



Anaesthesiology

EVALUATION OF THE EFFICACY OF FENTANYL AS AN ADJUVANT TO THE MIXTURE OF 0.5% BUPIVACAINE AND 2% LIGNOCAINE IN BRACHIAL PLEXUS BLOCK BY SUPRACLAVICULAR APPROACH
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ABSTRACT

Regional blocks are advantageous over general anaesthesia as they avoid morbidity and complications associated with general anaesthesia. In addition, they offer postoperative analgesia and cost-effectiveness. Hence, they are usual choice of anaesthesia for upper limb surgeries.

Supraclavicular approach of brachial plexus block is one of the regional block techniques that is safer and popular among various brachial plexus block techniques. Supraclavicular approach brachial plexus block is effective in terms of cost and performance, margin of safety, along with good postoperative analgesia. Lignocaine and bupivacaine are the most commonly used local anaesthetics of which lignocaine has faster onset and shorter duration of action whereas bupivacaine has slower onset and longer duration of action. Adding these two drugs make a mixture, which has shorter time of onset and longer duration of action. Adjuvants like fentanyl, dexamethasone, neostigmine and clonidine are usually added to local anaesthetics to improve the quality and duration of anaesthesia. (2)

Fentanyl is a potent synthetic opioid compound with rapid onset and shorter duration of action with strong agonistic activity at Mu-receptors with high therapeutic index which makes it very safe surgical analgesic.

Most of the studies proved the benefit of addition of fentanyl to the local anaesthetics in regional blocks in prolonging the sensory and motor blockade and decreasing the need for rescue analgesia following the surgery. (3,4,5) But some studies show no additional benefit. (6)

Hence this study has been taken up to evaluate the usefulness of addition of fentanyl to the local anaesthetic mixture considering the onset and duration of sensory and motor blockade along with the need for rescue analgesics postoperatively.

A randomized single blinded study was taken up in two groups of thirty patients each. The mean age of patients was 38.65 years and 40.23 years in group C (lignocaine and bupivacaine) and group F (lignocaine, bupivacaine and Fentanyl) respectively. The two groups were comparable with respect to age.

The mean times of onset of sensory and motor blockade in Group C (Lignocaine and Bupivacaine) was 8.8 ± 0.81 minutes and 13.2 ± 1.42 minutes and in Group F (Lignocaine, Bupivacaine and Fentanyl) 6.8 ± 1.01 minutes and 11.2 ± 1.51 minutes which are statistically significant.

The mean durations of sensory and motor blockade in Group C (Lignocaine and Bupivacaine) was 597.92 ± 41.71 minutes and 483.1 ± 34.64 minutes and in Group F (Lignocaine, Bupivacaine and Fentanyl) 823.54 ± 59.52 min and 627.8 ± 52.12 minutes which are statistically significant.

The mean number of rescue analgesics were significantly lesser in Fentanyl group compared to the control group in this study. Fentanyl group required lesser number of analgesics compared to Control group and control group required more frequent (3 to 4) rescue analgesics compared to Fentanyl group.

There were no significant changes in hemodynamic response between Group C (Lignocaine, Bupivacaine) and Group F (Lignocaine, Bupivacaine and Fentanyl) groups. There was no significant difference between the oxygen saturation between group C and Group F.

KEYWORDS : Regional blocks, supraclavicular brachial plexus block, Fentanyl, adjuvant.

INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.^{1,2} Various modalities to reduce pain are tried by the researchers for ages, using various oral preparations, parenteral preparations. With recent understanding of the human neuro-anatomy, various receptors on the peripheral nerves and the newer drugs like amide local anaesthetics, opioids like Fentanyl anaesthesiologists are able to reduce the pain of the patients undergoing surgery to the greatest level than before.

Regional nerve blocks are advantageous over general anaesthesia as they avoid morbidity and complications associated with general anaesthesia.³ In addition, they reduce the hospital stay, offer postoperative analgesia and are cost-effective too. This type of anaesthesia mainly helps in to achieve near-ideal operating conditions by producing muscular relaxation, maintaining stable intra-operative hemodynamic condition and sympathetic block which reduces postoperative pain, vasospasm and edema.^{3,4} Supraclavicular approach of brachial plexus block is one of the regional block techniques that is safer and popular among various brachial plexus block techniques

Local anaesthetics and adjuvants

Lignocaine and bupivacaine are the most commonly used local

anaesthetics of which lignocaine has faster onset and shorter duration of action whereas bupivacaine has slower onset and longer duration of action. Adding these two drugs make a mixture, which has shorter time of onset and longer duration of action.

Adjuvants like fentanyl, dexamethasone, neostigmine and clonidine are usually added to local anaesthetics to improve the quality and duration of anaesthesia.² Hence, addition of adjuvant Fentanyl is likely to improve the quality and duration of anaesthesia and post-operative analgesia.³

Fentanyl

Fentanyl is a potent synthetic opioid compound with rapid onset and shorter duration of action with strong agonistic activity at Mu-receptors. It is 50 to 100 times more potent than Morphine. It has high therapeutic index which makes it very safe surgical analgesic.

Possible side effects are Nausea, vomiting, constipation, drowsiness, dizziness, respiratory depression, tremor, seizures and rigidity. Most of the studies proved the benefit of addition of fentanyl to the local anaesthetics in regional blocks in prolonging the sensory and motor blockade and decreasing the need for rescue analgesia following the surgery.^(3,4,5) But some studies show no additional benefit.⁽⁶⁾

MATERIALS AND METHODS:

- Study period – 18 months- Dec 2016 to June 2018

- Study design – Prospective randomized Comparative study
- Study Area: Hospital attached to PES institute of Medical sciences and Research Kuppam, Chittoor district, Andhra Pradesh.
- Sample size – A total of 60 patients were randomly allocated into group F and group C. Hence 30 cases were included in each of the groups.
- Ethical Committee clearance was taken by the institute.

STATISTICAL ANALYSIS:

Data was analysed by entering into MS Excel 2007 version and further analysed using SPSS 20. For descriptive analysis, the categorical variables were analyzed by using percentages and the continuous variables were analysed by calculating mean ± Standard Deviation. For inferential analysis, the numerical data was analyzed using 't' test and the categorical data was analyzed using Chi square test. "p"<0.05 will be considered as statistically significant

INCLUSION CRITERIA:

1. patients of either sex aged between 18 to 60 years.
2. patients with ASA grade I and II.
3. BMI 18.5 to 30

EXCLUSION CRITERIA:

1. Patients belonging to ASA III and IV
2. Known case of hypersensitivity reaction to fentanyl, Lignocaine or bupivacaine or any other local anaesthetics
3. Local infection at the Site of supraclavicular block
4. Patients who are not willing to take part in the study
5. Underweight and obese (BMI<18.5 and >30)

After thorough preanesthetic evaluation and detailed laboratory workup the subjects who satisfy the above inclusion and exclusion criteria were alternatively allocated into two groups of 30 each.

Group ©- Control group will receive 20milli liters bupivacaine 0.5% + 10ml of lignocaine 2%+1ml Normal Saline. GROUP (F) - study group will receive 20ml bupivacaine 0.5% + 10ml of lignocaine 2%+1ml Fentanyl (50micro grams) through supraclavicular approach in brachial plexuses block

RESULTS:

A total of 60 cases posted for upper limb surgery were included in our study (30 in Group ©- Control group and 30 in GROUP (F) - study group)

Parameters evaluated

1. Times of onset of sensory and motor blockade
2. Durations of sensory and motor blockade
3. Need for 24-hour rescue analgesics

In this study, we noticed that the mean times of onset of sensory and motor blockade in Group C (Lignocaine and Bupivacaine) was 8.8 ± 0.81 minutes and 13.2± 1.42 minutes and in Group F (Lignocaine, Bupivacaine and Fentanyl) 6.8 ± 1.01 minutes and 11.2 ± 1.51 minutes which are statistically significant as shown in the figure.1

Onset time of sensory blockade and motor blockade was earlier in Group F when compared with GROUP Group C. The p value was < 0.001 which is statistically very highly significant.

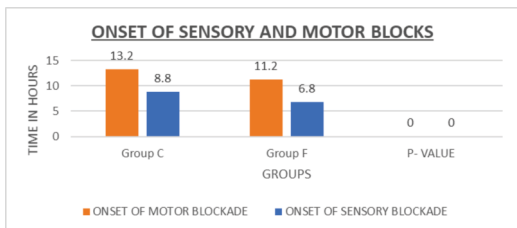


Figure 1: Comparison Of Control (c) Group And Fentanyl (f) Group On The Basis Of Onset Time Of Sensory And Motor Blockade.

It has also been noticed that the mean durations of sensory and motor blockade in group C (lignocaine and bupivacaine) was 597.92± 41.71 minutes and 483.1± 34.64 minutes and in group F (lignocaine, bupivacaine and fentanyl) 823.54±59.52 min and 627.8 ± 52.12 minutes which are statistically significant as shown in the figure.2

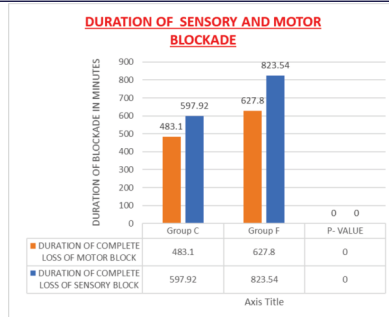
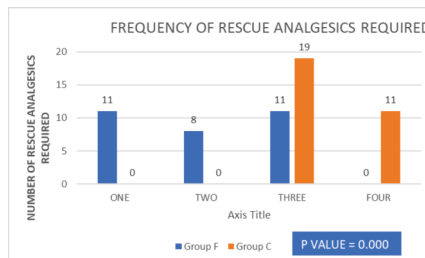


Figure 2. Comparison of control (c) group and fentanyl (f) group on the basis of duration of sensory and motor blockade.



The Mean Number Of Rescue Analgesics Were Significantly Lesser In Fentanyl Group Compared To The Control Group In This Study. Fentanyl Group Required Lesser Number Of Analgesics Compared To Control Group And Control Group Required More Frequent (3 To 4) Rescue Analgesics Compared To Fentanyl Group As Shown In The Figure3 And Table I figure 3. Comparison Of Control (c) Group And Fentanyl (f) Group On The Basis Of Number Of Rescue Analgesics Required

Table 1. Number Of Rescue Analgesics Required

NUMBER OF RESCUE ANALGESICS REQUIRED	Group F	Group C
ONE	11	0
TWO	8	0
THREE	11	19
FOUR	0	11

DISCUSSION:

Brachial plexus block has become a popular technique among the anaesthetists for upper limb surgeries. This type of anaesthesia avoids the untoward effects of general anaesthesia like complications related to upper airway instrumentation. The research has also shown that this approach is attractive approach and effective in terms of cost, performance, margin of safety and also provides good post-operative analgesia.²

Many approaches of brachial plexus block are also described and the available literature has consistently shown that supra clavicular block is better and easiest method for anaesthesia and post-operative pain management.³ supra clavicular approach is better and easiest method for anaesthesia and post-operative pain management.

Several drugs have been tried as anaesthetics in brachial plexus block and Bupivacaine was consistently used for its longer duration of action. However, the bupivacaine is condemned for its delayed onset, patchy or incomplete analgesia. Lignocaine and bupivacaine are the most commonly used local anaesthetics of which lignocaine has faster onset and shorter duration of action whereas Bupivacaine has long duration of action because of which, it has been the most commonly used local anaesthetic mixture in peripheral nerve blocks.

Adding these two drugs make a mixture, which has shorter time of onset and longer duration of action. Adjuvants like fentanyl, dexamethasone, neostigmine and clonidine are usually added to local anaesthetics to improve the quality and duration of anaesthesia.⁸

The mean time of onset of both sensory block and motor block were shorter in group F (6.8 ± 1.01 and 11.2 ± 1.51 respectively) compared to group C (8.8 ± 0.81 min and 13.2± 1.42 min respectively) in this study. This difference is statistically significant between the two groups. A similar study published in February 2018, by Pradeep Sahi,

Roopesh Kumar et al and they have reported that, compared to the use of ropivacaine 0.5%, 30 ml alone for brachial plexus block, the addition of fentanyl to ropivacaine enhanced the onset of both sensory and motor blockade and also increased duration of anaesthesia with prolongation of post-operative analgesia Which is in compliance with the present study.

In another study by Tejwant Rajkhowa et al⁸, the mean onset of sensory blockade was 7.52±1.49 minutes and motor blockade were 12.45±1 minute in control group whereas it is 8.15±1.22 minutes and 13.2±1.64 minutes in fentanyl group respectively. This finding is contradictory to the present study because the onset of sensory and motor blockade is delayed with the addition of the fentanyl in his study. But the durations of sensory and motor block are significantly greater in fentanyl group than the control group (p=0.0001,0.0001 respectively) which is in compliance with the present study.

In another study by Dr. Swetha Muniapalle and Dr. Bhavani Gonapa which compared ropivacaine with ropivacaine fentanyl mixture, showed that the onset of sensory block is earlier in fentanyl group compared to the control group which is in compliance with this study. the mean duration of analgesia was 9.43 + 2.64 hours in control group and 9.4 + 1.7 hours in fentanyl group. It shows that the blockade was shorter in fentanyl group in her study which is contradictory to the present study.

the mean durations of sensory and motor blockade in Group C (Lignocaine and Bupivacaine) was 597.92± 41.71 minutes and 483.1± 34.64 minutes and in Group F (Lignocaine, Bupivacaine and Fentanyl) 823.54±59.52 min and 627.8 ± 52.12 minutes which are statistically significant.

According to the study done by S P Singh and Vanitha Singh⁵⁶, Fentanyl added to supraclavicular block showed a significant fall in VAS (visual analogue scale (VAS)for the fentanyl group at one hour after surgery.

In a study by Tejwant et al, most patients in group R attained a VAS score of 4 at 4.5 hours and most patients in group RF attained a VAS score of 4 at 8 hours post block administration. lower VAS scores were recorded in group RF compared to group R. which is supporting the current study.

Bazin et al.⁴ (1997) reported sustained analgesic effect from opioids used in supraclavicular brachial plexus block which outlasted the local Anaesthetic action of bupivacaine. Patients reported prolonged satisfactory analgesia with buprenorphine, morphine and sufentanil compared with saline.

All these studies suggest the presence of peripheral opioid receptors and there are various studies supporting their action.

The mean numbers of rescue analgesics were significantly lesser in Fentanyl group compared to the control group in this study. Fentanyl group required lesser number of analgesics compared to Control group and control group required **more frequent** (3 to 4) rescue analgesics compared to Fentanyl group.

Mean number of rescue analgesics required by the group (F) was only 2 whereas it is 3.4 in group (C). which is statistically significant (p=0). This indicates that addition of fentanyl is helpful in reducing the post-operative pain significantly.

This indicates that the addition of fentanyl significantly reduces the requirement of post-operative analgesics which is cost-effective and is helpful in renal or hepatic failure patients where there is need for reduction of Non-Steroidal Anti-Inflammatory Drug dosage.

Limitations:

This study can't be generalised because of small sample size Needs bigger sample size, double blinding to avoid bias.

CONCLUSION:

Supraclavicular approach of brachial plexus block has been popular technique in delivery of anaesthesia in patients undergoing upper limb surgeries. This technique helps in safe delivery anaesthesia and also assures prolonged analgesia by preventing the side effects of general anaesthesia. opioids are commonly used now a day along with the local anaesthetics due to their haemodynamic stability. Fentanyl being a

potent opioid, has becoming popular for the regional blocks as an adjunct to the local anaesthetics.

This study has tried to compare the Lignocaine and Bupivacaine mixture with Lignocaine, Bupivacaine and Fentanyl mixture. The study is methodologically elegant since it is randomized controlled study. However, one cannot rule out bias since it is single blind study. Hence the results cannot be generalized. But this study has shown the beneficial effect of addition of Fentanyl to local anaesthetics in terms of onset, duration of anaesthesia and haemodynamic stability. A further research with large sample size is needed to study the beneficial or adverse effects of addition of opioids along with local anaesthetics for producing the blockade and to generalise the results to larger population.

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