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Anesthesiology

Comparison Between Efficacy Of Fentanyl 1.5µg/kg In Combination With 1.5% Lignocaine 5mg/kg Vs 1.5% Lignocaine 5mg/kg With Normal Saline In Prolonging The Duration Of Sensory Block And Analgesia For Axillary Brachial Plexus Block Following Upper Limb Surgeries-A Prospective Randomised, Double- Blinded Controlled Study

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Original Research Article

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Abstract: Regional anaesthesia may be defined as the application of a local anaesthetic agents to a nerve trunk far away from the affected site to block the nerve impulses reversibly to the part innervated. Peripheral nerve block have an increasingly important role in ambulatory anaesthesia and have many characteristic of the ideal outpatient anaesthetic: surgical anesthesia, prolonged postoperative analgesia and facilitated discharge. This double blinded study compare the use of Fentanyl along with local anaesthetic agent Lignocaine and saline for duration of sensory blockade and analgesia. A total number of 100 patients who were scheduled for elective hand and forearm surgeries were studied .Group A includes (n=50) 1.5% adrenalinized (1 in 2,00,000) Lignocaine + 2ml normal saline and Group B (n=50) includes 1.5% adrenalinized (1 in 2,00,000) Lignocaine + 1.5µg/kg Fentanyl. The patients were premedicated with an IM injection of 0.5 mg Atropine and Midazolam 0.04mg/kg 30 minutes before bringing into the operating room. A peripheral nerve stimulator with a 24-gauge 7 cm Sprotte needle was used for precise localization of each nerve. We used multiple stimulations technique in all of the patients. Increments of anesthetic mixture (8 mL/nerve in total) were injected through a stationary needle after identifying the 4 nerves in each patient in the following order: median, radial, ulnar, and musculocutaneous. Sensory blockade of each nerve was rated by the patient on a verbal analog scale from 100% (normal sensations) to 0% (no sensation). Motor block was evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), flexion of the elbow in supination and pronation of the forearm (musculocutaneous), and thumb opposition (median nerve). From the above study we conclude that addition of Fentanyl at a dose of 1.5µg to 1.5% Ligoncaine in Axillary brachial plexus block is superior to 1.5% Lignocaine with normal saline in prolonging the duration of sensory block and analgesia without any significant adverse effect

Keywords: Axillary brachial plexus block, analgesia, Fentanyl, Lignocaine, PNS.

INTRODUCTION

Regional anaesthesia may be defined as the application of a local anaesthetic agent to a nerve trunk far away from the affected site to block the nerve impulses reversibly to the part innervated. The interruption of impulses may be sensory, motor or both [1].

In past few years, we have witnessed resurgence in the use of regional anaesthesia techniques. Regional anaesthesia per se and an adjunct to general anaesthesia in providing balance anaesthesia has greatly influenced the anaesthetic practice in the past decade. It is becoming increasingly evident that regional anaesthesia offers immense benefit to the patients in the perioperative period to the extent that it might decrease the periopertaive morbidity and influence the overall outcome.

Peripheral nerve bock provide site specific analgesia with least systemic side effect and toxicity. Peripheral nerve block have an increasingly important role in ambulatory anaesthesia and have many characteristic of the ideal outpatient anaesthetic:

surgical anesthesia, prolonged postoperative analgesia and facilitated discharge. When peripheral nerve blocks (PNB) are used for the upper extremities procedures, there is consistent opioids sparing and fewer treatment related side effects when compared with general anaethesia [2]. The brachial plexus block can be employed in upper limb surgeries like soft tissue surgeries, orthopedic procedures and in plastic surgeries also. The axillary approach to brachial plexus blockade provides satisfactory anaesthesia for elbow, forearm, and hand surgery and also provides reliable cutaneous anaesthesia of the inner upper arm including the medial cutaneous nerve of arm and intercostobrachial nerve, areas often missed with other approaches [3]. In addition, the axillary approach remains the safest of the four main options, as it does not risk blockade of the phrenic nerve, nor does it have the potential to cause pneumothorax, making it an ideal option for day case surgeries. Opiates are widely known to have an antinociceptive affect at the central and spinal cord level. Evidence has begun to accumulate that opioids antinociception can be initiated by activation of peripheral opioids receptors. The addition of opioids in brachial plexus block is reported to improve success rate and postoperative analgesia by some authors [4, 5]. The introduction of peripheral nerve stimulators (PNS) into clinical practice has aided us to be more accurate.

MATERIALS AND METHODS

The study was conducted at Department of Anaesthesiology & Critical Care, DVVPF‟s Medical College & Hospital, Ahmednagar. After getting approval from the institutional ethical committee, an informed consent was taken from every patient enrolled in the study.

A total number of 100 patients who were scheduled for elective hand and forearm surgeries were studied. The patients were age between the age group 20-50 years belonging to both sexes.

The patients were allocated randomly into one of the two groups as follows:

GROUP	NO. OF CASES	DRUGS
A	50	1.5% adrenalinized (1 in 2,00,000) Lignocaine + 2ml normal saline
B	50	1.5% adrenalinized (1 in 2,00,000) Lignocaine + 1.5µg/kg Fentanyl

The study solutions were prepared by an anaesthesiologist not involved in patients management or data collection. Patients, anaesthesiologist and investigators were unaware of treatment groups.

Inclusion criteria

- Patients scheduled for hand and forearm elective surgeries.
- Age between 20 to 60 years of both the sexes.
- Patient with ASA Grade I & II.

Exclusion criteria

- Patients with coagulation abnormalities.
- Infection at the site of injection.
- Patients allergic to drugs.
- Patients with morbid obesity.
- Patients receiving preoperative narcotics

Anaesthesia technique

The patients were premedicated with an IM injection of 0.5 mg Atropine and Midazolam 0.04mg/kg 30 minutes before bringing into the operating room. Before commencement of the procedure, all the resuscitation armamentaria were kept ready in view of the impending complications, if any.

On arrival to the operating room, standard monitoring was established (pulse oximetry, electrocardiography, and noninvasive arterial blood pressure monitoring) and oxygen was delivered via Venturi facemask at a rate of 3 L/min. After insertion of a 18-gauge IV catheter in a peripheral vein in the contralateral arm. A nerve stimulator with a 24-gauge 7 cm Sprotte needle was used for precise localization of each nerve. The stimulation frequency was set at 3 Hz, the duration of stimulation at 0.1 ms, and the intensity of the stimulating current was initially set to deliver 3 mA and was then gradually decreased. The position of the needle was considered to be acceptable when an output current <0.7 mA still elicited a slight distal motor response in each of the nerve distributions. We used multiple stimulations technique in all of the patients [6]. Increments of anesthetic mixture (8 mL/nerve in total) were injected through a stationary needle after identifying the 4 nerves in each patient in the following order: median, radial, ulnar, and musculocutaneous. The remaining 4 mL was injected subcutaneously as the needle was withdrawn to block the intercostobrachial nerve. Sensory and motor blockade of radial, median, musculocutaneous and ulnar nerves were recorded after 5, 15, and 30 min and every 10 min after the end of the surgery. Sensory blockade of each nerve was assessed by pinprick and compared with the same stimulation on the contralateral hand. Sensory blockade of each nerve was rated by the patient on a verbal analog scale (VAS) from 100% (normal sensations) to 0% (no sensation). Motor block was evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), flexion of the elbow in supination and pronation of the forearm (musculocutaneous), and thumb opposition (median nerve). Measurements were performed using a modification of the Lovett rating scale from 6 (normal muscular force) to 0 (complete paralysis) [1]. The onset time of the sensory and motor blockade was

defined as the time between the end of last injection and the total abolition of the pinprick response and complete paralysis in all of the nerve distributions. The duration of sensory block was considered as the time interval between the administration of the local anesthetic and the first postoperative pain, and the duration of motor block was defined as the time interval between the local anesthetic administration and complete recovery of motor functions. The patients and the anesthesiologist who evaluated the sensory and motor blockades were blinded as to the mixture use.

RESULTS

Our study data was expressed as a mean±standard deviation .Statistical analysis for parametric data which include age, weight, sex, onset of sensory block, duration of sensory block and duration of analgesia was done using z test of difference between means of the sample size is more than 30 .Statistical analysis for intensity of motor blockade and incidence of complications was done using Test of difference between proportion. Probability value<0.05 were considered as statistically significance.

Table-1: Distribution by AGE

	Group-A (n=50)	Group-B(n=50)
Mean	33.84	32.96
Standard Deviation	9.57	9.73

Table-2: Distribution by SEX

	Group-A (n=50)	Group-B (n=50)
Males	25/50	27/50
Females	25/50	23/50

Table-3: Distribution by WEIGHT

	Group-A(n=50)	Group-B (n=50)
Mean	59.58	59.32
Standard Deviation	8.28	8.40

COMPARISON OF ONSET OF SENSORY BLOCK

It was taken as the periods from the time of injection of the anesthetic solution to the absence of pinprick sensation as experienced by the patients (in minutes).

Table-4: Comparison of Onset of Sensory Block

	Group-A	Group-B
Mean	10.36	10.6
Standard Deviation	4.48	4.02

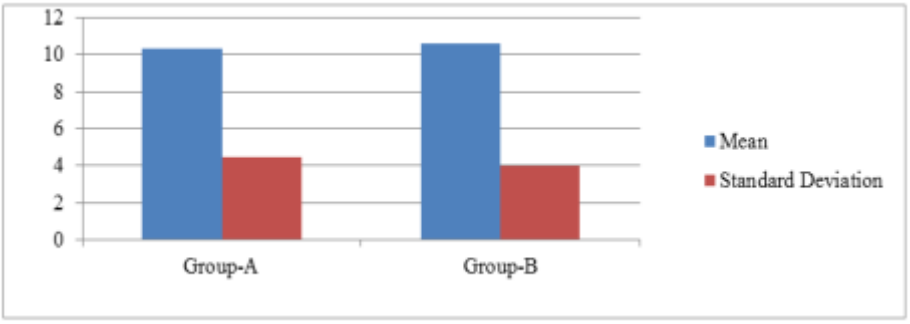

Fig-1: Comparison of Onset of Sensory Block
Z=0.28,p>0.05

COMPARISON OF DURATION OF SENSORY BLOCK

It was taken from the period from the time of loss of pinprick sensation to the reappearance of pinprick sensation as observed by the patients (in minutes).

Table-5: Comparison of Duration of Sensory Block

	Group-A	Group-B
Mean	94.02	151.6
Standard Deviation	13.85	13.72

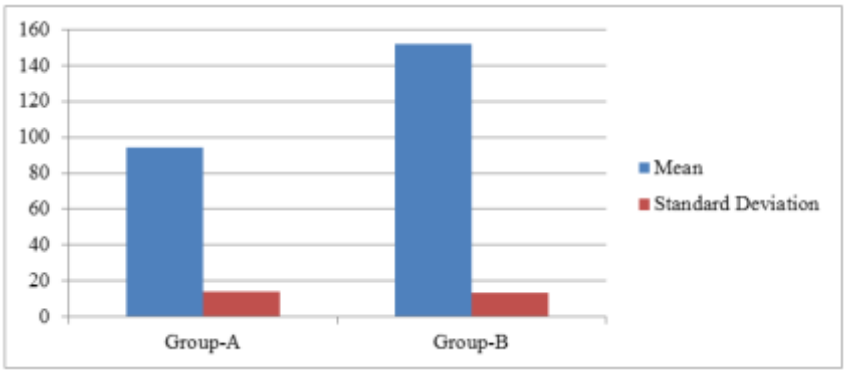

Fig-2: Comparison of Duration of Sensory Block
Z=20.88, p<0.05

The duration of sensory block in Group-A was 68 to 126 minutes.
Most of the patients had duration of 81 to 107 minutes.
The duration of sensory block in Group B was 126 to 183 minutes.
Most of the patients had duration of 138 to 164 minutes.

COMPARISON OF DURATION OF ANALGESIA

It was taken as time between the injection and the onset of pain and demand for rescue analgesia.

Table-6: Comparison of Duration of Analgesia

	Group-A	Group-B
Mean	83.96	135.98
Standard Deviation	15.71	16.31

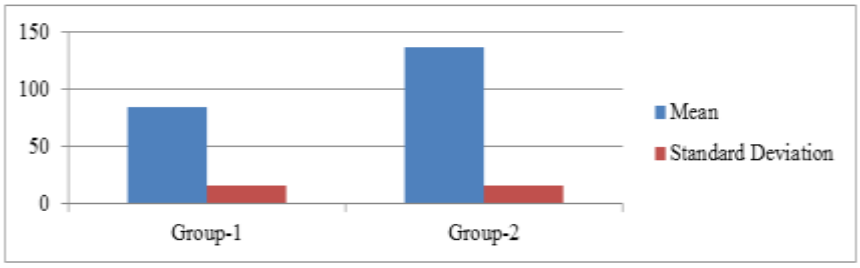

Fig-3: Comparison of Duration of Analgesia
Z=16.24, p<0.05

The duration of analgesia in Group-A was 57 to 115 minutes.
Most of the patients had duration of 68 to 98 minutes.
The duration of analgesia in Group-B was 105 to 170 minutes.
Most of the patients had duration of 119 to 151 minutes.

COMPARISON OF INTENSITY OF MOTOR BLOCK

Table-7: Comparison of Intensity of Motor Block

	Group-A	Group-B
Complete block	47 (94%)	48 (96%)
Incomplete block	3 (6%)	2 (4)
Failure	0	0

In both the groups, most of the patients had complete block.

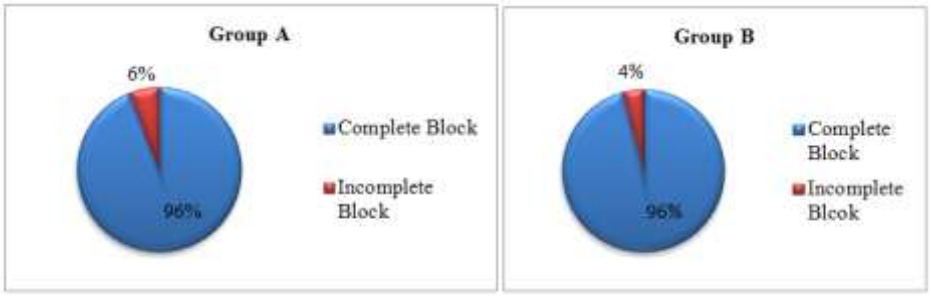

Fig-4: Comparison of Intensity of Motor Block (z=0.465) (p>0.05)

Table-8: Incidence Of Complications

	Group-A	Group-B
Hematoma	**2 (4%)**	**3 (6%)**
Drowsiness	**0**	**2 (4%)**

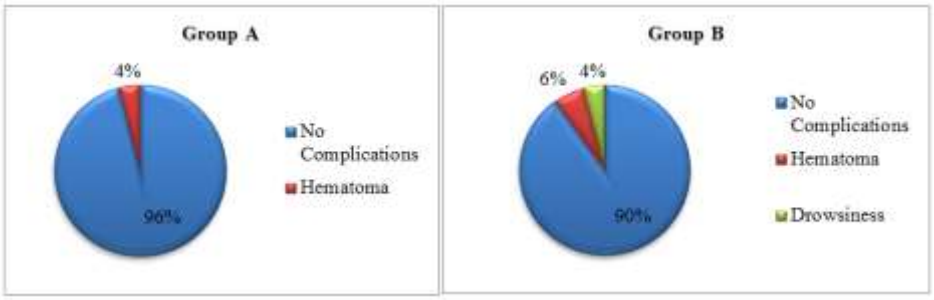

Fig-5: Incidence of Complications

DISCUSSION

Peripheral nerve blocks are widely used to provide anaesthesia for both upper and lower limb surgery [7]. Brachial plexus block is increasingly recognized as the technique of choice for anaesthesia and postoperative analgesia in orthopedic, plastic and peripheral vascular surgeries of upper limb. The use of the block, unlike general anaesthesia, reduces the consumption of opioids, reduces the length of hospital stay, and increases patients satisfaction. It provide site specific analgesia, hemodynamic stability and possible active patients participation during surgery. Regional techniques are useful in cases of polytrauma with maxillofacial surgeries and difficult airway. The nerve stimulator technique allows for exact needle location without eliciting parasthesia [8-10], hence there is increase in the specificity and reliability of peripheral nerve block technique.

Biochemical and clinical evidence shows that opiods may act at the level of peripheral nerves. Adding small doses of opiods to local anaesthetic solution for peripheral blocks have resulted in improvement in the onset of time, quality and duration of nerve block.

In our study the mean duration of sensory block and mean duration of analgesia in the Fentanyl added group is 151.6 minutes and 135.98 minutes respectively, and in the Lignocaine with normal saline group the duration are 94.02 versus 83.96 minutes respectively. These values are statistically analyzed by Z test of difference between mean and the $p<0.05$, which is significant.

Young *et al*., [11] demonstrated that opiods receptors and various micromolecules in the nerve undergo axonal flow. Laiden [12] later showed that opiods binding protein undergo bi-directional axonal transport. Young et al speculated that these moving receptors circulate endorphins, their endogenous ligands, in addition to exogenous opioids. The existence of such receptors underlies the hypothesis that opioids act directly on peripheral nervous system. Several studies have attempted to determine whether the addition of opioids to local anaesthetics would improve the efficacy of peripheral nerve blocks [13-17].

According to literature three possible mechanisms of actions for the improved analgesia produced by the peripheral application of Fentanyl were stipulated.

First, Fentanyl could act directly on the peripheral nervous system. Primary afferent tissues

(dorsal roots) have been found to contain opioids binding sites [18]. Because the presence of bi-directional axonal transport of opiods binding protein has been shown. Fantanyl may penetrate the nerve membrane and act at the dorsal horn .This could also account for the prolonged analgesia. Fentanyl is reported to have a local anesthetic action [19, 20] suggested that Alfentanil also prolonged postoperative analgesia by local anesthetic action.

Second, Fentanyl may diffuse from the brachial plexus sheath to epidural and subarachnoid spaces and then bind with the opiods receptors of dorsal horn, but it is unclear from this study whether a sufficient dose of Fentanyl diffused to the epidural or subarachnoid space to cause adequate analgesia

Third, Fentanyl may potentiate local anesthetic action via central opioids receptors mediated analgesia by peripheral uptake of Fentanyl to systemic circulation .Nishikwa et al., suggested that this mechanism is unlikely because the systemic applications of Fentanyl in their study had no effect on axillary brachial plexus block.

In our study, the motor block in Group A and B is complete in 94% and 96 % respectively and incomplete in 6% and 4 % patients respectively. Our result coincide the results of Nishikwa *et al*., study. Fletcher *et al*., [21] suggested that the addition of Fentanyl to Lignocaine 1:2,00,000 Epinephrine for axillary brachial plexus block produced no clinical benefit except for the faster onset in the musculocutanous nerve trunk. These conflicting results are probably caused by difference in opiods, anesthetic or, technique for nerve blockade.

In our study 3 (6%) patients in the Lignocaine with normal saline group required supplementation of anaesthesia due to prolonged surgery.

SUMMARY AND CONCLUSION

The present study was designed to compare and evaluate the efficacy of Fentanyl added to Lignocaine versus Lignocaine with normal saline on the duration and sensory blockade and analgesia. The duration of sensory block in the study group (151.6 minutes versus 94.02 minutes in the control group) was significantly prolonged. The duration of analgesia in the study group (135.98 minutes versus 83.96 minutes in the control group) was significantly prolonged without any significant side effects. There was no statistically significant effect on the onset of sensory blockade, intensity of motor blockade and incidence of complications in the two groups

From the above study we conclude that addition of Fentanyl at a dose of 1.5µg to 1.5% Ligoncaine in Axillary brachial plexus block is superior to 1.5% Lignocaine with normal saline in prolonging the duration of sensory block and analgesia without any significant adverse effect

REFERENCES

1. Burnham PJ. Regional block of the great nerves of the upper arm. Anesthesiology. 1958;19(2):281-4.
2. Klein SM, Evans H, Nielsen KC, Tucker MS, Warner DS, Steele SM. Peripheral nerve block techniques for ambulatory surgery. Anesthesia & Analgesia. 2005 Dec 1;101(6):1663-76.
3. Dunlop DJ, Graham CM, Watt JM. The practical use of axillary brachial plexus block for hand surgery. Journal of Hand Surgery. 1995 Oct;20(5):677-8.
4. Yaksh TL. Multiple opioid receptor systems in brain and spinal cord: Part I. European journal of anaesthesiology. 1984 Jun;1(2):171-99.
5. Stein C. Peripheral mechanisms of opioid analgesia. InOpioids II 1993 (pp. 91-103). Springer, Berlin, Heidelberg.
6. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. Anesthesia & Analgesia. 2006 Jan 1;102(1):263-7.
7. Miller R. Anesthesia New York: Churchill Livingstone. 1990.
8. Riegler FX. Brachial plexus block with the nerve stimulator: motor response characteristics at three sites. Regional anesthesia. 1992;17(5):295-9.
9. Lavoie J, Martin R, Tetrault JP, Cote DJ, Colas MJ. Axillary plexus block using a peripheral nerve stimulator: single or multiple injections. Canadian journal of anaesthesia. 1992 Jul 1;39(6):583-6.
10. Koscielniak-Nielsen ZJ, Stens-Pedersen HL, Lippert FK. Readiness for surgery after axillary block: single or multiple injection techniques. European journal of anaesthesiology. 1997 Mar;14(2):164-71.
11. Young WS, Wamsley JK, Zarbin MA, Kuhar MJ. Opioid receptors undergo axonal flow. Science. 1980 Oct 3;210(4465):76-8.
12. Viel EJ, Eledjam JJ, De JL, d'Athis F. Brachial plexus block with opioids for postoperative pain relief: comparison between buprenorphine and morphine. Regional anesthesia. 1989;14(6):274-8.
13. Bazin JE, Massoni C, Bruelle P, Fenies V, Groslier D, Schoeffler P. The addition of opioids to local anaesthetics in brachial plexus block: the comparative effects of morphine, buprenorphine and sufentanil. Anaesthesia. 1997 Sep 1;52(9):858-62.
14. Gissen AJ, Gugino LD, Datta S, Miller J, Covino BG. Effects of fentanyl and sufentanil on peripheral mammalian nerves. Anesthesia and analgesia. 1987 Dec;66(12):1272-6.
15. Gobeaux D, Landais A, Bexon G, Cazaban J, Levron JC. Addition of fentanyl to adrenalinized lidocaine for the brachial plexus block. Cahiers d'anesthesiologie. 1987;35(3):195-9.

16. Nishikawa K, Kanaya N, Nakayama M, Igarashi M, Tsunoda K, Namiki A. Fentanyl improves analgesia but prolongs the onset of axillary brachial plexus block by peripheral mechanism. Anesthesia & Analgesia. 2000 Aug 1;91(2):384-7.
17. Karakaya D, Büyükgöz F, Barış S, Güldoğuş F, Tür A. Addition of fentanyl to bupivacaine prolongs anesthesia and analgesia in axillary brachial plexus block. Regional Anesthesia and Pain Medicine. 2001 Sep 1;26(5):434-8.
18. Fields HL, Emson PC, Leigh BK, Gilbert RF, Iversen LL. Multiple opiate receptor sites on primary afferent fibres. Nature. 1980 Mar;284(5754):351.
19. Gissen AJ, Covino BG, Gregus J. Differential sensitivities of mammalian nerve fibers to local anesthetic agents. Anesthesiology. 1980 Dec;53(6):467-74.
20. Gissen AJ, Gugino LD, Datta S, Miller J, Covino BG. Effects of fentanyl and sufentanil on peripheral mammalian nerves. Anesthesia and analgesia. 1987 Dec;66(12):1272-6.
21. Fletcher D, Kuhlman G, Samii K. Addition of fentanyl to 1.5% lidocaine does not increase the success of axillary plexus block. Regional anesthesia. 1994;19(3):183-8.