

A Study On Effects Of Adding Fentanyl To Levobupivacaine (0.5%) In Supraclavicular Brachial Plexus Block.

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Abstract:

Introduction:Regional anaesthesia is a well accepted component of comprehensive anaesthetic care. Its role has expanded from the operating suite into the arena of postoperative and chronic pain management. **Aims and objectives:** comparative study was carried out to evaluate the analgesic efficacy and side effects of addition of fentanyl to levobupivacaine (0.5%) in Supraclavicular brachial plexus block. **Materials and 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. After obtaining paraesthesia, drugs were administered as follows: Group 1 (control group):- 0.5%plain Levobupivacaine - 30cc+2cc NS.Group 2 (Study Group):- 0.50% levobupivacaine-30cc +(2ml) Fentanyl(100mcg). Observations were noted. All the relevant information was recorded. Regular monitoring of PR, BP and RR, side effects,degree of sedation were recorded. **Results:** The addition of fentanyl to local anesthetics caused a delayed onset of analgesia. We hypothesized that the changes in pH of anesthetic solutions could be responsible for this effect.**Conclusion :** It increases the success rate and 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.

Keywords: Analgesia, Supraclavicular Brachial Plexus, levobupivacaine, fentanyl.

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I. Introduction

Regional anaesthesia is a well accepted component of comprehensive anaesthetic care. Its role has expanded from the operating suite into the arena of postoperative and chronic pain management. With appropriate selection and sedation, these techniques can be used in all age groups. Skilful application of peripheral neural blockade broadens the anaesthesiologist's range of options in providing optimal anaesthetic care¹. As a result it has become increasingly popular for ambulatory anaesthesia and has contributed to increase the percentage of day care surgery.

The techniques of peripheral neural blockade were developed early in the history of anaesthesia. It has been approximately 130 years that brachial plexus block was first attempted i.e. in 1884 by William Halsted and Hall^{2,3}, who injected the roots of the brachial plexus under vision with cocaine. Although Halsted was the first to block the brachial plexus, he did not use a percutaneous technique, as his method in 1884 and that used by George Crile 13 years later was to surgically expose the roots and then inject each nerve directly. While G. Hirschel⁴ produced the first percutaneous brachial plexus block in 1911 through an axillary approach. The axillary brachial plexus block has been modified by several surgeons, including George Pitkin and R. H. de Jong⁵, and remains a popular technique today. Several authors have described USG guided supraclavicular approach to the brachial plexus, in 1978 La Grange and colleagues used Doppler ultrasound to facilitate needle position⁶. Supraclavicular approach for brachial plexus block was first described by Kulenkampf⁷ in 1911. It is the most commonly used approach in providing surgical anaesthesia for upper extremity surgeries. In recent times, the Supraclavicular brachial plexus block has gained importance as a safer alternative to general anaesthesia. It includes blocking of the brachial plexus where it is most compactly arranged, with less requirement of the anaesthetic solution and rapid onset of action⁸. It provides ideal conditions for surgery, maintains stable intraoperative hemodynamic, decreases vasospasm and postoperative pain.

Regional techniques have become the preferred choice of anaesthesiologists whenever possible, reasons being⁹

- Less interference with general body physiology. Stress induced changes in body metabolism & hormonal milieu is minimal.
- Relatively simple to administer & preserves consciousness & protective reflexes.

- Reduced post-operative nursing care.
- Mental function is preserved in an elderly patient.
- Lesser quantity of drugs used as compared to General Anaesthesia, so fewer drug interactions & side effects.
- Prolonged post-operative analgesia.
- No risk of Operation theatre pollution as noted with inhalational agents.

There are some practical considerations while using regional anaesthesia which include:⁹

- Time taken to establish the block;
- Fear of neurological complications;
- Unpopularity of having awake patients at operation,
- Fear of failure of blocks;

The Supraclavicular route is being used in this study, as it is an easy technique to perform and landmarks are predictable and a small volume of solution can be administered at a point where three trunks are in close proximity, resulting in a rapid onset of a reliable sensory and motor blockade.

The technique however is not without complications, the chief ones being:⁹

- Intravascular drug injection
- Nerve damage (usually self-limiting)
- Haematoma at the site of injection
- Pneumothorax

Ultrasound continues to grow in popularity as a method of nerve localization, and for supraclavicular block, has the advantage of allowing real time visual visualization plexus, pleura and vessels along with the real time visualization of the plexus, pleura and vessels along with the needle and local anaesthetic spread¹⁰. Because of Bupivacaine's long duration of action and effectiveness, it is used most frequently among local anaesthetics for brachial plexus block. However, its major disadvantage is cardiotoxicity, primarily triggered by its dextrogyrous enantiomer. Owing to Bupivacaine's wide spread use, reports of severe irreversible cardiac and neurological toxic effects, including deaths from accidental intravascular injection are documented. The toxicity of levobupivacaine to the cardiovascular and central nervous system has been reported to be less than bupivacaine. Clinical trials comparing Levobupivacaine with Bupivacaine have not only showed similar anaesthetic efficacy in Levobupivacaine, an S-enantiomer of Bupivacaine but also a potentially reduced toxic profile compared to Bupivacaine. An ideal drug would have fast sensory onset time and differential offset time, due to its less toxicity and quality of anaesthesia Levobupivacaine is currently considered as closest to the ideal agent for neural blockade¹¹. Levobupivacaine is considered better than its racemic sibling Ropivacaine because it has faster onset of sensory and motor blockade¹¹.

Various adjuvant like (clonidine, dexmedetomidine, epinephrine, morphine, buprenorphine, potassium chloride, etc) have been studied, which established that addition of adjuvants leads to:

- Increased duration of action.
- Increased speed of onset.
- Increased density or quality of block.
- Improved overall analgesic effect.

Results from the studies show adding narcotics to local anaesthetics agent improves the intraoperative anaesthesia quality and prolongs the analgesic effect 2-3 times compared to LA providing alone¹². Three postulates have been proposed to explain the improved quality of fentanyl¹³

- Fentanyl can act directly on PNS. Primary afferent tissues (dorsal horn) 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 dorsal horn leading to prolonged analgesia.
- Fentanyl can potentiate local anesthetic action via central opioid receptor-mediated analgesia by peripheral uptake of fentanyl to systemic circulation.

II. AIM AND OBJECTIVES

To study the effect of adding Fentanyl to Levobupivacaine as adjuvant in supraclavicular brachial plexus block on:

1. Onset and duration of action.
2. Haemodynamic parameters.
3. Perioperative sedation.

III. MATERIAL AND METHODS

The prospective study entitled "A study on the effects of adding Fentanyl to Levobupivacaine in supraclavicular brachial plexus block" was carried out on 100 patients of both sexes with comparable characteristics, in the department of Anaesthesia, Rajendra Institute of Medical Sciences, Ranchi and patient were randomly divided into two group : Group 1(Control Group) and Group 2 (Study Group).

Group 1 (control group):- 0.5% plain Levobupivacaine - 30cc+2cc NS.

Group 2 (Study Group):- 0.50% levobupivacaine-30cc +(2ml) Fentanyl(100mcg).

The study was conducted after obtaining approval from ethical, academic committee and a written informed consent from the patient.

Inclusion Criteria:

1. ASA Grade 1 and 2 posted for elective operation on forearm and hand.
2. Age group between 18-60 years of both the gender who are willing to participate.
3. No known hypersensitivity to local anaesthetic of the amide type of drugs.
4. No history of coagulation disorder or intake of any antiplatelet drugs.
5. No history of pulmonary/cardiac/renal or endocrinal disease.
6. Patient who were willing to participate in the study.

Exclusion Criteria:

1. ASA Grade III,IV,V
2. Age below 18 or above 60.
3. Any local infection.

A routine pre anaesthetic checkup was done after noting the medical history. Thorough systemic examination was carried to rule out any systemic disorder. Routine and special investigations were carried out accordingly.

Local examination of block site was done to exclude any sign of sepsis/previous injury or deformity. Prior to induction, patient was kept NPO 6-8 Hrs. Patients who fulfilled the inclusion criteria and gave the consent were explained about the procedure and were randomly included in Group1/Group2, intravenous access was established with wide bore cannula. Base line vitals(respiratory/heart rate/noninvasive blood pressure/SPO₂/ECG) were recorded. I.V fluid was started according to requirement.

Premedication:-

Inj. Ondansetron (4mg) i.v.+Inj. Ranitidine(50mg) i.v.+Inj. Midazolam(1mg) I.v. 5 mins before giving supraclavicular brachial plexus block.

Technique:- After proper positioning, cleaning and draping, the procedure was done by ultrasound guided approach using (Portable colour Doppler and Ultrasound for Anaesthesia) by 6-13 MHz linear probe. Transducer is placed firmly over the supraclavicular fossa, parallel and immediately posterior to the clavicle. The head will be slightly turned to the contralateral side. A good transverse view of subclavian artery and brachial plexus is necessary for a safe approach. The supraclavicular brachial plexus is visualized as a group of hypoechoic nodules frequently described as "A cluster of grapes". Needle was approached as an in plane technique so as to better visualize the needle tip. The needle was inserted in a medial to lateral direction in the long axis of the transducer, this has the advantage of needle movement away from the lung, with the first rib acting as a backstop, until brachial plexus is reached. After negative aspiration 32 ml of drug will be administered and 3 minutes of massage was performed.

Assessment of the Block:

Onset of Sensory and Motor Blockade was monitored every 2 min for first 10 mins, then every 5 min for 30 mins and every 10 mins upto 90 mins.

Sensory blockade: Assessment of sensory blockade was done after completion of drug injection in dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve. Sensory block was measured with pin prick test at a 3 point scale.

- 0- Sharp pain
- 1- Dull pain (analgesia)
- 2- No pain (anaesthesia)

Onset of Sensory Block: was considered when there was complete loss of sensation to pinprick. The block was considered as failed block, if anaesthesia is not present in 2 or more peripheral nerve distribution and these patients will be excluded from the study.

Motor Blockade: Onset of motor blockade was considered as time from injection to the inability of the patient to move his/her fingers or raise their hand. Motor block was assessed at the same time interval at which sensory blockade was observed. Following functions were taken into consideration:

1. Flexion at the elbow (musculocutaneous nerve)
2. Extension at the elbow and wrist (radial nerve)
3. Opposition of thumb and index nerve (ulnar nerve)

Motor block was measured using Modified Bromage Scale:

- 0- No block (full muscle activity).

- 1- Partial block(decreased muscle activity).
- 2- Complete muscle block(no muscle activity).

In case of both sensory and motor block a score of 2 denote complete onset of block.

- ❖ **Duration of sensory blockade:** - Defined as the onset of sensory block and return of dull pain and VAS<3,was assessed every 30 mins postoperatively in atleast 3 major nerve distributions.
- ❖ The duration of motor block was assessed every 30 min still the ability of the patient to move his/her fingers.
- ❖ The duration of analgesia, defined as the time between onset of action and onset of pain(VAS MORE THAN OR EQUAL TO 4),was the time when patient received the first dose of analgesic.

Patients requiring rescue analgesia within 30 min. of administration of block were excluded from the study.

Sedation: sedation was assessed on Ramsay sedation score.

Ramsay sedation scale: Score Response

1. Anxious or restless or both
2. Cooperative, orientated and tranquil
3. Responding to commands
4. Brisk response to stimulus
5. Sluggish response to stimulus
6. No response to stimulus

Operative quality: operative quality was assessed on following numeric scale.

Grade 4:- (excellent) no complaint from patient.

Grade 3:- (good) minor complaint with no need for supplemental analgesia.

Grade 2:- (moderate) complaint that required supplemental analgesia.

Grade 1:- (unsuccessful) patient given general anaesthesia.

- Post-operative analgesia was assessed on VAS (visual analogue score) from 0 to 10.

For haemodynamic changes baseline pulse and non-invasive blood pressure(mean arterial blood pressure)was recorded. After administration of supraclavicular brachial plexus block pulse and NIBP(mean arterial blood pressure) was documented every 2 mins for 10 mins,every 5 mins upto 30 mins and then every 10 mins upto 90 mins. Oxygen was given via oxygen maskat the rate of 4-6ltr/hr.Patient was monitored for side effects and complications if any. The observation and result of adding Fentanyl as adjuvant was compared with control group. The template was generated in MS Excel and analysed by using SPSS version 20 and Chi square test was used to know the strength of association.

IV. RESULTS

Total 100 patients were included in the Study. All preferred blocks were adequate for the proposed surgery and the quality of nerve block was defined satisfactory nerve block for all the patients.

Group 1 (control group):- 0.5%plain Levobupivacaine - 30cc+2cc NS.

Group 2(Study Group):- 0.50% levobupivacaine-30cc +(2ml) Fentanyl(100mcg).

TABLE -1: Showing Mean age and Weight of the two groups (Mean± S.D)

VARIABLES	Group 1(Control)	Group 2(Study)
SEX RATIO (M:F)	33:17	43:7
AGE (In Years)	36.28±7.17	32.08±9.21
WEIGHT (in Kgs)	64.04±7.50	60.46±5.25

Sex ratio was found to be 33:17 in Control Group and 43:7 in Study group .

TABLE-2: Showing Duration of Sensory Onset(Mean± S.D)

	Radial(In Secs)	Ulnar(In Secs)	Median(In Secs)	Musculocutaneous (In Secs)
Group 1	155.04±73.413	159.20±74.204	157.82±73.287	158.18±72.548

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Group 2	278.98±56.363	285.70±56.277	281.58±55.464	282.16±56.184
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The Duration of Sensory blockage in Group 2 were longer as compared to Group 1.

TABLE 3: Showing duration of Motor onset (Mean± S.D)

MOTOR ONSET	G1 (In Secs)	G2(In Secs)	G3(In Secs)
Group 1	216.74±39.648	238±64.475	235.34± 55.564
Group 2	454.30±56.573	464±54.978	479.28±54.528

The duration of motor onset was found to be increased in Group 2.

Table 4: Mean Heart Rate at Different Interval of Time

Group1	0	2	4	6	8	10	15	20	25	30	40	50	60	70	80	90
MEAN	74.4	76.9	75.46	75.5	74.90	76.3	77.2	78.7	79.9	79.3	77.74	78.04	77.32	77.18	78.18	81.02
SD	8.22	8.49	8.579	8.30	7.152	6.56	5.53	7.07	7.31	8.51	8.410	9.357	9.811	7.515	6.219	6.823
Group2	78.1	76.3	75.80	74.8	76.00	76.9	77.9	82.2	78.7	77.8	79.22	77.82	78.06	77.96	78.14	81.70
MEAN																
SD	8.62	7.80	7.967	8.27	7.96	5.15	6.22	7.20	8.62	8.24	8.445	8.817	8.534	5.470	6.701	6.399

Table 5: Mean Arterial Pressure at Different Interval of Time

Group 1	0	2	4	6	8	10	15	20	25	30	40	50	60	70	80	90
MEAN	79.3	79.52	79.2	79.1	77.72	76.84	76.90	77.64	76.80	77.96	77.68	78.10	78.24	78.56	78.48	79.5
SD	7.28	6.211	5.55	5.42	5.883	5.347	5.285	5.851	4.998	5.973	6.039	6.338	6.110	6.389	6.911	6.99
Group 2	79.0	79.24	79.0	78.2	77.84	77.00	77.02	77.76	76.92	77.96	77.76	78.10	78.28	78.44	78.36	79.2
MEAN																
SD	7.11	6.056	5.46	5.39	5.825	5.288	5.255	5.794	4.969	5.918	6.083	6.325	6.048	6.289	6.757	6.76

Table 6: Oxygen Saturation at Different Interval Of Time

Group 1	0	2	4	6	8	10	15	20	25	30	40	50	60	70	80	90
MEAN	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
SD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Group 2	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
MEAN																
SD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Table 7: Respiratory Rate at Different Interval Of Time

Group 1	0	2	4	6	8	10	15	20	25	30	40	50	60	70	80	90
MEAN	13.2	15.3	18.2	16.1	14.3	13.3	13.3	13.6	13.3	13.3	13.5	13.5	13.08	13.0	13.06	13.56
SD	1.45	1.25	1.54	2.00	1.76	1.59	1.37	1.12	1.10	1.14	1.18	1.21	0.986	1.18	0.978	1.198
Group 2	13.2	15.3	18.1	16.1	14.4	13.6	13.5	13.6	13.4	13.2	13.4	13.6	13.20	13.1	13.12	13.38
MEAN																

SD	1.62	1.37	1.53	1.98	1.77	1.54	1.40	1.15	1.14	1.20	1.21	1.17	1.107	1.22	1.003	1.086
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Table 8: Showing Post Operative Duration

	POD MOTOR	POD SENSORY
Group 1	590.88± 28.673	723.06±36.032
Group 2	811.44±55.590	995.10± 46.090
Dof =1 X²= 651.1 p value =.001*		

TABLE 9.: Showing Post Operative Duration Rescue Analgesia

	POD RESCUE ANALGESIA	
	Mean	SD
Group 1	980.86	69.077
Group 2	1269.48	117.420

V. Discussion

In our Present Study which was carried out in 100 patients the Male to Female ratio was found to be 33:17 in Control Group and 43:7 in Study Group. The duration of Sensory blockage and motor onset was found to be increased in Study Group. Mean age in control group was found to be 36±7.17 years while in Study group it was 32.08±9.21 Years. In control group Mean age was found to be 64.04 ±7.50 kg and 60.46 ±5.25 kg in Study group. The Haemodynamic parameters like Mean heart rate, mean arterial pressure and respiratory rate was found to be similar in both control and study group. All patients were hemodynamically stable, and there were no serious side effects in any of the patients in both the groups.

This study demonstrated that the addition of fentanyl to levobupivacaine in brachial plexus block increased the success rate of sensory blockade and prolonged the duration of blockade. After Comparison we observed that there is remarkable increase in postoperative analgesia which was found in similar to study done by Shirish G.chavan et al.¹²

In our study, the addition of fentanyl to local anesthetics for brachial plexus block improved the success rate of sensory blockade similar to study done by Shirish G.chavan et al. In contrast, Fletcher *et al.*¹³ reported that no changes were observed in the success rate, onset time or duration of analgesia by axillary fentanyl administration. Because neither of these reports included an axillary fentanyl alone group, it is rather difficult to evaluate the pure peripheral opioid receptor-mediated effect. However, local anesthetic is required to obtain surgical anaesthesia. In our study, the addition of fentanyl to local anesthetics caused a delayed onset of analgesia. We hypothesized that the changes in pH of anaesthetic solutions could be responsible for this effect.

VI. Conclusion

The addition of small dose fentanyl to levobupivacaine in supraclavicular brachial plexus block can increase the success rate and 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 anaesthetics used in combination.

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