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Original Article

Efficacy and Safety of Fentanyl as An Adjuvant with Bupivacaine and Lignocaine in Supraclavicular Brachial Plexus Block

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Abstract

Background: Adding narcotics to local anesthetic is very effective in prolonging the analgesic effects. The aim of this study is to evaluation the efficacy and safety of fentanyl as an adjuvant with bupivacaine-lignocaine in supraclavicular block. **Methods:** This analytical study was carried out in the department of anesthesiology in Chittagong Medical College Hospital in collaboration with the department of orthopedic surgery over a period of 22 months starting from January 2012 to December 2014. A total 130 adult patients of either sex with American Society of Anesthesiology (ASA) health status I-II were selected for upper limb surgery under supraclavicular brachial plexus block was randomly allocated in to two groups of 65 patients in each. Group- C was received Distilled water 2ml and Group-F was received fentanyl 2ml (100 g) in 38ml of bupivacaine and lignocaine with adrenaline (Total volume of 40ml). **Results:** The mean onset of sensory & motor block was 10.49±0.75 min & 9.41±0.76 min in group-C and 7.60±3.711min & 9.23±5.114min in group-F. The duration of analgesia in group-C was 3.81±0.88 hrs and in group-F was 8.62±1.747 hrs. **Conclusion:** There was significantly prolonged duration of analgesia and better onset of sensory and motor block in fentanyl group without any unwanted effects.

Key words

Supraclavicular brachial plexus block; Dexamethasone; Fentanyl; Bupivacaine; Lignocaine; Adjuvant.

INTRODUCTION

Brachial plexus block appears as a very effective alternative of general one. It has the reputation of providing most complete and reliable anesthesia for upper limb surgery as it performed at the trunk level where the plexus is presented most compactly[1].

Currently available local anesthetics can provide analgesia for limited period of time. Lignocaine is an effective local anesthetic of amide group, with a rapid onset of action and lasts for 60-90 minutes. It has a tendency to cause vasodilatation and this is normally counteracted by the addition of a vasoconstrictor. Adrenaline is used with lignocaine to delay absorption and prolong the action. 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[2,3]. However local anesthetics provide analgesia for not more than 4-8 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[4]. 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[5]. Addition of fentanyl to local anesthetics reported to influence post operative analgesia in a study on brachial plexus block[6]. Singh et al. reported that fentanyl-bupivacaine improves analgesia in supraclavicular brachial plexus block[7].

Considering the fact, the current study was planned to compare the anesthetic and analgesic effects of adding fentanyl to bupivacaine-lignocaine in supraclavicular brachial plexus block for upper limb surgery.

MATERIALS AND METHODS

All patients of both sexes, age 18-60 years, ASA class-I & class-II undergoing routine operation schedule for upper limb surgery under supraclavicular brachial plexus block were enrolled in this study. 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, peptic ulcer disease.

Patients were randomly selected by card sampling method into two groups. Sample size was 65 in each group. A box was prepared containing 130 cards (C-card & D-card in equal numbers). Randomization of the sample was done by asking the patient to draw one card blindly from the box. The patients who drew card marked F were allocated into group-F and patients with card marked C were assigned to group-C (Control). 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 Pluse Oximetry (SPO_2) were monitored and were recorded as base line value.

Group-C (Control) received distilled water 2ml and Group-F received fentanyl 2ml (100µg) in 38ml of Bupivacaine and Lignocaine with adrenalin.

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. grade1 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.

Postoperative analgesia was noted by interviewing the patient according to Visual Analog Scale (VAS) and Verbal Rating Scale (VRS) in post operative ward.

The sociodemographic variables studied were age, sex and weight. The preoperative variables were pulse, blood pressure, SpO_2, respiratory rate. The outcome variables were the assessment of sensory and motor block, onset time of sensory and motor block, duration of surgery, duration of anesthesia, adjuvant required, sedation score, G /A required, quality of block, side effects monitored as well as per-operative hemodynamic stability by recording pulse, NIBP, SPO_2 and RR. Postoperative variables on analgesic demand by VAS and VRS to determine analgesic demand. A structured case record form was developed containing all the variables of interest. Proper permission was taken for this study from the ethical committee of Chittagong Medical College.

Collected data was complied, checked and edited. Data processing and analysis was done with the help of computer using statistical software SPSS (Statistical Package for Social Sciences) version -18(Chicago, IL, USA). The test statistics used for analysis of data was Student's t-test (For comparison of data presented in quantitative scale-age, sex, wt) Chi-square test (For comparison of data presented in categorical scale-outcome in both groups). The results were presented in tables and figures. The statistical terms was included in this study are mean, standard deviation, percentage. Statistical significance was set at $p<0.05$ and confidence interval set at 95% level.

RESULTS

Table 1: Onset of sensory and motor block in study patients (n=130)

	Group C (n=65)		Group F (n=65)		p value*
	Mean	±SD	Mean	±SD	
Onset of sensory block (min)	10.49	0.75	7.60	3.711	0.000
Onset of motor block (min)	9.41	0.76	9.23	5.114	0.774

*(Calculated by t- test)

Table 2 : Duration of analgesia between the study groups (n=130)

	Group C (n=65)		Group F (n=65)		p value*
	Mean	±SD	Mean	±SD	
Duration of analgesia (hrs)	3.81	0.88	8.62	1.747	0.000

*(Calculated by t- test)

Table 3 : Side effects observed in the study patients (n=130)

Side effects	Group C (n=65)		Group F (n=65)		Total	
	No.	%	No.	%	No.	%
Hematoma formation	1	1.5	1	1.5	2	6.2
Ptosis	3	4.6	3	4.6	6	
None	61	93.8	61	93.8	122	93.8

p = 1.000 (Calculated by Chi square test)

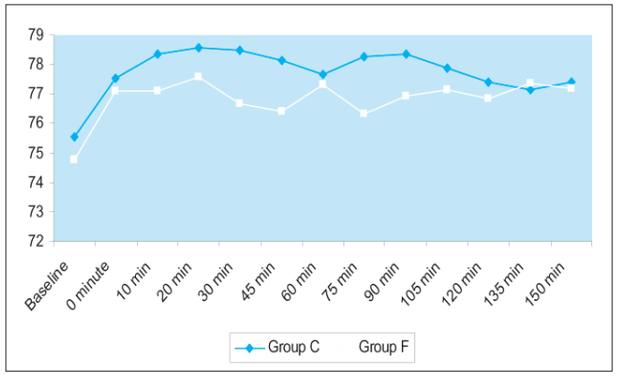

Figure 1: Per operative monitoring of pulse of the study patients (n=130)

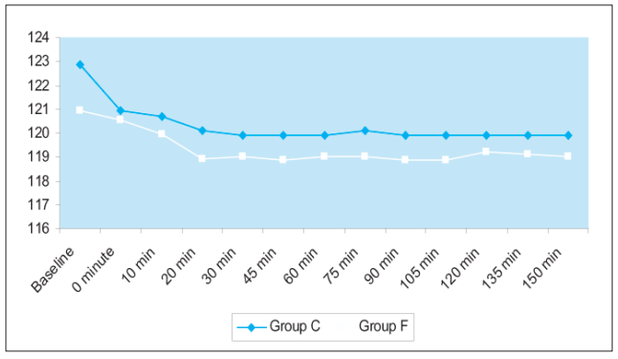

Figure 2 : Per operative monitoring of systolic blood pressure of the study patients (n=130)

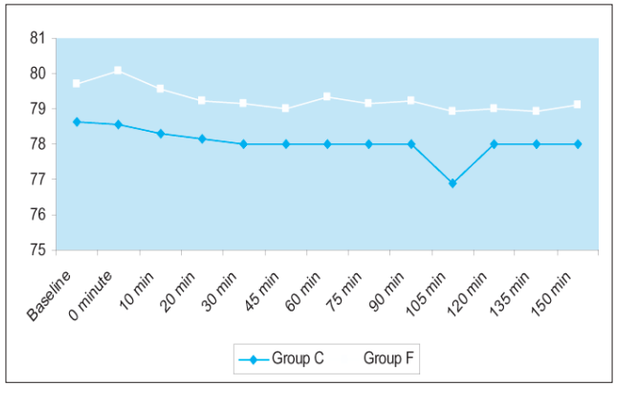

Figure 3 : Per operative monitoring of diastolic blood pressure of the study patients (n=130)

The mean onset of sensory & motor block was 10.49±0.75 & 9.41±0.76min in group-C and 7.60±3.711& 9.23±5.114min in group-F. Onset of sensory in two group was statistically significant (p=0.000) but motor block was not statistically significant (p=0.774) [Table-1].

The duration of analgesia in group-C was 3.41±0.88 hrs and in group-F was 8.62±1.747 hrs. The results was significantly higher in group-F than group-C ($p<0.05$). [Table-2]

The side effects of procedure and the drug of study patients where 3 case of ptosis, 1 case of hematoma in both groups Total 6.2 %(p=1.00). [Table-3].

Preoperative variables pluse, SBP, DBP, SPO_2, resp. rate have no effect on drug group. [Figure 1, 2, 3].

DISCUSSION

The present analytical study was carried out with the objectives to make a comparative evaluation of the efficacy and safety of fentanyl as an adjuvant with bupivacaine-lignocaine in supraclavicular block during upper limb surgery.

Regarding the mean onset of the sensory block in group-F and group-C was 7.60±3.71 min and 10.49±0.75 min (p=0.000). The mean onset of the motor block in group-F and group-C was 9.23±5.114 min and 9.41±0.76 min (p=0.774) respectively. Onset of sensory in two groups was statistically significant but motor block was not statistically significant.

As compared to the study done by Sarkar et al where one group received Lignocaine (2%) with adrenaline (1:2, 00,000) 10ml + bupivacaine (0.5%) 20 ml + distilled water 10ml and other group received same amount of local anesthetic + 1ml(50 µg) fentanyl, to make total volume of 40ml, in Supraclavicular block using nerve stimulator technique[8]. Onset time of the sensory and motor block was delayed in fentanyl group 4.4±1.41 min and 3.04±1.31 min respectively than local anesthetic group (2.88 min). This does not correlate with the present study done by paraesthesia technique. In a study, Ahmed et al, used 100 g fentanyl in 40ml of 0.25% of bupivacaine in the supraclavicular approach in paraesthesia technique and achieved the onset of the sensory and motor block at 8.9±2.9 min and 8.8±2.7 min, respectively[9]. The results nearly matched with the present study. Almost similar result was depicted in a comparative study carried out by Chavan and colleagues, by addition of Fentanyl to local anesthetics (Bupivacaine 0.5% and Lignocaine 2%) undergoing surgery of forearm and hand with Supraclavicular approach and revealed that the gripping forces significantly decreased 10 minutes after the injections[6]. The onset of sensory block was faster than motor block in both groups in this study which was similar in most of the study done in brachial plexus block. But the study done by Jarbo et al and Shrestha et al, have shown in their study, the onset time of motor block was significantly faster than the onset of the sensory block, which does not correlate with those found in present study[10.11]. This can be explained by the "core and mantle concept" of Winnie[12]. As described by Winnie, the outer motor fibers are blocked earlier

than the sensory fibers which are situated deeper in the brachial plexus at the level of trunk and division. But the earlier time to achieve the sensory block than motor in present study, as compared to theirs, can be attributed to the mixture of local anesthetics which were used.

The duration of analgesia in present study was demonstrated in group-C was 3.41±0.88 hrs and in group-F was 8.62±1.747hrs.The results was significantly higher in group-F than group-C ($p<0.05$).

Regarding the duration of analgesia with fentanyl in brachia plexus block in a study by SP Singh and colleagues, they found the duration was maximum with the addition of fentanyl to local anesthetic (7.28±0.55 hrs). Similar result was depicted in a comparative study carried out by Chavan and colleagues to evaluate the analgesic efficacy and side effects of addition of fentanyl to local anaesthetics[6]. The study revealed that mean duration of analgesia was extended (695±85 min) if fentanyl is added to local anesthetics without increasing the side effects, however onset time of analgesia was prolonged. Both the results nearly matched with the present study. Similarly, there were number of study regarding duration of analgesia, such as in Ahmed et al was 10±1.5 hrs and Sharker et al was 11 hrs, Denz et al was 10.1 hrs[9,8,13]. These results were also nearly matched with this present study.

Regarding the side effects the present study was showing side effects of ptosis was found 3 case and Hematoma in 1 case in both group. All above side effects were related to procedure rather than drug. Others side effects like nausea, vomiting, pruritus, respiratory distress, dryness of mouth, LA toxicity (CNS, CVS, Hypersensitivity) Pneumothorax was not found in both groups. Though the Pneumothorax is possible complication when attempting supraclavicular block. But the incidence of Pneumothorax is likely reduced by operator experience and using shorter needles with caution[14,15]. The side-effects reported after opioids administration in a study done by Bazin et al, was pruritus (1) nausea (2) vomiting (3)[16]. However, such side-effects were relatively rare and their incidence was similar to that reported previously[17]. The serious potential risk of opioid administrations respiratory depression, although it seems a small risk in young patients given the doses of opioids currents used. Moreover, all the side-effects observed in Bazin et al study took place during the first 6h following the injection. This suggests that blood level became very low after this time.

In the present study the baseline characteristics were within normal value, which support the Jarbo et al study[10]. In this study it was observed that per-operative mean pulse rate, systolic blood pressure, diastolic blood pressure, $SP0_2$ and respiratory rate changes at different times were almost similar between two groups, no significant ($p>0.05$) mean difference was found. In another study Dogru et al. showed stable hemodynamic parameters in their study groups, which support the present study findings[15].

LIMITATION AND RECOMMENDATIONS

It was a single center study. Relative perception of pain by the patients may have caused biasness regarding postoperative pain assessment by VAS and VRS and that could have affected the findings of the present study. Availability of an ultrasound and/or peripheral nerve stimulator would have helped to achieve more accurate nerve blocks.Large scale multicenter double blind study with nationally representative sample and nerve stimulator or ultrasound guided techniques, find more accurate result to have a conclusion.

CONCLUSION

In this study, main analysis was done on duration of analgesia by use Fentanyl as an adjuvant with Bupivacaine and Lignocaine in Supraclavicular brachial plexus block. In our study Fentanyl group was more prolonged duration of analgesia than Control group. Onset of sensory and motor block and hemodynamic stability was almost similar in both groups.

So, on the basis of student's t-test and Chi-square test, we can conclude that there was significantly prolonged duration of analgesia and better onset of sensory and motor block in Fentanyl group without any unwanted effects.

DISCLOSURE

All the authors declared no competing interest.

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