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Research Article

EFFECT OF BUTORPHANOL VERSUS PLACEBO AS ADJUVANT TO BUPIVACAINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKADE

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ABSTRACT

Introduction: Butorphanol is a synthetic opioid analgesic like morphine having partial agonist at μ & agonistic activity at kappa opioid receptor. It has been used alone & in combination with a local anesthetic for axillary brachial plexus blockade. So we tried to evaluate the effect of butorphanol versus placebo as adjuvant to bupivacaine for supraclavicular brachial plexus blockade on the onset and duration of blockade, duration of analgesia for surgeries of moderate duration.

Patients and methods: The study was conducted by Department of Anesthesiology in collaboration with Department of Pharmacology of IMS and SUM Hospital, Bhubaneswar,Odisha. It was a prospective, randomized, double blind, placebo controlled trial with 60 patients. Patients were allocated randomly into one of two groups of 30 patients each to receive either 25ml (0.5%) bupivacaine with 1ml of NS or 25ml (0.5%) bupivacaine with 1ml (2mg) butorphanol tartarate. Supraclavicular brachial plexus nerve block was performed. Onset time of sensory & motor block, duration of motor block & post operative analgesia was observed.

Results: There was also no significant difference between the two groups when comparing the onset and duration of sensory block as well as the onset of motor block. The duration of motor block was prolonged in butorphanol treated group i.e. 302 ± 0.52 (Mean ± SEM) which was statistically significant in comparison to control group i.e.202 ± 0.48. The the duration of analgesia was 663 ± 0.51 min in the butorphanol treated group but 312 ± 0.44 min in the control group . There was no significant difference in age, sex distribution, body weight and duration of surgery in the butorphanol group & the placebo control group.

Conclusion: Addition of butorphanol 2mg with bupivacaine prolongs the duration of blockade and postoperative analgesia in supraclavicular brachial plexus blockade without compromising the haemodynamic parameters or producing any significant adverse drug reactions.

Keywords: Butorphanol, Bupivacaine, Postoperative analgesia, Supraclavicular brachial plexus block

INTRODUCTION

Presence of pain indicates presence of some diseases or damage in the body. If this pain is not treated adequately, it may lead to derangement in various body functions[1].Pain is commonly seen during various major surgeries most commonly in orthopedic surgery.

It is always be the interest of an anesthetist to increase the quality of local anesthetics. The local anesthesia prolongs the duration of surgical anesthesia and analgesia. Previously different studies gave us ideas that adjuvant added to local anesthetics prolongs the block and reduce the toxicity. For example, for axillary brachial plexus blockade different additives like tramadol [2], dexamethasone[3], and clonidine [4] have been added to local anesthetics like mepivacaine and lignocaine. Butorphanol has been used alone and in combination with a local anesthetic, like mepivacaine [5], for axillary brachial plexus blockade.

In various surgical procedures, local anesthetics are administered in regional nerve block for relieving postoperative pain by blocking the transmission of pain signals to the dorsal horn.

With advent of opioid receptors, variety of opioid agents is used for post operative analgesia in brachial plexus block. Butorphanol is a synthetically derived opioid antagonist acts as an analgesic of the phenanthrene series. It exhibits partial agonist and antagonist activity at the μ(mu) opioid receptor and agonist activity at k(kappa) opioid receptors. Stimulation of these receptors on central nervous system neurons cause an intracellular inhibition of adenylyl cyclase, closing the influx membrane calcium channels and opening of membrane potassium channels. This leads to hyperpolarization of the cell membrane potential and suppression of action potential transmission of ascending pain pathways[6].

The aim of this placebo controlled study was to evaluate the effect of butorphanol versus placebo as adjuvant to bupivacaine for supraclavicular brachial plexus blockade on the onset and duration of blockade, duration of analgesia for surgeries of moderate duration.

PATIENTS AND METHODS

The study was conducted in IMS and SUM Hospital, Bhubaneswar a tertiary care teaching hospital of Odisha in collaboration with two departments i,e Department of Anesthesia and Department of Pharmacology with prior approval from Institutional Ethical committee and written informed consent from all 60 patients. The study period was of 6months from July 2013 to December 2013.

Total number of 60 patients of ASA-I and ASA-II physical status aged 20 years to 60 years scheduled for elective surgery of hand and forearm of moderate duration (<90mins) under supraclavicular brachial plexus block were included in the study. The procedures included in the study were implant removal, bone plating, olecranon fixation etc. Patients receiving chronic analgesic therapy, those receiving any premedication like opioids, benzodiazapines, clonodinethose with severe cardiopulmonary disease, hepatic or renal failure, thyroid disorder, diabetes mellitus, central or peripheral neuropathies, H/O of allergy to local anesthetics, other contraindication to regional anesthesia or supraclavicular brachial plexus block were excluded from the study.

Procedure

The study was designed as a prospective, randomized, double blind, placebo controlled trial. All patients were kept nil by mouth 6-8hours prior to induction of anesthesia. No premedication were given to the patients. In the operation theater intravenous access was secured with 18-G cannula in the contralateral hand. Patients were allocated randomly into one of two groups of 30 patients each to receive either 25ml of 0.5% bupivacaine with 1ml of normal saline (as control or placebo group) or 25ml of 0.5% bupivacaine with 1ml (2mg) butorphanol tartarate (test or butorphanol group). Supraclavicular brachial plexus nerve block was performed with the aid of a nerve stimulator by using 22G short beveled, insulated 25mm long stimulating

needle. Stimulation frequency was set at 2 Hz while intensity of stimulating current was initially set to deliver 1mA, gradually decreased to <0.5mA. Negative aspiration was performed while injecting the drug solution to avoid any intravascular placement. Sensory and motor blocks on the operated limb were evaluated after the completion of anaesthetic injection by one of the investigator who was unaware of drug combination administered.

All the monitoring (vitals) such as pulse oximetry, electrocardiography and noninvasive arterial blood pressure monitoring was done regularly by the anesthesiologists. Time required to achieve surgical block in the operation theater and the time to rescue analgesic in the post anesthesia care unit were also recorded. Parameters observed were:

- Onset time of sensory block
- Onset time of motor block
- Duration of motor block
- Duration of post operative analgesia
- Any suspected adverse effect

Sensory block was assessed by pin prick method.

- Grade 0: sharp pain,
- Grade 1: touch sensation,
- Grade 2: No sensation (Anesthesia).

Sensory score at 2 was taken as the time of onset of sensory block.

Motor block assessed by Bromage Scale as

- 0: normal motor function,
- 1: decreased motor strength with ability to move the fingers only,
- 2: complete motor block with inability to move the fingers.

Motor score of 2 was taken as onset time of complete motor block and duration of motor block was taken as time interval between local anesthetic administration and recovery of the motor block.

All patients were observed for analgesia hourly. Duration of analgesia was noted as time taken until patient demanded analgesia i.e VAS > 4. Visual analogue scale was observed every hourly for 9 hours postoperatively.

Visual analogue scale (VAS)

0 1 2 3 4 5 6 7 8 9 10

No pain Excruciating pain

Side effects like nausea, vomiting, Pruritus, pneumothorax, urinary retention were also noted.

OBSERVATION AND RESULTS

Primary and the most important parameter to be measured in our study was the duration of post operative analgesia. This was estimated as the time interval from the placement of the block till first injection of rescue analgesics. The second most important parameter to be observed was onset of sensory and motor blockade, duration of motor block and any suspected adverse effect.

The onset time of sensory and motor blockade was defined as the time between the end of last injection and the total abolition of the pin prick response and complete paralysis with inability to move the fingers respectively. The duration of sensory block was considered as the period from the administration of the block and the first postoperative pain; whereas the duration of the motor block was taken as the time interval between the local anesthetic administration and complete re over of motor function.

All the data obtained were analyzed by student's paired't' test.

Table I: Study of demographic & other parameters between two groups (mean ± SEM)

Parameters		Placebo control group	Butorphanol group
Age in years		48 ± 5.7	51.2 ± 3.8
Sex	Male	68.2%	63.33%
	Female	31.8%	36.67%
Weight in kg		60.31 ± 0.98	58 ± 1.75
Duration of surgery in min		64.21 ± 9.8	66.72 ± 11.2

There was no significant difference in age, sex distribution, body weight and duration of surgery in the butorphanol group and the placebo control group. There was also no significant difference between the two groups when comparing the onset of sensory block as well as the onset of motor block.

Table II: Duration of sensory, motor block & post operative analgesia (mean ± SEM)

Parameters (mins)	Placebo control group	Butorphanol group
Onset of sensory block	6.1 ± 1.02	5.8 ± 0.62
Onset of motor block	7.4 ± 1.05	6.92 ± 0.82
Duration of motor block	202 ± 0.48	302 ± 0.52*
Duration of analgesia	312 ± 0.44	663 ± 0.51*

*p< 0.001

The duration of motor block was prolonged in butorphanol treated group which was statistically significant in comparison to the control group. The mean time from block placement to first request for analgesia (the duration of analgesia) was 663 ± 0.51 min in the butorphanol treated group but 312 ± 0.44 min in the control group which was highly significant (p< 0.001).

Suspected adverse drug reaction profile was very much similar in both the groups.

DISCUSSION

Acute postoperative pain is the result of a complex physiological reaction to tissue injury. The dorsal horn of the spinal cord is the site of termination of primary afferents and there is complex interaction between such afferent fibres, intrinsic spinal neurons, descending pain modulating fibres and various neurotransmitters such as serotonin, nor epinephrine, acetylcholine, adenosine and glutamate in the dorsal horn[7]. Local anesthetics as regional nerve blocks provide postoperative pain relief.

Certain adjuvant drugs enhance the analgesic efficacy while reducing the incidence of adverse reactions related to local anesthetics. Tramadol and fentanyl were used as adjuvant to local anesthetics in brachial plexus block[8, 9]. It was seen that adrenergic receptor agonists improve the nerve block by LA either due to vasoconstriction [10] and facilitation C fiber blockade[11]or a spinal

action caused by slow retrograde axonal transport or simple diffusion along the nerve[12].

The result of this study shows that addition of 2mg butorphanol to 0.5% bupivacaine for supraclavicular brachial plexus blockade results in significant increase in the duration of motor block without affecting the time of onset of the blockade. For past many years, various agents like epinephrine, clonidine, opioids, and steroids have been added to LA to improve the quality and increase the duration of anesthesia and to reduce the toxicity of LA. Kapral etal[2] added tramadol to mepivacaine to axillary brachial plexus blockade and found that the admixture of 100mg tramadol with 1% mepivacaine provides a pronounced prolongation of the axillary plexus blockade without side effects. Tramadol and its metabolites act by affecting the opiate receptors[13, 14, 15] .Wajima etal [16]showed that continuous infusion of butorphanol locally into the brachial plexus sheath provides superior analgesia to that of continuous IV systemic injection. In another study, Wajima etal [5] found that butorphanol 2mg with 0.5% mepivacaine provides sufficient postoperative analgesia after upper limb surgery. Opioids have been used with or without LA for epidural analgesia[17, 18]. Veil etal [19] showed that injection buprenorphine into the brachial plexus sheath using supraclavicular technique is an efficient way to control postoperative pain after upper limb surgery[20] .Young etal[21] demonstrated, that opioid receptors and various macromolecules in the nerve undergoes axonal flow. Laiden et al [22] showed that proteins undergo bidirectional axonal transport and speculated that these receptors circulate endorphins, their endogenous ligands, in addition to exogenous opioids which proves that opioids act directly on peripheral nervous system.

CONCLUSION

In this study we found that butorphanol prolongs the duration of supraclavicular brachial plexus blockade when given along with bupivacaine. Dorsal horn cell contains opioid receptors with opioid binding site. From our study it is concluded that addition of butorphanol 2mg to bupivacaine in supraclavicular brachial plexus block increases the duration of blockade and postoperative analgesia without compromising the hemodynamic parameters of patient significantly.

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