgery were comparable in both the groups and the difference was not statistically significant (p>0.05) (Table-1).

Table-2: Showing Onset of Block (N=50)

Onset of blockade (in min)	Group A		Group B		P value
	Mean	SD	Mean	SD	
Sensory	9.08	1.46	7.96	1.56	0.0004
Motor	13.8	2.66	12.94	2.52	0.0572

Duration of sensory and motor blockade was longer in group B and shorter in group A. The differences in duration of sensory and motor blocks were statistically significant in both groups (Table-2).

Table-3: Showing Duration of Blocks (N=50)

Duration of Block (in min)	Group A		Group B		P value
	Mean	SD	Mean	SD	
Sensory	364.52	110.62	1089.0	180.04	0.0001
Motor	314.38	108.94	1030.5	197.93	0.0001

Table-4: Timing and amount of analgesia (N=50)

Variables	Group A		Group B		P value
	Mean	SD	Mean	SD	
Timing of 1st rescue analgesia (in Min)	364.52	110.62	1089	180.04	0.0001
Total amount of Analgesia (in mg)	79.8	14.35	34.2	10.52	0.001

Pulse rate, blood pressure, oxygen saturation was monitored throughout the surgery and also postoperatively. All values were within the normal range. There was no statistically significant difference between the mean preoperative, intra-operative and postoperative values. The vitals were well maintained in all the patients. The timing of the first rescue analgesia was significantly late and the total consumption of analgesia was significantly less in the first 24 hours in Bupivacaine group (Table 3-4).

DISCUSSION

The current study shows that addition of fentanyl to bupivacaine for ultrasound-guided supraclavicular nerve block significantly leads to earlier onset of sensory and motor block as well as increased duration of analgesia than bupivacaine alone. Total 50 patients were included both groups. The

groups were comparable with respect to age, height, and weight, and ASA physical status. There was no significant difference in the type and duration of surgery. The characteristics of sensory block are summarized. Murphy *et al.* and Brummett *et al.* in their studies on administration of bupivacaine as an adjuvant to local anesthetics reported that the mechanism of the analgesic effect of bupivacaine is still not clear and may be multifactorial [12,13]. Brachial plexus block is widely employed regional anesthesia for upper limb surgery. Brachial plexus blocks many advantages over general anesthesia for upper limb surgeries such as sympathetic block, better post-operative analgesia and fewer side effects [9]. Bupivacaine is the most commonly administered drug, but it is cardiotoxic and its delayed onset of action is the limiting factors and duration of action is 2-4 hrs. [10]. Nowadays, different drugs have been used as adjuvants to achieve quicker onset, dense and prolonged block [11]. Adjuvants improve analgesia, reduce systemic side-effects and reduce total dose of local anesthetics required [12]. Moderate to severe pain after orthopedic surgeries can be reduced by regional neural blockade with local anesthetics [11]. Interventions that increase the duration of local anesthetics action could prolong postoperative pain control [13]. We use bupivacaine for the supraclavicular block. The major finding of our study was that the duration of sensory and motor blocks gets significantly prolonged with the addition of fentanyl in bupivacaine. These results show a similar finding as in many previous studies using dexamethasone with bupivacaine for brachial plexus block [14,15,16]. This prolongation of analgesia may be explained by corticosteroid's local action on nociceptive C-fibers and up regulation of the function of potassium channels in excitable cells. However, most of these studies have demonstrated variation in the duration of analgesia [17,18]. This result nearly matched with another randomized double blind control study undertaken by SP Singh and colleagues to compare the effect of plain bupivacaine, bupivacaine and fentanyl-bupivacaine mixture in supraclavicular brachial plexus blocks. The quality of block (assessed by VAS) was significantly improved in the bupivacaine group and fentanyl-bupivacaine group as compared to the control group ($p<0.05$) [19]. Fentanyl to mepivacaine in supraclavicular blocks on block characteristics and postoperative analgesia. There was no statistically significant difference between the two groups in sensory or motor block characteristics [20]. Concerning addition of fentanyl, we found that it prolongs anesthesia and enhances postoperative analgesia by 1h when compared with the control group, and this is consistent with Hickey R *et al.* which found in their study that fentanyl prolongs sensory and motor duration by 3 h [21]. On the other hand, Farooq *et al.* in their study showed that addition of fentanyl was nearly equal effective in extending the duration of bupivacaine in ultrasound-guided brachial plexus block. This may be due to the use of ropivacaine rather than bupivacaine has a longer duration of action, and the effect of adjuvants may not appear [22]. Furthermore, our results show that there is statistically difference between fentanyl group, and bupivacaine group as regards to intraoperative HR with low HR among fentanyl group which can be explained by association of fentanyl with a vagus nerve-mediated. This differs from Manohar and Prakash that shows lower HRs with bupivacaine group than fentanyl, and this difference may be due to larger number of patients in their study with use of smaller doses of fentanyl (50 mg only) [23]. Although many studies reported the prolonged duration of sensory and motor block when bupivacaine was used as an adjuvant with bupivacaine in brachial plexus block, they show variable results regarding the onset of sensory and motor block [24]. In his study, Vieira et al

performed a brachial plexus block in 88 patients scheduled for shoulder arthroscopy using 20 ml of the local anesthetic mixture with dexamethasone adjuvant [25]. This may be accounted for by the decreased pH caused by fentanyl [24]. In this study the intensity of pain was measured on visual analogue scale at different time intervals postoperatively. Technical complications of supraclavicular brachial Plexus block such as hematoma and pneumothorax were not observed in our study. No respiratory depression was observed in any patient of the study. Hypotension was noted in two patients of bupivacaine group and in one patient of control group. Incidence of nausea and vomiting was recorded in fentanyl group in two patients only. Quality of anesthesia was excellent in three groups of the study with no incidence of block failure necessitating induction of general anesthesia. This prospective, randomized comparative study of supraclavicular brachial plexus block with local anesthetic mixtures, with or without fentanyl revealed that addition of fentanyl significantly causes early onset of anesthesia and longer duration of analgesia without any side effects. On the basis of the results of the present study, integrated with understanding from the available literature it may be recommended that, this technique will open new perspective for upper limb surgery under regional anesthesia.

CONCLUSION

Supraclavicular brachial plexus block with local anesthetic mixtures, with or without fentanyl revealed that addition of fentanyl to bupivacaine significantly causes early onset of anesthesia and longer duration of analgesia without any side effects. On the basis of the results of the present study, integrated with understanding from the available literature it may be recommended that, this technique will open new perspective for upper limb surgery under regional anesthesia.

Conflict of Interest: None.

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