

## EFFECT OF FENTANYL AS AN ADJUVANT TO LOCAL ANAESTHETICS IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK ON DURATION OF POST-OPERATIVE ANALGESIA: A PROSPECTIVE RANDOMISED CLINICAL STUDY.



### Medical Science

**KEYWORDS :** Supraclavicular block, Adjuvants, Fentanyl, Duration of analgesia.

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### ABSTRACT

**OBJECTIVE:** Regional blocks as always remain a well-accepted component of comprehensive anesthetic care. Any knowledge acquired in this field should be extended into the postoperative period, which is the period of severe, intolerable pain requiring attention. The addition of opioids in brachial plexus block is reported to improve success rate and postoperative analgesia, by some authors, whereas others have found no effect. This prospective clinical study was undertaken to compare the onset, the quality and duration of analgesia with 2% lignocaine with adrenaline- bupivacaine mixture and 2% lignocaine with adrenaline- bupivacaine-fentanyl in supraclavicular brachial plexus block.

**MATERIAL & METHODS:** Patients were randomly divided into two groups: group I (control) and group II (study). All the patients were subjected to brachial plexus block with supraclavicular approach with all aseptic precautions with a 24-gauge needle, immediately lateral to subclavian artery. After obtaining paraesthesia, drugs were administered as follows: Group I (control): bupivacaine 0.5% 20 mL + lignocaine with adrenaline 2% 20 mL + NS 1 mL Group II (study): bupivacaine 0.5% 20 mL + lignocaine with adrenaline 2% 20 mL + fentanyl 1 mL (50 microgram). Onset of analgesia time, duration of sensory blockade, duration of postoperative analgesia & any side effects were noted. Rescue analgesia was given when VAS > 4/10 and it was given in the form of Inj.Diclofenac Sodium 1.5 mg/kg intramuscularly.

**RESULTS:** The addition of fentanyl to brachial plexus block prolonged the onset of analgesia. The durations of sensory blockade and analgesia were significantly longer in fentanyl Group. There was no statistically significant difference in the incidence of side effects between the two groups.

**CONCLUSION:** Fentanyl as an adjuvant to local anaesthetic solution in supraclavicular brachial plexus block can increase the success rate and significantly prolong the duration of analgesia, but it delays the onset time of sensory blockade as compared with that achieved by the same doses of local anesthetics used in combination.

### INTRODUCTION

Regional blocks as always remain a well-accepted component of comprehensive anesthetic care. Skillful application of these blocks broadens the anesthesiologist's range of options in providing optimal anesthetic care. Any knowledge acquired in this field should be extended into the postoperative period, which is the period of severe, intolerable pain requiring attention. So there is need of extended analgesia without any side effects in the process of achieving this goal.

The effects of opioids on regional blockade are controversial. The addition of opioids in brachial plexus block is reported to improve success rate and postoperative analgesia, by some authors, 1, 2 whereas others have found no effect 3, 4. Brachial plexus block is extensively used for upper extremity surgeries. This prospective clinical study was undertaken to compare the onset, the quality and duration of analgesia with 2% lignocaine with adrenaline-bupivacaine mixture and 2% lignocaine with adrenaline-bupivacaine-fentanyl in supraclavicular brachial plexus block.

### MATERIALS AND METHODS

After obtaining Ethical committee approval, an informed written consent was taken from all the patients undergoing study. 100 healthy adults of either sex aged 20 to 60 years, belonging to ASA physical status I or II undergoing below midarm surgery, were included in this study. The exclusion criteria were history of hypersensitivity reaction to any of the study medication, patients having opposite side pneumothorax or collapsed lung, patients having bilateral upper limb surgery, clotting disorder and patients on opioid or chronic analgesic therapy.

Patients were randomly divided into two groups: group I (control) and group II (study). All the patients were subjected to bra-

chial plexus block with supraclavicular approach with all aseptic precautions with a 24-gauge needle, immediately lateral to subclavian artery. After obtaining paraesthesia, drugs were administered as follows: Group I (control): bupivacaine 0.5% 20 mL + lignocaine with adrenaline 2% 20 mL + NS 1 mL Group II (study): bupivacaine 0.5% 20 mL + lignocaine with adrenaline 2% 20 mL + fentanyl 1 mL (50 microgram).

### Sensory block was assessed by pin-prick method.5

Grade 0 – Sharp pain felt

Grade 1 – Analgesia: dull sensation felt

Grade 2 – Anaesthesia: no sensation felt

Time to sensory onset was considered when there was dull sensation to pinprick and same was assessed for after completion of the block.

### Motor block was assessed as under:5

Grade 0 – Normal grip strength

Grade 1 – Paresis: reduced grip strength and heaviness felt on raising arm above head

Grade 2 – Paralysis: No grip strength and inability to raise arm above head.

Onset of motor block was considered when there was Grade 1 blockade. Time to peak motor effect was considered when there was Grade 2 blockade.

### Success rate of block was assessed at 30 minutes after drug

**injection and was graded as:**

**Complete:** When all segments supplied by median, radial, ulnar and musculocutaneous nerves had analgesia or anaesthesia.

**Incomplete:** When any of the segments supplied by median, radial, ulnar and musculocutaneous nerves did not have analgesia or anaesthesia.

**Failed: When more than one nerve remained unaffected.**

General anaesthesia was administered to patients in case of incomplete or failed blocks and these patients were excluded from the study. Patients were monitored for hemodynamic variables such as pulse, blood pressure, respiratory rate and SpO2.

Postoperatively patients were examined at regular intervals to note the duration of analgesia. It is time from administration of block to 1st request of analgesics. Rescue analgesia was given when VAS > 4/10 and it was given in the form of Inj.Diclofenac Sodium 1.5 mg/kg intramuscularly. The number of rescue analgesia doses was noted.

All the patients were observed for any side effects and complication like Nausea, Vomiting, Bradycardia, Hypotension, Pruritus, Respiratory depression, Urinary retention, Local anesthetic toxicity, Hypersensitivity, Inadvertent arterial puncture, Hematoma, post block neuropathy in intra & Post-operative period.

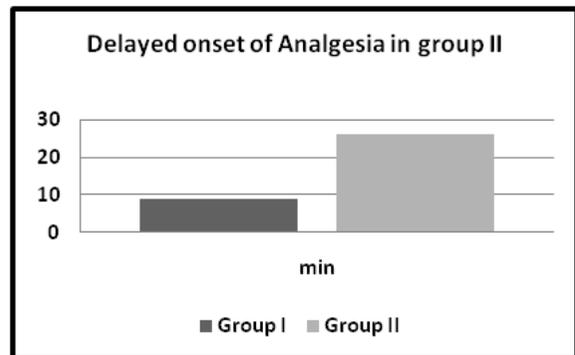
**RESULTS**

There were no significant differences in patient characteristics or in the duration of surgery among groups (Table 1). A total of 100 patients were included. Hemodynamic parameters (HR & MAP), all the groups were similar.

**Table 1: Patient Characteristics**

	Group I	Group II	P Value
Age in years (Mean ± SD)	38.12 ± 15.05	34.88 ± 11.07	>0.05
Sex (M:F)	22:28	23:27	
Weight (kgs.)	57 ± 4.84	56.36 ± 4.47	>0.05
Duration of Surgery	84 ± 29	81 ± 27	>0.05

The addition of fentanyl to brachial plexus block prolonged the onset of analgesia (P=0.01) as shown in Figure 1



**Fig 1: onset of analgesia**

The durations of sensory blockade and analgesia in group II (study) were significantly longer (618 ± 91 and 690 ± 80 minutes,

respectively) than those in group I (445 ± 74 and 470 ± 73 minutes, respectively). The gripping forces significantly decreased 10 minutes after the injections, and there were no significant differences among the two groups.

**Table 2: Mean duration of anaesthesia**

	Group I	Group II
Duration of sensory blockade (min)	445 ± 74	618 ± 91
Total duration of analgesia (min)	470 ± 73	690 ± 80

In a different set of experiments, the pH of local anesthetic solutions was measured. At room temperature, the pH was 6.2 ± 0.1. It was decreased to 5.2 ± 0.1 by adding 100 µg fentanyl.

There was no statistically significant difference in the time required for onset of complete motor block (P > 0.05).

The incidence of various side effects in both the groups is shown in table 3. There was no statistically significant difference in the incidence of side effects between the two groups. Our study has shown that the mean duration of analgesia is extended if fentanyl is used as an adjuvant to the local anesthetics, without increasing the side effects.

No complications of the supraclavicular block were noted.

**Table 3: Incidence of intraoperative side effects**

SIDE EFFECTS	NUMBER OF PATIENTS		P value
	Group I	Group II	
Nausea	2	2	> 0.05
Vomiting	1	0	> 0.05
Dryness of mouth	2	2	> 0.05
Itching	0	0	
Respiratory depression (RR < 10 breaths/min)	0	0	
Hypotension (SBP fall > 30 mm Hg)	0	0	
Bradycardia (HR < 60 beats/min)	2	1	> 0.05

SBP- Systolic blood pressure, HR- Heart rate

**DISCUSSION**

Peripheral nerve blocks provide excellent operating conditions with good muscle relaxation. However, two major drawbacks encountered are latency of block and duration of post-operative analgesia. Our study demonstrated that the addition of fentanyl to local anaesthetic mixture in brachial plexus block increased the success rate of sensory blockade and prolonged the duration of blockade. Although, the onset time of analgesia was prolonged by adding fentanyl to brachial plexus block, we observed that there is remarkable increase in postoperative analgesia.

Opiates have an antinociceptive effect at the central and/or spinal cord level. In animals, the presence of peripheral opioid receptors has been reported; 8, 9 however, it is still unclear whether functional opioid receptors exist in human peripheral tissue.

In our study, the onset time of the sensory block was delayed in the fentanyl group. As compared to the study done by Ni-

shikawa K *et al* 10, who used 100µgm of fentanyl in 40 ml of 1.5% lignocaine with 1:2,00,000 epinephrine in the brachial plexus block by the axillary approach, we found a similar delay in the time which was required for the complete sensory block. They concluded that the decrease in pH of lignocaine from 6.2 to 5.2 by the addition of 100µgm of fentanyl may have reduced the rate of nerve penetration of lignocaine, thus resulting in a slower onset of analgesia.

Nishikawa *et al* demonstrated the addition of fentanyl to lignocaine in axillary block prolonged the onset of block. They postulated that the acidic nature of Fentanyl caused a decrease in the pH of local anesthetic solution which increased the latency of the block.<sup>10</sup>

Shirish G *et al* concluded that the mean duration of analgesia is extended if fentanyl is added to local anesthetics, without increasing the side effects.<sup>6</sup>

Fentanyl has also been studied in peripheral nerve blocks such as brachial plexus block by Kohki Nishikawa *et al* 10, and S.P. Singh *et al* 11, femoral block by Md. Ashraf AbdElmawgoud *et al* 12 and in peribulbar block by Mostafa El Hamid El Enin *et al* 13. Also Mark Tverskoy *et al* 14 in 1998 and PT Vijay Kumar *et al* 15 in 2006 demonstrated increased duration of analgesia by wound infiltration with fentanyl.

Mostafa Abdel Hamid Abo El Enin *et al* 13 postulated the possible mechanisms of action for the improved analgesia produced

by the peripheral application of fentanyl. First, fentanyl could act directly on the peripheral opioid receptor. Primary afferent tissues (dorsal roots) have been found to contain opioid binding sites. Because the presence of bidirectional axonal transport of opioid binding protein has been shown fentanyl may penetrate the nerve membrane and act at the dorsal horn. Second, fentanyl may potentiate local anesthetic action via central opioid receptor-mediated analgesia by peripheral uptake of fentanyl to systemic circulation.

## CONCLUSION

Fentanyl as an adjuvant to local anaesthetic solution in supraclavicular brachial plexus block can increase the success rate and significantly prolong the duration of analgesia, but it delays the onset time of sensory blockade as compared with that achieved by the same doses of local anesthetics used in combination.

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