

A Critical Evaluation of an Effect of Nalbuphine as an Adjuvant to Bupivacaine for Ultrasound Guided Interscalene Brachial Plexus Block

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Abstract

Context: The use of Brachial plexus block under Ultrasound guidance for Anesthesia has increased recently. Various adjuvants are added to enhance the analgesic effect of local anesthetic agents namely opioids, alpha 2 agonist, dexamethasone, etc. *Aim:* The aim of this study was to evaluate the effect of analgesic efficacy of nalbuphine as an adjuvant to 0.5% bupivacaine for interscalene brachial plexus block. *Settings and Design:* This is a prospective randomized double blind control study conducted in Melmaruvathur Adhiparasakthi Institute of Medical Science & Research over a period of one year from June 2016 to June 2017. *Methods and Material:* Sixty patients of ASA I and II undergoing elective shoulder surgery under Ultrasound guided Interscalene brachial plexus block were randomly allocated into two groups of thirty patients each to receive either 20mL of 0.5% bupivacaine with 1 mL normal saline (Group I-Bupivacaine with control group) or 20mL of 0.5% bupivacaine with 1 mL of Nalbuphine 10mg (Group II- Bupivacaine with Nalbuphine). Onset and duration of sensory and motor block and duration of postoperative analgesia were observed. *Statistical analysis used:* Statistical analysis was performed using appropriate test with Graphic prism 5.0 software. *Results:* Addition of Nalbuphine with bupivacaine has faster onset of sensory and motor block and enhanced duration of sensory motor block compared to bupivacaine alone with statistically significant difference ($p < 0.0001$). Nalbuphine prolongs the duration of analgesia significantly ($p < 0.0001$). None of the patients experienced any adverse hemodynamic changes and complications. *Conclusion:* The present study explains that Nalbuphine 10 mg added to 0.5% bupivacaine in interscalene brachial plexus block has significant increase in the duration of analgesia with no adverse effects.

Keywords: Nalbuphine; Bupivacaine; Interscalene Brachial Plexus Block.

Introduction

Interscalene brachial plexus block is relatively safe and effective regional anesthetic technique for upper arm and shoulder surgeries. It is an effective alternative to general anesthesia for most patients as it avoids the undesired effect of general anesthetic drugs and stress of laryngoscopy. Various adjuvants like Opioids, Alpha 2 agonist, Dexamethasone etc are added to local anesthetic to prolong the block effect and to reduce the toxicity of local anesthetics [1-3].

Nalbuphine is a phenanthrene opioid derivative

which is a strong analgesic with partial agonist at kappa receptors and antagonist at μ receptors. Nalbuphine have ceiling analgesic and respiratory depressant effect, but still it can be as effective as full μ agonist action in providing analgesia [4,5]. After going through the literature, Nalbuphine was studied several times as an adjuvant to local anesthetics in spinal, epidural and caudal. Very minimal study has been done in peripheral nerve blocks [6-9] .

The aim of the present study is to evaluate the clinical efficacy of Nalbuphine as an adjuvant to 0.5% bupivacaine for interscalene brachial plexus block for various arm and shoulder surgeries under ultrasound guidance.

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Materials and Methods

It was a prospective randomized double blind control study conducted over a period of one year from June 2016 to June 2017 in the Department of Anesthesiology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences & Research, after obtaining approval of the ethical committee. This study included sixty patients of American society of Anesthesiologist physical status I & II of both male and female, aged 18 to 60 years scheduled for elective shoulder and arm surgeries in orthopedic operation theatres. The patients with infections at the injection site, coagulopathy, cardiovascular, pulmonary, renal, hepatic disease, allergy to local anesthetics, failure of block and neurological deficit were excluded from this study. Patients were randomly allocated into two groups according to computer generated random number. Group I (Bupivacaine with control group) patients received 20 ml of 0.5% Bupivacaine with 1ml of normal saline and Group II (Bupivacaine with Nalbuphine) patients received 20 ml of 0.5% bupivacaine with 1ml of Nalbuphine (10mg) for Interscalene Brachial Plexus under ultrasound guidance.

All patients were assessed and explained about visual analogue pain score, where zero indicates no pain, ten indicates severe unbearable pain. The patients were premedicated with tablet alprazolam 0.25 mg and tablet Ranitidine 150mg orally at night before surgery. On arrival to the preoperative room, patient was cannulated with 18 gauge IV cannula into the peripheral vein, Ringer lactate infusion were started as per perioperative fluid requirement. Monitors like Heart rate, Non invasive blood pressure, Electrocardiogram and pulse oximetry were connected. Patients then shifted to operative room. Patient were positioned in supine position with head turned 45 degree to opposite side. The interscalene brachial plexus block was performed with a transportable ultrasound machine (sonosite inc) with 6-13 MHz, 38mm linear high frequency probe. Under strict aseptic precautions and local infiltration of skin, supraclavicular fossa is scanned first to identify the subclavian artery as it passes over the first rib. Brachial plexus is identified as bunch of grapes lying superolateral to the artery. The plexus is followed medially and cephalad along its course till the trunk is seen between the anterior scalene and middle scalene muscles. Now 23 gauge 5cm echogenic needle was advanced lateral to medial in long axis of the probe. The needle is advanced till the needle tip is in close proximity to C6 nerve root. The prepared local anesthetic volume of 21ml is injected. The spread of local anesthetics should expand the interscalene space and cover C5,

C6 and C7 nerve roots. Patient were assessed for onset of sensory and motor block, duration of motor block and duration of analgesia. The onset of sensory block was assessed from the drug administration to first loss of pinprick sensation in any dermatome (C5-T1). The onset of motor block was analysed from the drug administration to reduction of muscle power (grade 2). Motor onset was assessed by using a modified Bromage scale. Duration of analgesia was the time from the onset of sensory block and the need of rescue analgesia. Rescue analgesia used in the form of diclofenac 75 mg IV. Intraoperative vital parameters of heart rate, Respiratory rate, NIBP, oxygen saturation were monitored. Any adverse effects like hypoxia, hypovolemia, and bradycardia were also monitored.

Statistical analysis were done by using the graph pad prism 5.0 software. The data were expressed as a mean and standard deviation or number and percentage. The p-value of <0.0001 was considered statistically significant.

Results

A total of 60 patients were enrolled in this study, and they were randomly divided into two groups, 30 patients in each. The demographic data of Age, Gender and Weight were comparable. About 75% of them were ASA Class I (Table 1). This study evaluated the clinical efficacy of nalbuphine as an adjuvant to 0.5% bupivacaine for interscalene brachial plexus block under USG guidance for various arm and shoulder surgeries. Onset of sensory and motor block was found to be rapid in patients receiving Nalbuphine as an adjuvant to 0.5% bupivacaine (Group II) that is (6.23±0.79 min, 11.63±1.32 min) when compared to Group I (9.10±1.02 min, 14.67±1.06 min) and it was statistically significant (p<0.0001). Duration of analgesia was also significantly prolonged in patients of Nalbuphine group (Group II) in comparison with control bupivacaine (Group I) and it was 482±19.72 min and 317±12.64 min respectively and it showed statistically significant p-value (p<0.0001), Thus Group II showed a delayed regression in the sensory block when compared with the control group (Group I). Regarding the duration of motor block Group II was found to last for 276±15.74 min when compared to group I 227±7.39 min and is also statistically significant. The blockade was effective and succeeded in all patients. No hemodynamic and local anesthetic toxicity changes related to block was found (Table 1 & 2).

Table 1: Demographic Data

Data	Group I	Group II	P value
Age	41.07±9.14	39.90±10.73	0.6521
Sex(M:F)	20:10	21:9	
Weight	68.70±9.59	68.17±8.48	0.8204
ASA(I:II)	22:8	23:7	
Duration of surgery	142.9±13.35	136.9±12.51	0.0809

Data are presented as mean±SD, SD: Standard Deviation, number of patients as percentage ASA: American Society of Anesthesiologist.

Table 2: Onset and duration of sensory and motor block

Parameters	Group I	Group II	P-value
Onset of sensory block	9.10±1.02	6.23±0.79	<0.0001
Onset of motor block	14.67±1.06	11.63±1.32	<0.0001
Duration of motor block	227±7.39	276±15.74	<0.0001
Duration of analgesia	317±12.64	482±19.72	<0.0001

Data are presented as mean±SD, p<0.0001 is statistically significant, SD: Standard Deviation

Discussion

Upper limb surgeries are commonly done under brachial plexus block as it provides good surgical anesthesia and analgesia. Interscalene brachial plexus is easy to perform and has been used for various shoulder surgery [10-16]. After searching the literature, it was found that various opioids were added to local anesthetics for peripheral nerve blocks to achieve faster onset, to enhance the duration of motor and duration of analgesia [17].

Nalbuphine is an agonist-antagonist opioid that is chemically related to oxycodone and naloxone. It is equal in potency as an analgesic to morphine. Its agonist action at kappa receptors result in sedation and analgesia. In contrast to pentazocine and butorphanol, nalbuphine does not increase systemic blood pressure, heart rate or atrial filling pressures. Hence it is a good cardiovascular stability agent with very minimal respiratory depression. The mode of action is upon binding the opioid receptors, the GP protein gets activated on neurons leads to inhibition of adenylyl cyclase, decreases the conductance of voltage gated calcium channel or opening of potassium channels. Opioid receptor also modulate phospho inositide signaling cascade & phospholipase C. These effects resulting in hyperpolarisation of cell membrane potential thus preventing excitation and propagation of action potential. The prevention of calcium inflow results in suppression of neurotransmitter release (substance P) in many neurons [1].

Nalbuphine was used as an analgesic and adjuvants in spinal, epidural, caudal and peripheral

nerve blocks. Jothi et al. [16] compared the analgesic effect of different doses of nalbuphine hydrochloride with bupivacaine and concluded that nalbuphine has earlier onset of sensory and motor block with significant prolongation of sensory and motor block and delayed analgesic requirements.

Now a days peripheral nerve blocks was done under ultrasound guidance rather than the conventional technique [2]. This helps in the performance of interscalene block with more precision and without any injury to the adjacent vascular structures and complications of nerve injury [3,4]. Also Ultrasound helps in the performance of the block effectively with reduced volume of local anesthetic and avoidance of hemidiaphragmatic paresis [18].

The present study demonstrates that the addition of nalbuphine to 0.5% bupivacaine significantly prolonged the onset of sensory and motor block. Ankit et al. [14]. demonstrated the use of nalbuphine as an adjuvant to 0.75% bupivacaine in supraclavicular block resulted in earlier onset of sensory and motor block with statistical significance this was well correlated with our study. The present study also demonstrates that there was a prolongation of motor block and also significant increase in the duration of analgesia is noted in nalbuphine bupivacaine group (482±30.6 min) as compared to bupivacaine (317±23.7 min).

Mohamed A et al. [5] demonstrated that 20 mg of nalbuphine as an adjuvant to 25 ml of 0.5% bupivacaine for supraclavicular block for upper arm surgeries has resulted in significant increase in the duration of both sensory and motor block with

enhanced duration of analgesia it was concurrent with our study. Kumkum gupta et al.[13] concluded nalbuphine 10 mg as an adjuvant to 0.5% bupivacaine has significantly extended the duration of analgesia of brachial plexus block with no adverse effects this results was similar to our study.

Conclusion

The current study found that the addition of 10 mg nalbuphine to 0.5% bupivacaine in ultrasound guided interscalene brachial plexus block for shoulder and arm surgeries is associated with significant increase in the duration of analgesia without any adverse effects.

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Conflict of Interest: No conflict of interest.

Key Messages

Nalbuphine is a good adjuvant for bupivacaine . It increases both the sensory and motor block thereby prolongs the duration of the analgesic effect. Hence it can be used as an effective adjuvant both intraoperatively as well as postoperatively.

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