ORIGINAL ARTICLE

EFFECT OF ADDING FENTANYL TO LOCAL ANAESTHETICS IN BRACHIAL PLEXUS BLOCK ON THE ONSET AND DURATION OF ANESTHESIA AND POSTOPERATIVE ANALGESIA

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ABSTRACT:
Introduction: Fentanyl is added commonly to local anaesthetic administrated in the extra dural space to improve analgesia in the postoperative period. The addition of fentanyl produced only slight change in the quality and duration of analgesia after administration of 2% lidocaine with epinephrine for a short surgical procedure or after administration of 0.125% bupivacaine. **Material & Method:** Fifty patients, ASA physical status I-II, 18 years of age or older, undergoing surgery of the upper limb, were recruited.two groups (n=25) were investigated: Group–A: Patients received 30ml 1.5% Lidocaine with Adrenaline (1:200,000), 10ml Bupivacaine 0.5%.Group–B: Patients received 30ml 1.5% Lidocaine with Adrenaline (1:200,000), 10ml Bupivacaine 0.5% with fentanyl 50 microgram added to it. **Results and Conclusion:** The present study concluded that addition of fentanyl to local anaesthetic mixtures in brachial block delay the onset, but prolong duration of motor and sensory anesthesia, and improves quality of analgesia without affecting hemodynamic stability and without added complications.
Keywords: Fentanyl, Local Anaesthesia, brachial plexus

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INTRODUCTION

The supraclavicular brachial plexus block provides anaesthesia of the entire upper extremity in the most consistent and time-efficient manner. Fentanyl (N-phenyl-N-(1-Phenethyl-4-piperi dinyl) propanamide) is anopioid analgesic with potency eighty times that of morphine.Fentanyl is extensively used for anaesthesia and analgesia in the operating room and intensive care unit. It is frequently given intrathecally as a part of spinal anaesthesia or epidurally as a part of epidural anaesthesia and analgesia, it is also used as a sedative.[1] Addition of small amount of local anaestheics augments the effect of intrathecal opioids by increasing the duration of the block and speeding the onset of analgesia.[2]

Fentanyl is added commonly to local anaesthetic administrated in the extra dural space to improve analgesia in the postoperative period.[3] The addition of fentanyl produced only slight change in the quality and duration of analgesia after administration of 2% lidocaine with epinephrine for a short surgical procedure[4] or after administration of 0.125% bupivacaine [5] , other studies[6] in adults report improved and/or prolonged anal gesia following the addition of fentanyl to lumbar extra dural bupivacaine for lower abdominal procedures, caesarean section and pain relief in labour.[7] This study is designed to examine the effect of adding

fentanyl to local anaesthetics in brachial plexus block on the onset and duration of motor and sensory block and post-operative analgesia.

MATERIALS & METHODS

The study protocol of this prospective, randomized, trial was approved by the Hospital Ethics Committee. All participants gave written informed consent. Fifty patients, ASA physical status I-II, 18 years of age or older, undergoing surgery of the upper limb, were recruited. Excluded from the study were patients for whom supraclavicular brachial plexus block or the study medications were contraindicated or those who had a history of significant neurological, psychiatric, neuromuscular, cardiovascular, pulmonary, renal or hepatic disease or alcohol or drug abuse, as well as pregnant or lactating women. Also barred from the study were patients taking medications with psychotropic or adrenergic activities and patients receiving chronic analgesic therapy.

In our study, two groups (n=25) were investigated: Group–A: Patients received 30ml 1.5% Lidocaine with Adrenaline (1:200,000), 10ml Bupivacaine 0.5%.Group–B: Patients received 30ml 1.5% Lidocaine with Adrenaline (1:200,000), 10ml Bupivacaine 0.5% with fentanyl 50 microgram added to it.

After aseptic preparation of the area, a skin wheal was raised at the marked point with 1ml of lidocaine 2% subcutaneously, next standing at the side of patient, facing the patient's head, a 23 G – 3.75cm needle was directed in a caudal slightly medial and posterior direction. A nerve locator was used to locate the brachial plexus. The location end point was a distal motor response with an output lower than 0.7ma. On localization of the brachial plexus and negative aspiration of blood, the study medication was injected.

The assessment for onset of sensory and motor block was done every minute from the time of injection of test drug until the block was established.Sensory block was evaluated by pinprick test in hand and forearm whereas motor block was assessed by asking the patient to abduct the shoulder and flex the forearm and hand against gravity.

Onset of sensory block was defined as the time elapsed between injection of drug and complete loss of pin prick sensation, while onset of motor block was defined as the time elapsed from injection of drug to complete motor block. Only patients with complete motor block were included in the study.

After the establishment of block, surgery was started and time of beginning of surgery was noted. Intravenous fluids were continued intraoperatively at a rate of 2 ml/kg/hour. pulse, BP, SPO2 and ECG were monitored. Any complication like tachycardia, bradycardia, hypotension, nausea, vomiting, breathlessness, cough, discomfort and sedation were noted.

During the procedure, anaesthesia was considered satisfactory if patient did not complain of any pain or discomfort. Any patient requiring supplemental anaesthesia was excluded from the study. All 50 patients were monitored for anaesthesia and analgesia upto 12 hours from injection in the post-operative period.

Duration of sensory block (the time elapsed between injection of the drug and return of pinprick sensation) and duration of motor block (time elapsed between injection of the drug to complete return of motor power evaluated by finger and shoulder movement) were recorded.

Intensity of pain was evaluated using (Visual Analogue Scale) , Grade 0 (No pain) to 10 (Worst pain).Analgesia was considered satisfactory if the score was 3 or less. If the score was more than 3, analgesia was judged unsatisfactory and rescue analgesic inj. Diclofenac sodium 75mg i.v was administered. Time for first analgesic was noted.

Results were compared for the duration of satisfactory analgesia from the time when the block was performed and the time for first administration of rescue analgesic.Data were presented as mean values and mean + S.D and analysed using unpaired't' test with p value <0.05 considered statistically significant and p value <0.001 considered statistically highly significant.

RESULTS

Demographic data

There were no differences between the both groups regarding age, sex and weight.

Table 1: Demographic data

	Group A (n = 25)	Group B (n = 25)	P value	Inference
Sex (M/F)	18/7	19/6	0.78	**NS**
Age (Years)	34.32±12.55	35.92±11.37	0.638	**NS**
ASA 1	15	17	0.768	**NS**
ASA 2	**10**	**8**		

Table 2: Pre operative hemodynamic parameters

PARAMETER	GROUP A(n=25)	GROUP B(n=25)	P value
PULSE(bpm)	82.64±6.59	84.6±8.48	0.36
BP(SBP/DBP)	120.72±7.48/77.6±4.39	121.28±7.04/77.6±5.53	0.78/1.0
RR(per min)	15.32±1.029	15.32±1.039	1.0

No significant difference was seen in pre-operative hemodynamic parameters of patients between both the groups.

Table 3: Onset of anaesthesia

Onset of Anaesthesia	Group A	Group B	P value
Mean Sensory (min) Block	12.76±1.33	14.8±0.91	**0.0001**
Mean Motor (min) Block	**10.24±1.3**	**11.24±1.05**	**0.0044**

Table 4: Duration of anaesthesia and analgesia

Time(hrs)	Group A	Group B	P value
Mean duration of Motor Block	3.7560±0.248	5.716±0.367	**0.0001**
Mean duration of Sensory Block	3.5920±0.388	4.68±0.40	**0.0001**
Mean time of 1st analgesic	**4.344±0.204**	**7.22±0.472**	**0.0001**

Table 5: Hemodynamic changes

	PULSE RATE (per min)		**RESPIRATORY RATE (per min)**		**SBP (mm Hg)**		**DBP (mm Hg)**	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	**Group B**
	Mean±S.D	Mean±S.D	Mean± S.D	Mean± S.D	Mean± S.D	Mean± S.D	Mean± S.D	**Mean±S.D**
0	85.00±6.84	84.80±7.19	15.2±.9 3	15.4±1. 0	120.72 ±7.48	121.28 ±7.04	77.6±4. 39	**77.6±5.53**
15	85.08±5.98	84.24±6.95	15.4±1. 0	15.3±1. 03	123.04 ±8.68	119.12 ±6.27	76.44± 5.58	**76.08±4.74**
30	85.92±7.33	80.72±6.40	15.2±1. 1	15.4±.8 2	123.08 ±8.77	113.40 ±4.66	77.92± 5.7	**73.32±5.31**
60	86.08±6.53	87.20±6.58	14.9±1. 3	15.0±1. 2	120.80 ±7.81	122.32 ±7.47	79.36± 3.9	**76.80±6.60**
90	85.40±6.51	84.00±6.95	14.6±1. 15	14.7±1. 2	119.20 ±8.24	122.56 7.64	78.64± 4.82	**76.64±6.62**
120	84.68±6.79	85.56±6.91	15.0±1. 35	15.0±1. 2	118.40 ±5.31	120.08 ±8.27	78.2±4. 14	**74.8±4.76**
180	84.16±6.37	85.32±6.72	14.7±1. 16	15.1±.9 8	117.32 ±6.18	117.60 ±7.07	78.08± 4.3	**73.04±4.62**
240	84.20±6.51	84.76±5.26	15.0±1. 2	14.8±1. 3	118.0± 6.78	115.52 ±6.17	84.24± 3.87	**70.80±4.20**
300	84.04±6.52	83.84±4.80	15.0±1. 1	14.9±1. 2	118.36 ±5.21	117.04 ±5.48	80.1±4. 0	**71.52±3.84**
360	84.24±6.48	82.28±3.84	15.1±1. 1	15.1±1. 3	123.96 ±6.1	117.04 ±4.9	82.1±4. 03	**71.6±3.14**
540	84.36±6.11	81.76±3.96	15.0±1. 09	15.0±1. 13	118.9± 6.5	117.2± 5.06	80.4±3. 9	**71.1±3.4**
720	**86.16±6.08**	**81.88±3.70**	**15.1±1. 3**	**14.8±.8 8**	**122.16 ±7.1**	**117.36 ±3.9**	**82.0±4. 11**	**74.0±4.06**

Table 6: Intraoperative and Postoperative Complications

EVENT	**No. of Patients**	
	Group A	**Group B**
Tachycardia :P>20/min from baseline	Nil	**Nil**
Bradycardia :P<20/min from baseline	Nil	**Nil**
Hypotension :MAP<30mmHg from baseline	Nil	**Nil**
Nausea / Vomiting	Nil	**1**
Sedation/Drowsiness	Nil	**Nil**
Respiratory depression	**Nil**	**Nil**

Nausea occured in only one patient in group B intraoperatively. It did not require any treatment. No incidence of hypotension,tachycardia or bradycardia were observed in any group. No incidence of decline in SPO2 perioperatively.

DISCUSSION

Supraclavicular blocks are performed at the level of the brachial plexus trunks. Here, almost the entire sensory, motor and sympathetic innervations of the upper extremity are carried in just three nerve structures (trunks), confined to a very small surface area. Consequently, typical features of this block include rapid onset, predictable and dense anaesthesia along with its high success rate.

Opiates are widely known to have an antinociceptive effect at the central and/or spinal cord level.[8] However, evidence has begun to accumulate that opioid antinociception can be initiated by activation of peripheral opioid receptors.[9] The presence of peripheral opioid receptors is shown in immune cells and primary afferent neurons in animals. [10] If opioid administration improves regional anaesthesia without centrally mediated side effects, it would be useful in clinical practice. Study has demonstrated the presence of peripheral opioid receptors that mediate analgesia by endogenous as well as exogenous opioid agonists. [11] It is speculated that the peripheral administration of opioids provides stronger and longer lasting analgesia with a lower dose of opioid without central side effects such as respiratory depression, nausea, vomiting and pruritus. [12] A number of trials have examined the peripheral analgesic effect of opioids in a large variety of surgical set tings particularly arthroscopy and conduction nerve blocks.[13],[14]

The addition of opioids in brachial plexus block is reported to improve success rate and postoperative analgesia.[15] We postulate 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 receptors. Primary afferent tissues (dorsal roots) have been found to contain opioid binding sites. [10] Because the presence of bidirectional axonal transport of opioid binding protein has been shown [16] fentanyl may penetrate the nerve membrane and act at the dorsal horn. This could also account for the prolonged analgesia. However, fentanyl is reported to have a local anaesthetic action.[17] Gormley et al[15] suggested that alfentanil also prolonged postoperative analgesia by local anaesthetic action.

Second, fentanyl may potentiate local anaesthetic action via central opioid receptor-mediated analgesia by peripheral uptake of fentanyl to systemic circulation.[18]

A synergistic interaction between local anaesthetics and opioids with epidural administration has been reported.[19] It appears that local anaesthetics and opioids exert their action independently via different mechanisms. Local anaesthetics block propagation and generation of neuralaction potentials by a selective effect on sodium channels, whereas opioids act on the opioid receptors creating an increase in a potassium conductance. This action results in hyperpolarization of the nerve cell membrane and a decrease in excitability.[20] Although sodium channel block is proposed to be the primary mode of action, local anaesthetics also have an effect on synaptic transmission[21]. Li et al[21] showed that lidocaine inhibited both substances P binding and sub stance P-evoked increase in intracellular calcium. In contrast, in addition to the considered primary mode of action, opioids were found to directly suppress the action potential in nerve fibers [22]. Frazieret al [23] showed that morphine depressed both sodium and potassium currents associated with the action potential in squid giant axons. Therefore, the combination of local anaesthetics and opioids may effectively inhibit multiple areas of neuronal excitability.

The present study compares the effect of addition of fentanyl to local anaesthetic mixtures in brachial block on the onset and duration of anesthesia. The results of the present study showed that addition of fentanyl to local anaesthetic mixtures in brachial block delay the onset of block(Table 3). As regard duration of anesthesia Fentanyl group had longer duration than control group (Table 4). Denizet al [24] found that addtion of fentanyl to bupivacaine in brachial plexus axillary approach prolonganaesthesia and analgesia, prolong duration of sensory and motor block and prolong the duration of postoperative analgesia. In the present study the first time to require analgesia is prolonged in Fentanyl group (Table 4).These results are similar to the results of constant O et al [25] who studied the effect of addition fentanyl to local anaesthetic mixture in caudal block in children undergoing bilateral vesicoureteral reflex and they found that addition of fentanyl (1 mcg.kg -1) to bupivacaine 0.25% and lidocaine 1% prolong duration of surgical analgesia after single injection from start of injection to first requirement of analgesia from 174min in Control group to 253min in Fentanyl group. In the present study fen tanyl group had lower pain score postoperatively than in Control group. In accordance with the study done by Vitaet al [26] who found that intraarticular injection of fentanyl improve postoperative pain and no difference between

intraarticular morphine and fentanyl in post operative pain relief. Also Vijay et al [27] found that wound infiltration with fentanyl has lower VAS postoperatively and combination of lidocaine with fentanyl for wound infiltration in cholecystectomy patients was associated with better postoperative analgesia, reduced analgesic consumption and better lung function. Saryazdietal [28] found that injection of fentanyl intraarticularly has better postop erative pain less pain score and short time to walk were achieved by fentanyl orpethedine in comparison with dexamethasone when injected intraarticular.

The present study concluded that addition of fentanyl to local anaesthetic mixtures in brachial block delay the onset, but prolong duration of motor and sensory anesthesia, and improves quality of analgesia without affecting hemodynamic stability and without added complications.

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